FOR CONTRACT NO.: 11252-0F0401

INFORMATION HANDOUT

MATERIALS INFORMATION

LEAD INVESTIGATION REPORT
BALL RD FOUNDATION REPORT
DOUGLASS RD FOUNDATION REPORT
KATELLA AVENUE FOUNDATION REPORT
LINCOLN AVENUE FOUNDATION REPORT
SOUTH STREET FOUNDATION REPORT
WAGNER AVENUE FOUNDATION REPORT
GEOTECHNICAL DESIGN REPORT FOR RETAINING WALL nos. 275 AND 293
MATERIALS REPORT
PROCEDURE – OUT OF SERVICE PIPE REMOVAL

ROUTE: 12-Ora-57-12.2/ 15.2

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

T R A N S M I T T A L

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: August 12, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail		Draft Report	X	Your Use
X	Courier/Overnight	X	Final Report		As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Aerially Deposited Lead (ADL) Investigation Report, Northbound SR-57 Widening Project, Katella Avenue to Lincoln Avenue, Orange County, California, EA #OF0400

LEIGHTON CONSULTING, INC.

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AERIALLY DEPOSITED LEAD (ADL) INVESTIGATION REPORT, NORTHBOUND SR-57 WIDENING PROJECT, KATELLA AVENUE TO LINCOLN AVENUE, ORANGE COUNTY, CALIFORNIA,

CALTRANS DISTRICT 12, EA# OF0400

Prepared For:

HDR ENGINEERING, INC.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

April 16, 2009

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

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Leighton

1.0 INTRODUCTION

Leighton Consulting, Inc. is pleased to present this report summarizing an aerially deposited lead (ADL) survey conducted within the State Route (SR) 57 right-of-way (ROW) associated with the proposed northbound widening project. The project site is located along the northbound side of SR-57 in Orange County, California (Figure 1). It extends from approximately 900 feet south of Katella Avenue (SR-57 Station 259+60) to 1,100 feet north of Lincoln Avenue (SR-57 Station 397+00).

ADL is the result of tetraethyl lead, which was added to gasoline to prevent knocking for many years. The lead was present in vehicle exhaust emissions and has been detected in the near-surface soils adjacent to major thoroughfares at concentrations that may require special handling if disturbed during construction.

This survey was conducted to assess, based on the lead concentrations identified in the soil at the site, how the soil should be classified if it is disturbed during construction activities. The classifications are:

- Non-hazardous,
- Non-Resource Conservation and Recovery Act (RCRA), California hazardous,
- Non-RCRA, California Department of Toxic Substances Control (DTSC) Variance applies, and
- RCRA hazardous.

The concentrations of total and soluble lead will determine the appropriate handling and disposition of lead-impacted soils that will be disturbed during construction activities.

2.0 SCOPE OF SERVICES

2.1 Pre-Field Activity

2.1.1 Work Plan and Site-Specific Health and Safety Plan

Leighton Consulting prepared a Work Plan and Site-Specific Health and Safety Plan (SSHSP) for the ADL soil sampling to be performed at the site. The Work Plan was prepared in accordance with California Department of Transportation (Caltrans) guidelines. The Work Plan described the field activities and included figures showing the proposed sampling locations and a sampling and analysis plan.

The SSHSP was prepared in compliance with the Occupational Safety and Health and Administration (OSHA) Regulation 29 CFR 1910.120 and signed by a Certified Industrial Hygienist.

Both documents were submitted to Caltrans for review and comment on December 26, 2008. On February 2, 2009, Caltrans approved the Work Plan and SSHSP.

2.1.2 Underground Service Alert/Encroachment Permit

Underground Service Alert (USA) was contacted at least 72-hours prior to the commencement of fieldwork to mark known underground utility locations. Each proposed boring location was clearly marked with a flagged wooden stake prior to contacting USA. If necessary, to avoid a subsurface obstruction, the boring location was adjusted.

Prior to commencing fieldwork, Leighton Consulting obtained Encroachment Permit 12-08-N-DP-0771 from Caltrans. A copy of this permit is included in Appendix B.

2.2 Field Investigation

Between February 26 and March 4, 2009, Leighton Consulting personnel advanced 35 soil borings within the existing Caltrans ROW to a maximum depth of 4 feet below ground surface (bgs) at locations ADL-1 through ADL-35, as shown on Figures 2A through 2F. Soil samples for lead analysis were collected, using a limited-access direct-push drill rig

and hand-auger equipment, at depths of 0.5 feet, 1.5 feet, 3 feet, and 4 feet bgs. Rocky conditions and refusal were encountered at locations ADL-8 and ADL-20. An attempt was made at each location to advance another boring approximately 3 feet from the proposed location; however, refusal was again encountered. For these two borings, samples were collected at 0.5 feet and 1.5 feet before refusal was encountered. Table 1 summarizes the sample locations, samples identifications, and the depths at which they were collected.

Soil samples collected using the limited-access direct-push drill rig were retained in 1-inch diameter by 4-foot long acetate sleeves. Approximately 3-inch long sections, each containing the soil sample from a targeted depth, were marked and cut from the acetate sleeve. A Teflon™ square was placed over each end of the sample section and secured with a plastic end cap. Samples collected using hand-auger equipment were contained in 4-ounce, laboratory-supplied glass jars, sealed with a Teflon™ lined lid. All soil samples were placed in an ice-cooled chest for temporary storage, transportation, and delivery to TestAmerica Analytical Laboratories (TestAmerica) of Irvine, California for chemical analysis.

All sampling equipment was decontaminated between boreholes by washing in a solution of trisodium phosphate and water, rinsing with potable water, final rinsing with de-ionized water, then allowed to air-dry.

A Trimble GeoXH was used to determine the coordinates of each boring. The coordinates, based on the California Coordinate System NAD 83 (State Plane) Zone 6 datum, are provided in Table 2.

2.3 Laboratory Analysis

Leighton Consulting submitted all soil samples to TestAmerica for analysis for total lead, also known as the Total Threshold Limit Concentration (TTLC), by EPA Method 6010B, in order to evaluate appropriate handling procedures for excavated soil during the proposed widening project. Select soil samples were also analyzed for soluble lead using the Soluble Threshold Limit Concentration (STLC) Waste Extraction Test (WET Citric) where total lead exceeded 50 milligrams per kilogram (mg/kg). In addition, soil samples were also analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) and STLC WET Deionized Water (DI) where STLC WET Citric results exceeded 5 milligrams per liter (mg/L).

Approximately 10 percent of the total number of samples was analyzed for pH by EPA Method 9045C. Soils found to be contaminated with lead and exhibiting pH concentrations less than 5, may only be re-used in areas beneath paved roadways according to the DTSC Variance issued to Caltrans.

3.0 RESULTS

3.1 Subsurface Conditions

The soils encountered during this investigation were generally fine-grained, medium brown, dry to moist, silty sands with some clay from Katella Avenue north to exit ramp of Ball Road. From the exit ramp of Ball Road north to Lincoln Avenue, the soils encountered were generally fine-grained, light brown, moist, sands with some silt. Groundwater was not encountered in any of the borings.

3.2 Laboratory Results

A summary of the analytical results for total lead, soluble lead, and pH is presented in Table 1. Copies of the laboratory reports and chain-of-custody forms are included as Appendix C.

Total Lead (TTLC)

One hundred and fifty (150) samples (including duplicates) were analyzed for total lead by EPA Method 6010B. Lead was reported above the detection limit in 130 of the 150 soil samples collected during this investigation. The soil samples exhibited total lead concentrations ranging from 2.0 mg/kg (ADL-18 at 4 feet, ADL-33 at 4 feet, and ADL-35 at 1.5 feet) to 550 mg/kg (ADL-12 at 1.5 feet duplicate). These concentrations are below the California Code of Regulation (CCR), Title 22 waste disposal criterion for lead of 1,000 mg/kg.

STLC WET Citric

Nineteen (19) samples were analyzed for soluble lead using the STLC WET Citric method. Only those samples which exceeded 50 mg/kg for total lead were analyzed by this method. STLC WET Citric concentrations ranged from 0.11 mg/L (ADL-2 at 1.5 feet) to 42 mg/L (ADL-8 at 0.5 feet).

STLC WET DI

Ten (10) samples were analyzed for soluble lead using the STLC WET DI method. Only those samples which exceeded 5 mg/L for STLC WET Citric were analyzed by this method. STLC WET DI concentrations ranged from 0.016 mg/L (ADL-9 at 3 feet) to 0.15 mg/L (ADL-9 at 1.5 feet).

TCLP

Ten (10) samples were analyzed for soluble lead using the TCLP method. Only those samples which exceeded 5 mg/L for STLC WET Citric were analyzed by this method. TCLP concentrations ranged from 0.15 mg/L (ADL-12 at 0.5 feet) to 1.9 mg/L (ADL-9 at 3 feet).

pH

Fourteen (14) samples, selected at random, were analyzed for pH using EPA method 9045B. The pH values ranged from 6.30 (ADL-15 at 3 feet) to 8.78 (ADL-31 at 0.5 feet).

4.0 STATISTICAL ANALYSIS

4.1 Statistical Analysis Methods

Leighton evaluated the results of the soil sample analyses to determine the mean and the 95% upper confidence intervals (UCLs) for lead in soil in accordance with SW-846, Chapter 9. This evaluation was conducted to determine if the soil would be considered a hazardous waste if excavated or if it could be reused at the site in accordance with the DTSC Variance, issued to Caltrans, for management of soils containing ADL. The Variance uses the mean concentrations and 95% UCLs of the data to determine the appropriate disposition of the soil.

Duplicate samples were collected at 14 locations resulting in 28 values for 14 sampling locations. In order to have the number of samples equal the number of sampling locations for the statistical analysis, the average of the duplicate samples was used for the locations where duplicate samples were collected.

Statistical methods were applied to the total and soluble data to determine the distribution of the data sets (normal, lognormal, gamma, and/or non-parametric), if there is an acceptable correlation between the total and soluble lead concentrations, and the 95% UCL on the mean value.

The first step for determining the 95% UCL on the mean is establishing the type of distribution of the data set. Distribution was determined by creating histograms of the different data sets, including all non-detect values. The laboratory reporting limit was entered as the sample concentration for all non-detect samples. The histogram for the TTLC values indicates a non-parametric distribution; therefore, the data could not be transformed. The histogram for the STLC WET Citric values indicates a normal distribution; therefore, the data was transformed using the natural log. Histograms for the total and soluble lead concentrations are included in Appendix D.

4.2 Data Correlation

Data correlation is necessary to indicate the validity of any predicted soluble lead concentrations of soil samples not analyzed for soluble lead by the laboratory. Using only those samples analyzed for both total lead (TTLC) and soluble lead (STLC WET Citric), a correlation coefficient, r, was calculated for use as a quality check of the data. Linear regression analysis was used to calculate the r-value. The TTLC values versus the STLC

values were plotted on a graph and a best fit line was plotted for the data. To ensure the predicted value were above zero, the y-intercept was set to zero. The calculated equation of the line is y = 0.0751x and the r-value equals 0.889. Since the calculated value of the correlation coefficient, r, is above the limit of 0.8 (the referenced limit indicating a non-linear relationship between data sets), soluble lead concentrations can be predicted for samples that were not analyzed by the laboratory. A graph of the linear regression analysis is included in Appendix D. The histogram for the STLC WET Citric values, with the predicted values included, indicates a non-parametric distribution. The histogram is included in Appendix D.

4.3 Statistical Analysis

Once the distribution was confirmed using histograms, the data was imported into a statistical program. The UCL methods used during this investigation and the calculated values were provided by the Environmental Protection Agency (EPA)'s statistical program, ProUCL, version 4.0. A summary of the statistical analysis is included in Table 3.

Statistical evaluation of lead analytical results for the complete data set, including non-detects (NDs), was completed to determine the confidence intervals. The 95% UCL for the population mean for total lead was 41.18 mg/kg. The 95% UCL for soluble lead (STLC WET Citric), with laboratory supplied data only, was 16.13 mg/L. Based on these results, the soil would be considered California non-RCRA hazardous waste and, if not reused onsite, should be disposed of at a Class I waste facility. However, it should be noted that this 95% UCL for soluble lead is considered conservative based on the fact that only 14% of the total data set analyzed for total lead were analyzed using the STLC WET Citric method. To get a better overall representative 95% UCL for soluble lead, Leighton Consulting re-analyzed the data set to include the predicted STLC WET Citric values provided by the regression analysis. Based on this more complete and representative data set, the 95% UCL for soluble lead (including the predicted data) was 4.00 mg/L; therefore, the soil does not represent significant environmental or health hazards and can be classified as non-hazardous.

5.0 CONCLUSIONS

The soil samples collected during this investigation exhibited total lead concentrations ranging from 2.0 mg/kg to 550 mg/kg, STLC WET Citric concentrations ranging from 0.11 mg/L to 42 mg/L, STLC WET DI concentrations ranging from 0.016 mg/L to 0.15 mg/L, TCLP concentrations ranging from 0.15 mg/L to 1.9 mg/L, and pH values ranging from 6.30 to 8.78.

Statistical methods were applied to the total and soluble data to determine the distribution of the data sets (normal, lognormal, gamma, and/or non-parametric), if there is an acceptable correlation between the total and soluble lead concentrations, and the 95% UCL on the mean value.

The histogram for the TTLC values indicates a non-parametric distribution and the histogram for the STLC WET Citric values indicates a lognormal distribution. Based on linear regression analysis, the calculated correlation coefficient between total lead versus soluble lead for the sample pair data set was 0.889. Since this falls above the referenced limit of 0.8, the data could be used to predict soluble lead concentrations for those samples not analyzed by the laboratory.

Statistical evaluation of lead analytical results indicates that the 95% UCL for the mean total lead concentration is 41.18 mg/kg. The 95% UCL for soluble lead (STLC WET Citric, including predicted values) was 4.00 mg/L. Based on this data, the soil does not represent significant environmental or health hazards and can be classified as non-hazardous. No special handling of the soil is considered necessary during grading at the site.

Leighton appreciates this opportunity to be of service. Should you have any questions regarding this report, please contact the undersigned at (949) 681-4208.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Brynn McCulloch
Senior Staff Geologist

Meredith Church, PG
Project Geologist

BFM/MDC/gv

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Leighton

TABLE 1
Summary of Sample Locations and Laboratory Results for Aerially Deposited Lead
SR-57 Northbound Widening Project

Boring Number	Sample Depth (feet bgs)	Sample Number	Sample Date	Total Lead (mg/kg) Reported Value	Total Lead (mg/kg) Value Used	STLC WET Citric Acid (mg/L)	ln(x) Transformed STLC WET Citric Acid	STLC WET Deionized Water (mg/L)	TCLP (mg/L)	pH
ADL-1	0.5	09-061-S-BFM-01	03/02/09	**20**	**20**	*1.50*	NA	NA	NA	NA
	1.5	09-061-S-BFM-02	03/02/09	**2.8**	**2.8**	*0.21*	NA	NA	NA	**6.60**
	3	09-061-S-BFM-03	03/02/09	**5.0**	**5.0**	*0.38*	NA	NA	NA	NA
	4	09-061-S-BFM-04	03/02/09	**4.0**	**4.0**	*0.30*	NA	NA	NA	NA
ADL-2	0.5	09-061-S-BFM-05	03/02/09	**30**	**30**	*2.25*	NA	NA	NA	**7.96**
	1.5	09-061-S-BFM-06	03/02/09	**64**	**64**	**0.11**	-2.21	NA	NA	NA
	3	09-061-S-BFM-07	03/02/09	**4.1**	**4.1**	*0.31*	NA	NA	NA	NA
	4	09-061-S-BFM-08	03/02/09	**4.8**	**4.8**	*0.36*	NA	NA	NA	NA
ADL-3	0.5	09-061-S-BFM-09	03/03/09	**6.7**	**6.7**	*0.50*	NA	NA	NA	NA
	1.5	09-061-S-BFM-10	03/03/09	**5.6**	**5.6**	*0.42*	NA	NA	NA	NA
	3	09-061-S-BFM-11	03/03/09	**5.0**	**5.0**	*0.38*	NA	NA	NA	NA
	4	09-061-S-BFM-12	03/03/09	**6.8**	**6.8**	*0.51*	NA	NA	NA	NA
ADL-4	0.5	09-061-S-BFM-13	03/03/09	**13**	**13**	*0.98*	NA	NA	NA	NA
	1.5	09-061-S-BFM-14	03/03/09	**6.9**	**6.75**	*0.52*	NA	NA	NA	NA
		09-061-S-BFM-15	03/03/09	**6.6**		*0.50*	NA	NA	NA	NA
	3	09-061-S-BFM-16	03/03/09	**5.3**	**5.3**	*0.40*	NA	NA	NA	**7.48**
	4	09-061-S-BFM-17	03/03/09	**6.5**	**6.5**	*0.49*	NA	NA	NA	NA
ADL-5	0.5	09-061-S-BFM-18	03/03/09	**10**	**10**	*0.75*	NA	NA	NA	NA
	1.5	09-061-S-BFM-19	03/03/09	**7.0**	**7.0**	*0.53*	NA	NA	NA	NA
	3	09-061-S-BFM-20	03/03/09	**8.9**	**8.9**	*0.67*	NA	NA	NA	NA
	4	09-061-S-BFM-21	03/03/09	**6.3**	**6.3**	*0.47*	NA	NA	NA	NA
ADL-6	0.5	09-061-S-BFM-22	03/03/09	**2.6**	**2.6**	*0.20*	NA	NA	NA	**7.70**
	1.5	09-061-S-BFM-23	03/03/09	**3.7**	**3.7**	*0.28*	NA	NA	NA	NA
	3	09-061-S-BFM-24	03/03/09	**6.7**	**6.7**	*0.50*	NA	NA	NA	NA
	4	09-061-S-BFM-25	03/03/09	**14**	**14**	*1.05*	NA	NA	NA	NA
ADL-7	0.5	09-061-S-BFM-26	03/03/09	**29**	**29**	*2.18*	NA	NA	NA	NA
	1.5	09-061-S-BFM-27	03/03/09	**6.3**	**6.3**	*0.47*	NA	NA	NA	NA
	3	09-061-S-BFM-28	03/03/09	**13**	**66.5**	*0.98*	NA	NA	NA	NA
		09-061-S-BFM-29	03/03/09	**120**		**5.9**	1.77	<0.0050	<0.10	NA
	4	09-061-S-BFM-30	03/03/09	**11**	**11**	*0.83*	NA	NA	NA	NA
ADL-8	0.5	09-061-S-BFM-31	03/03/09	**320**	**320**	**42**	3.74	**0.020**	**1.60**	NA
	1.5	09-061-S-BFM-32	03/03/09	**140**	**140**	**9.8**	2.28	**0.042**	**0.90**	NA
	3	Refusal at 2 feet bgs, no samples collected at 3 feet and 4 feet bgs								
ADL-9	0.5	09-061-S-BFM-33	03/03/09	**100**	**100**	**7.4**	2.00	**0.034**	**1.3**	NA
	1.5	09-061-S-BFM-34	03/03/09	**93**	**93**	**8.3**	2.12	**0.15**	**0.73**	NA
	3	09-061-S-BFM-35	03/03/09	**180**	**92.4**	**12**	2.48	**0.016**	**1.9**	**7.14**
		09-061-S-BFM-36	03/03/09	**4.8**		*0.36*	NA	NA	NA	NA
	4	09-061-S-BFM-37	03/03/09	**110**	**110**	**4.4**	1.48	NA	NA	NA
ADL-10	0.5	09-061-S-BFM-38	03/03/09	**8.1**	**8.1**	*0.61*	NA	NA	NA	NA
	1.5	09-061-S-BFM-39	03/03/09	**5.7**	**5.6**	*0.43*	NA	NA	NA	NA
		09-061-S-BFM-40	03/03/09	**5.5**		*0.41*	NA	NA	NA	NA
	3	09-061-S-BFM-41	03/03/09	**3.7**	**3.7**	*0.28*	NA	NA	NA	NA
	4	09-061-S-BFM-42	03/03/09	**7.5**	**7.5**	*0.56*	NA	NA	NA	NA

TABLE 1
Summary of Sample Locations and Laboratory Results for Aerially Deposited Lead
SR-57 Northbound Widening Project

Boring Number	Sample Depth (feet bgs)	Sample Number	Sample Date	Total Lead (mg/kg) Reported Value	Total Lead (mg/kg) Value Used	STLC WET Citric Acid (mg/L)	ln(x) Transformed STLC WET Citric Acid	STLC WET Deionized Water (mg/L)	TCLP (mg/L)	pH
ADL-11	0.5	09-061-S-BFM-43	03/03/09	**4.8**	**4.8**	*0.36*	NA	NA	NA	NA
	1.5	09-061-S-BFM-44	03/03/09	**2.2**	**2.2**	*0.17*	NA	NA	NA	NA
	3	09-061-S-BFM-45	03/03/09	**3.4**	**3.4**	*0.26*	NA	NA	NA	NA
	4	09-061-S-BFM-46	03/03/09	**4.5**	**4.5**	*0.34*	NA	NA	NA	**6.91**
ADL-12	0.5	09-062-S-BFM-26	03/04/09	**140**	**140**	**12**	2.48	**0.030**	**0.15**	NA
	1.5	09-062-S-BFM-27	03/04/09	**4.9**	**277.5**	*0.37*	NA	NA	NA	NA
		09-062-S-BFM-28	03/04/09	**550**		**34**	3.53	**0.10**	**0.95**	NA
	3	09-062-S-BFM-29	03/04/09	<2.0	2.0	NA	NA	NA	NA	NA
	3	09-062-S-BFM-30	03/04/09	**4.5**	**4.5**	*0.34*	NA	NA	NA	NA
ADL-13	0.5	09-062-S-BFM-22	03/04/09	**190**	**190**	**10**	2.30	**0.040**	**1.2**	NA
	1.5	09-062-S-BFM-23	03/04/09	**5.1**	**5.1**	*0.38*	NA	NA	NA	NA
	3	09-062-S-BFM-24	03/04/09	**3.9**	**3.9**	*0.29*	NA	NA	NA	NA
	4	09-062-S-BFM-25	03/04/09	**3.6**	**3.6**	*0.27*	NA	NA	NA	NA
ADL-14	0.5	09-062-S-BFM-18	03/04/09	**38**	**38**	*2.85*	NA	NA	NA	NA
	1.5	09-062-S-BFM-19	03/04/09	**7.3**	**7.3**	*0.55*	NA	NA	NA	NA
	3	09-062-S-BFM-20	03/04/09	**4.3**	**4.3**	*0.32*	NA	NA	NA	NA
	4	09-062-S-BFM-21	03/04/09	**2.9**	**2.9**	*0.22*	NA	NA	NA	NA
ADL-15	0.5	09-062-S-BFM-14	03/03/09	**290**	**290**	**26**	3.26	**0.10**	**0.25**	NA
	1.5	09-062-S-BFM-15	03/03/09	**3.4**	**3.4**	*0.26*	NA	NA	NA	NA
	3	09-062-S-BFM-16	03/03/09	**3.5**	**3.5**	*0.26*	NA	NA	NA	**6.30**
	4	09-062-S-BFM-17	03/03/09	<10	10	NA	NA	NA	NA	NA
ADL-16	0.5	09-062-S-BFM-09	03/03/09	**63**	**63**	**1.9**	0.64	NA	NA	NA
	1.5	09-062-S-BFM-10	03/03/09	**12**	**12**	*0.90*	NA	NA	NA	NA
	3	09-062-S-BFM-11	03/03/09	**3.0**	**2.6**	*0.23*	NA	NA	NA	NA
		09-062-S-BFM-12	03/03/09	**2.2**		*0.17*	NA	NA	NA	NA
	4	09-062-S-BFM-13	03/03/09	**2.4**	**2.4**	*0.18*	NA	NA	NA	NA
ADL-17	0.5	09-062-S-BFM-05	03/03/09	**54**	**54**	**2.0**	0.69	NA	NA	NA
	1.5	09-062-S-BFM-06	03/03/09	**3.5**	**3.5**	*0.26*	NA	NA	NA	NA
	3	09-062-S-BFM-07	03/03/09	<2.0	2.0	NA	NA	NA	NA	NA
	4	09-062-S-BFM-08	03/03/09	<2.0	2.0	NA	NA	NA	NA	NA

TABLE 1
Summary of Sample Locations and Laboratory Results for Aerially Deposited Lead
SR-57 Northbound Widening Project

Boring Number	Sample Depth (feet bgs)	Sample Number	Sample Date	Total Lead (mg/kg) Reported Value	Total Lead (mg/kg) Value Used	STLC WET Citric Acid (mg/L)	ln(x) Transformed STLC WET Citric Acid	STLC WET Deionized Water (mg/L)	TCLP (mg/L)	pH
ADL-18	0.5	09-062-S-BFM-01	03/03/09	**24**	**24**	*1.80*	NA	NA	NA	NA
	1.5	09-062-S-BFM-02	03/03/09	**11**	**11**	*0.83*	NA	NA	NA	NA
	3	09-062-S-BFM-03	03/03/09	<2.0	2.0	NA	NA	NA	NA	NA
	4	09-062-S-BFM-04	03/03/09	**2.0**	**2.0**	*0.15*	NA	NA	NA	NA
ADL-19	0.5	09-057-S-BFM-01	02/26/09	**10**	**10**	*0.75*	NA	NA	NA	NA
	1.5	09-057-S-BFM-02	02/26/09	**5.4**	**4.25**	*0.41*	NA	NA	NA	NA
		09-057-S-BFM-03	02/26/09	**3.1**		*0.23*	NA	NA	NA	NA
	3	09-057-S-BFM-04	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
	4	09-057-S-BFM-05	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
ADL-20	0.5	09-057-S-BFM-06	02/26/09	**3.5**	**3.5**	*0.26*	NA	NA	NA	NA
	1.5	09-057-S-BFM-07	02/26/09	**7.4**	**7.4**	*0.56*	NA	NA	NA	NA
	3	Refusal at 2 feet bgs, no samples collected at 3 feet and 4 feet bgs								
ADL-21	0.5	09-057-S-BFM-08	02/26/09	**5.3**	**5.3**	*0.40*	NA	NA	NA	NA
	1.5	09-057-S-BFM-09	02/26/09	**3.8**	**3.8**	*0.29*	NA	NA	NA	NA
	3	09-057-S-BFM-10	02/26/09	**15**	**15**	*1.13*	NA	NA	NA	NA
	4	09-057-S-BFM-11	02/26/09	**2.3**	**2.3**	*0.17*	NA	NA	NA	NA
ADL-22	0.5	09-057-S-BFM-12	02/26/09	**3.0**	**3.0**	*0.23*	NA	NA	NA	NA
	1.5	09-057-S-BFM-13	02/26/09	**3.2**	**3.2**	*0.24*	NA	NA	NA	NA
	3	09-057-S-BFM-14	02/26/09	**3.8**	**3.8**	*0.29*	NA	NA	NA	NA
	4	09-057-S-BFM-15	02/26/09	**2.9**	**2.9**	*0.22*	NA	NA	NA	**8.75**
ADL-23	0.5	09-057-S-BFM-16	02/26/09	**4.2**	**4.2**	*0.32*	NA	NA	NA	NA
	1.5	09-057-S-BFM-17	02/26/09	**3.5**	**3.5**	*0.26*	NA	NA	NA	NA
	3	09-057-S-BFM-18	02/26/09	**3.6**	**3.6**	*0.27*	NA	NA	NA	NA
	4	09-057-S-BFM-19	02/26/09	**3.9**	**3.9**	*0.29*	NA	NA	NA	NA
ADL-24	0.5	09-057-S-BFM-20	02/26/09	**5.4**	**5.4**	*0.41*	NA	NA	NA	**7.73**
	1.5	09-057-S-BFM-21	02/26/09	**3.2**	**3.2**	*0.24*	NA	NA	NA	NA
	3	09-057-S-BFM-22	02/26/09	**3.2**	**3.2**	*0.24*	NA	NA	NA	NA
	4	09-057-S-BFM-23	02/26/09	**4.2**	**4.2**	*0.32*	NA	NA	NA	NA
ADL-25	0.5	09-057-S-BFM-24	02/26/09	**4.2**	**4.2**	*0.32*	NA	NA	NA	NA
	1.5	09-057-S-BFM-25	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
	3	09-057-S-BFM-26	02/26/09	**2.2**	**2.2**	*0.17*	NA	NA	NA	NA
	4	09-057-S-BFM-27	02/26/09	<2.0	**2.2**	NA	NA	NA	NA	NA
		09-057-S-BFM-28	02/26/09	**2.3**		*0.17*	NA	NA	NA	NA

TABLE 1
Summary of Sample Locations and Laboratory Results for Aerially Deposited Lead
SR-57 Northbound Widening Project

Boring Number	Sample Depth (feet bgs)	Sample Number	Sample Date	Total Lead (mg/kg) Reported Value	Total Lead (mg/kg) Value Used	STLC WET Citric Acid (mg/L)	ln(x) Transformed STLC WET Citric Acid	STLC WET Deionized Water (mg/L)	TCLP (mg/L)	pH
ADL-26	0.5	09-057-S-BFM-29	02/26/09	**2.8**	**3.5**	*0.21*	NA	NA	NA	NA
		09-057-S-BFM-30	02/26/09	**4.2**		*0.32*	NA	NA	NA	NA
	1.5	09-057-S-BFM-31	02/26/09	**2.4**	**2.4**	*0.18*	NA	NA	NA	NA
	3	09-057-S-BFM-32	02/26/09	**2.5**	**2.5**	*0.19*	NA	NA	NA	NA
	4	09-057-S-BFM-33	02/26/09	**2.6**	**2.6**	*0.20*	NA	NA	NA	NA
ADL-27	0.5	09-057-S-BFM-34	02/26/09	**8.9**	**8.9**	*0.67*	NA	NA	NA	NA
	1.5	09-057-S-BFM-35	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
	3	09-057-S-BFM-36	02/26/09	**2.7**	**2.7**	*0.20*	NA	NA	NA	NA
	4	09-057-S-BFM-37	02/26/09	<2.0	2.0	NA	NA	NA	NA	**7.47**
ADL-28	0.5	09-057-S-BFM-38	02/26/09	**11**	**11**	*0.83*	NA	NA	NA	NA
	1.5	09-057-S-BFM-39	02/26/09	**4.7**	**4.2**	*0.35*	NA	NA	NA	NA
		09-057-S-BFM-40	02/26/09	**3.7**		*0.28*	NA	NA	NA	NA
	3	09-057-S-BFM-41	02/26/09	**2.3**	**2.3**	*0.17*	NA	NA	NA	NA
	4	09-057-S-BFM-42	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
ADL-29	0.5	09-057-S-BFM-43	02/26/09	**53**	**53**	**2.6**	0.96	NA	NA	NA
	1.5	09-057-S-BFM-44	02/26/09	**74**	**74**	**4.1**	1.41	NA	NA	NA
	3	09-057-S-BFM-45	02/26/09	**52**	**52**	**2.3**	0.83	NA	NA	NA
	4	09-057-S-BFM-46	02/26/09	**2.9**	**2.9**	*0.22*	NA	NA	NA	NA
ADL-30	0.5	09-057-S-BFM-47	02/26/09	**4.9**	**4.9**	*0.37*	NA	NA	NA	NA
	1.5	09-057-S-BFM-48	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
	3	09-057-S-BFM-49	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
	4	09-057-S-BFM-50	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
		09-057-S-BFM-51	02/26/09	<2.0		NA	NA	NA	NA	NA
ADL-31	0.5	09-057-S-BFM-52	02/26/09	**100**	**100**	**3.7**	1.31	NA	NA	**8.78**
	1.5	09-057-S-BFM-53	02/26/09	**6.5**	**6.5**	*0.49*	NA	NA	NA	**8.13**
	3	09-057-S-BFM-54	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
	4	09-057-S-BFM-55	02/26/09	<2.0	**2.3**	NA	NA	NA	NA	NA
		09-057-S-BFM-56	02/26/09	**2.6**		*0.20*	NA	NA	NA	NA
ADL-32	0.5	09-057-S-BFM-57	02/26/09	**6.6**	**6.6**	*0.50*	NA	NA	NA	NA
	1.5	09-057-S-BFM-58	02/26/09	**2.1**	**2.1**	*0.16*	NA	NA	NA	NA
	3	09-057-S-BFM-59	02/26/09	**3.1**	**3.1**	*0.23*	NA	NA	NA	NA
	4	09-057-S-BFM-60	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
ADL-33	0.5	09-057-S-BFM-61	02/26/09	**47**	**47**	*3.53*	NA	NA	NA	NA
	1.5	09-057-S-BFM-62	02/26/09	**57**	**57**	**2.8**	1.03	NA	NA	NA
	3	09-057-S-BFM-63	02/26/09	**2.8**	**2.8**	*0.21*	NA	NA	NA	NA
	4	09-057-S-BFM-64	02/26/09	**2.0**	**2.0**	*0.15*	NA	NA	NA	NA

TABLE 1
Summary of Sample Locations and Laboratory Results for Aerially Deposited Lead
SR-57 Northbound Widening Project

Boring Number	Sample Depth (feet bgs)	Sample Number	Sample Date	Total Lead (mg/kg) Reported Value	Total Lead (mg/kg) Value Used	STLC WET Citric Acid (mg/L)	ln(x) Transformed STLC WET Citric Acid	STLC WET Deionized Water (mg/L)	TCLP (mg/L)	pH
ADL-34	0.5	09-057-S-BFM-65	02/26/09	**13**	**13**	*0.98*	NA	NA	NA	**8.06**
		09-057-S-BFM-66	02/26/09	**2.4**	**2.4**	*0.18*	NA	NA	NA	NA
	1.5	09-057-S-BFM-67	02/26/09	**3.6**	**3.6**	*0.27*	NA	NA	NA	NA
	3	09-057-S-BFM-68	02/26/09	**3.1**	**3.1**	*0.23*	NA	NA	NA	NA
	4	09-057-S-BFM-69	02/26/09	<2.0	2.0	NA	NA	NA	NA	NA
ADL-35	0.5	09-057-S-BFM-70	02/26/09	**9.4**	**9.4**	*0.71*	NA	NA	NA	NA
	1.5	09-057-S-BFM-71	02/26/09	**15**	**15**	*1.13*	NA	NA	NA	NA
		09-057-S-BFM-72	02/26/09	**2.0**	**2.0**	*0.15*	NA	NA	NA	NA
	3	09-057-S-BFM-73	02/26/09	**3.9**	**3.9**	*0.29*	NA	NA	NA	NA
	4	09-057-S-BFM-74	02/26/09	**2.6**	**2.6**	*0.20*	NA	NA	NA	**8.70**

mg/kg = Milligrams per Kilogram
mg/L = Milligrams per Liter
TCLP = Toxicity Characteristic Leaching Procedure
STLC = Soluble Threshold Limit Concentrations
<2.0 = Below Laboratory Detection Limits
2.9 = Analyte Detected Above Laboratory Reporting Limit and/or above STLC Limit
NA = Not Analyzed
CI = Confidence Interval
UCL = Upper Confidence Level
3.53 = Concentrations in italics are predicted values using regression analysis of laboratory supplied data

Note - If a duplicate sample was collected at a specific depth and location, the average concentration of the two values was used in the statistical analysis.

TABLE 2
Boring Coordinates
SR-57 Northbound Widening Project

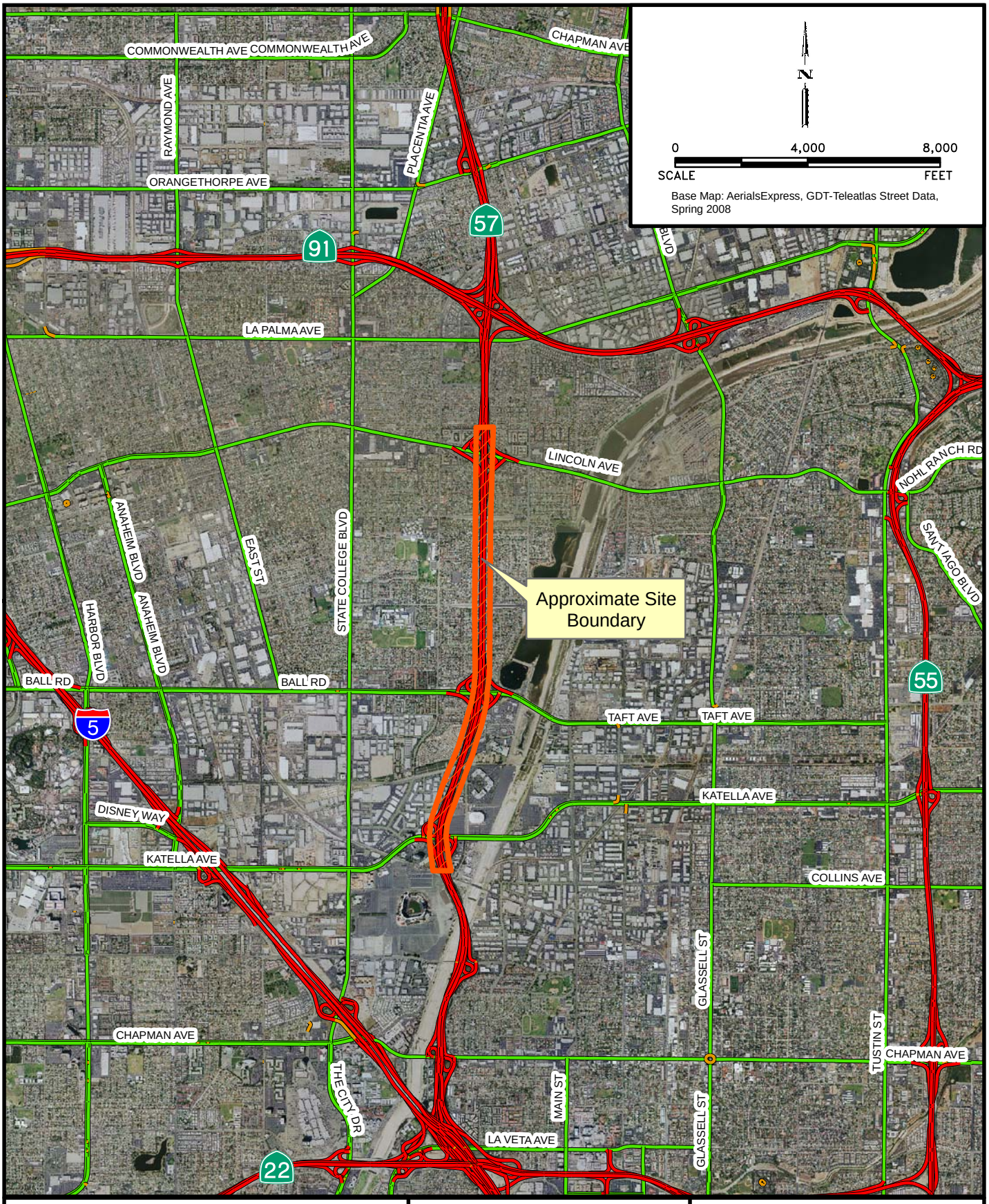
Boring ID	X-Value	Y-Value
ADL-1	6066609.3378	2240043.5632
ADL-2	6066568.3330	2240246.7251
ADL-3	6066557.3801	2240561.4014
ADL-4	6066597.2334	2241241.4823
ADL-5	6066736.5873	2241602.1147
ADL-6	6066829.9323	2241939.8924
ADL-7	6066926.5099	2242235.4180
ADL-8	6067052.5690	2242581.5300
ADL-9	6067319.0613	2243389.3670
ADL-10	6067447.0942	2243732.2268
ADL-11	6067575.9157	2244079.3044
ADL-12	6067658.6807	2244408.0903
ADL-13	6067727.1080	2244726.4575
ADL-14	6067806.3421	2245057.7700
ADL-15	6067842.7378	2245510.2175
ADL-16	6067877.4381	2245938.0081
ADL-17	6067885.2479	2246332.3403
ADL-18	6067880.3887	2246626.1596
ADL-19	6067877.4946	2246876.0923
ADL-20	6067891.6676	2247195.0079
ADL-21	6067886.6386	2247640.4227
ADL-22	6067906.5339	2248255.3180
ADL-23	6067909.5241	2248563.4837
ADL-24	6067909.4239	2248888.3924
ADL-25	6067920.6751	2249294.3286
ADL-26	6067948.1771	2249603.7065
ADL-27	6067930.0452	2249953.1418
ADL-28	6067934.7231	2250290.8516
ADL-29	6067944.1613	2250729.4850
ADL-30	6067966.8716	2251168.7501
ADL-31	6067973.1805	2251616.7199
ADL-32	6067975.5823	2251948.5548
ADL-33	6067996.2449	2252703.5729
ADL-34	6068024.9031	2253073.2851
ADL-35	6068023.6912	2253454.3357

TABLE 3
Summary of Statistical Analysis for Aerially Deposited Lead
SR-57 Northbound Widening Project

TTLC and STLC WET Citric Data Analysis	TTLC	STLC WET Citric (Laboratory Only)	STLC WET Citric (w/Predicted Data)
Distribution Type	Non-Parametric	Gamma/Lognormal	Non-Parametric
Number of Samples, n	138	19	19
Minimum Detected Value	2.0 (mg/kg)	0.11 (mg/L)	0.11 (mg/L)
Maximum Detected Value	320* (mg/kg)	42 (mg/L)	42 (mg/L)
Mean (Average), x	22.20 (mg/kg)	10.07 (mg/L)	1.90 (mg/L)
Std Deviation of sample set, s	51.24 (mg/kg)	11.52 (mg/L)	5.50 (mg/L)
Mean of transformed data	NA	1.69 (mg/L)	NA
Std Dev of transformed data	NA	1.32 (mg/L)	NA
95% UCL on data (Chebyshev Method)	**41.18** (mg/kg)	NA	**4.00** (mg/kg)
95% UCL on data (Approximate Gamma)	NA	**16.13** (mg/L)	NA

Additional Analysis	STLC WET DI	TCLP	pH
Number of Samples, n	10	10	14
Minimum Detected Value	0.016 (mg/L)	0.15 (mg/L)	6.30
Maximum Detected Value	0.15 (mg/L)	1.9 (mg/L)	8.78
Mean (Average), x	0.06 (mg/L)	1.00 (mg/L)	7.69
Std Deviation of sample set, s	0.05 (mg/L)	0.58 (mg/L)	0.78

NA = not applicable
mg/L = milligrams per liter
UCL = Upper Confidence Level
UCL Methods and values provided by the Environmental Protection Agency's statistical program, ProUCL, Version 4.0
Distribution type was selected based on histograms produced by ProUCL
* = Average of sample and duplicate collected at that depth (ADL-12 at 1.5 feet)



SR-57 Widening
Katella Avenue to Lincoln Avenue
Orange County, California

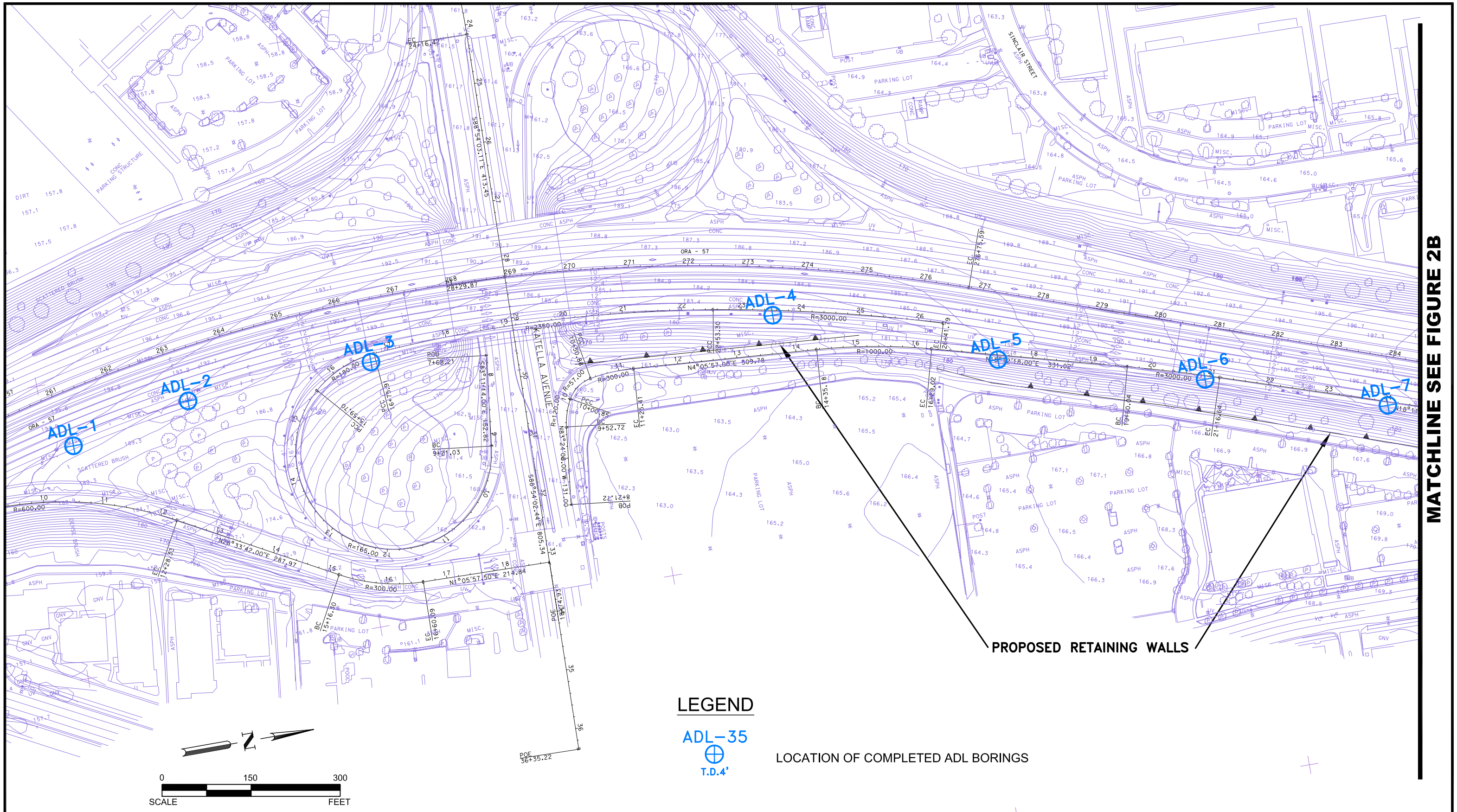
SITE LOCATION MAP

Project No.
602231-002

Date
August 2008

Figure 1

\\GIS\Administration\ArcGISTemplates\NEW_GDT_SiteLocationMap.mxd



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Scale: 1"=150'	Date: 4/09	
Drafted By: BQT	Checked By: BQT	P:\DRAFTING\602231\002\OF_2009-03-12\FIGURES.DWG (04-15-09 4:49:21PM) Plotted by: btran

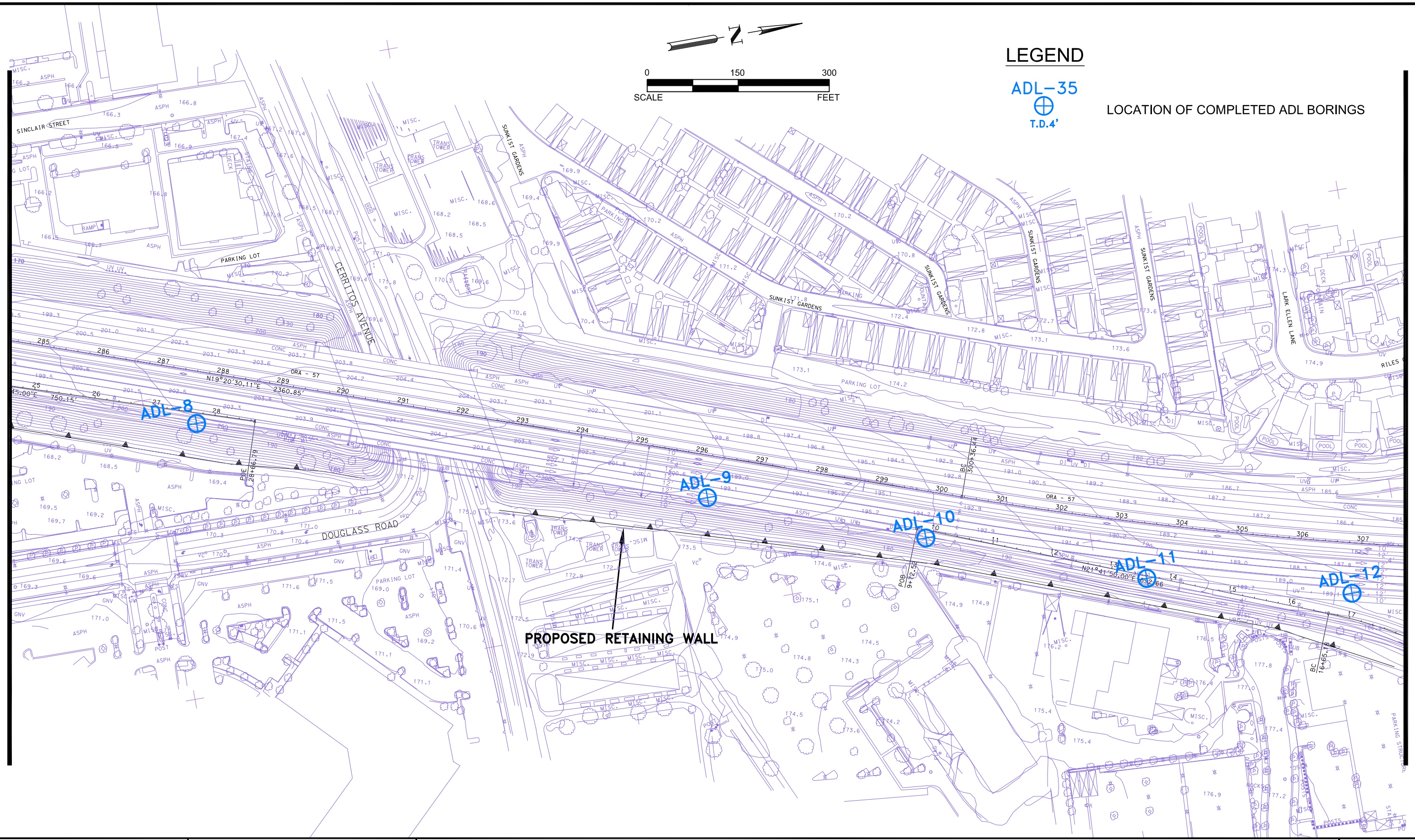
ADL BORING LOCATION MAP

NORTHBOUND SR-57 WIDENING
BETWEEN KATELLA AVENUE AND LINCOLN AVENUE
ORANGE COUNTY, CALIFORNIA

FIGURE 2A

Leighton

MATCHLINE SEE FIGURE 2A



MATCHLINE SEE FIGURE 2C

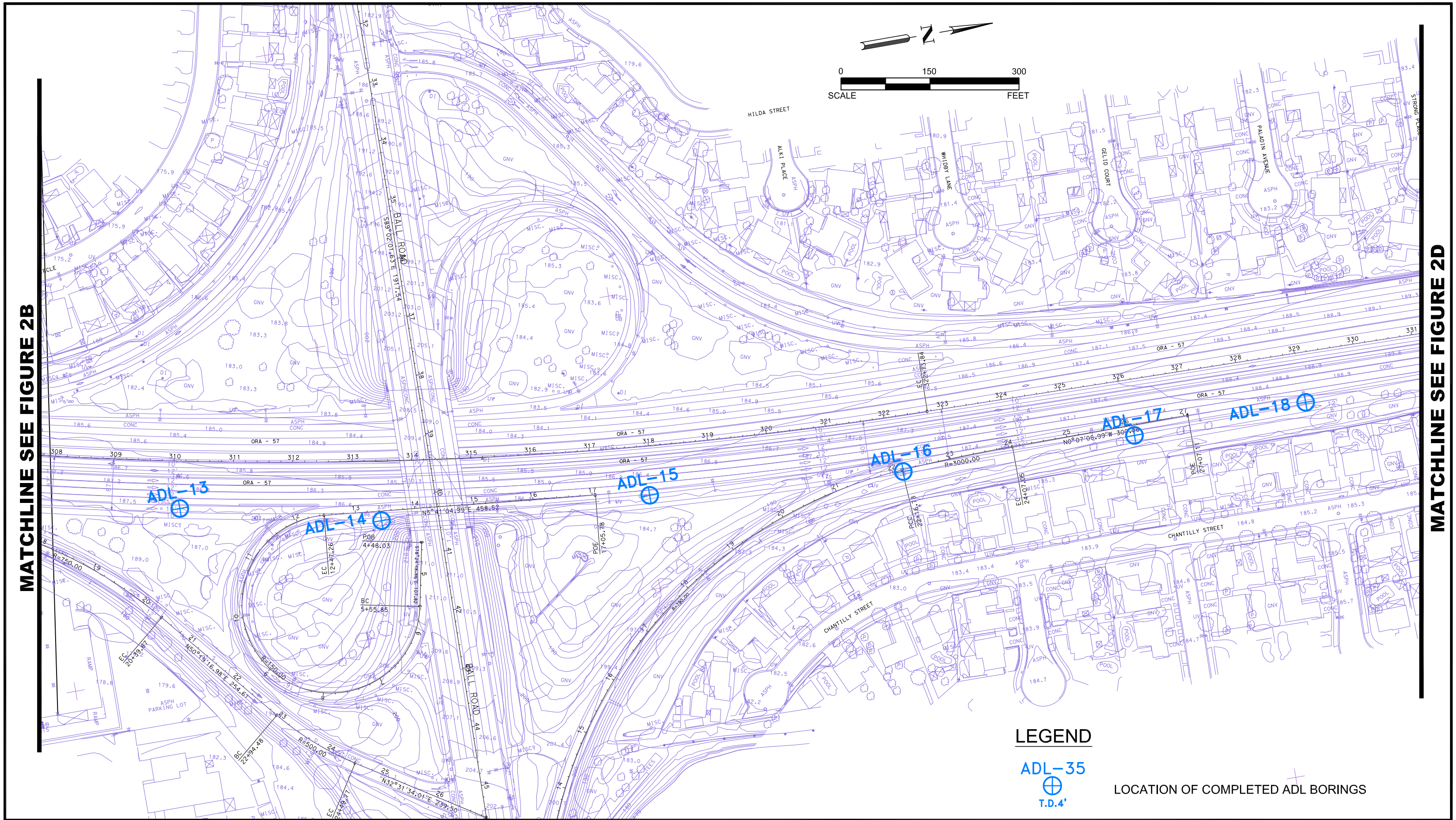
Proj: 602231-002	Eng/Geol: DJC/ELB	
Scale: 1"=150'	Date: 4/09	
Drafted By: BQT	Checked By: BQT	P:\DRAFTING\602231\002\OF_2009-03-12\FIGURES.DWG (04-15-09 4:50:34PM) Plotted by: btran

ADL BORING LOCATION MAP

NORTHBOUND SR-57 WIDENING
BETWEEN KATELLA AVENUE AND LINCOLN AVENUE
ORANGE COUNTY, CALIFORNIA

FIGURE 2B

Leighton



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Drafted By: BQT	Checked By: BQT	P:\DRAFTING\602231\002\OF_2009-03-12\FIGURES.DWG (04-15-09 4:51:15PM) Plotted by: btran

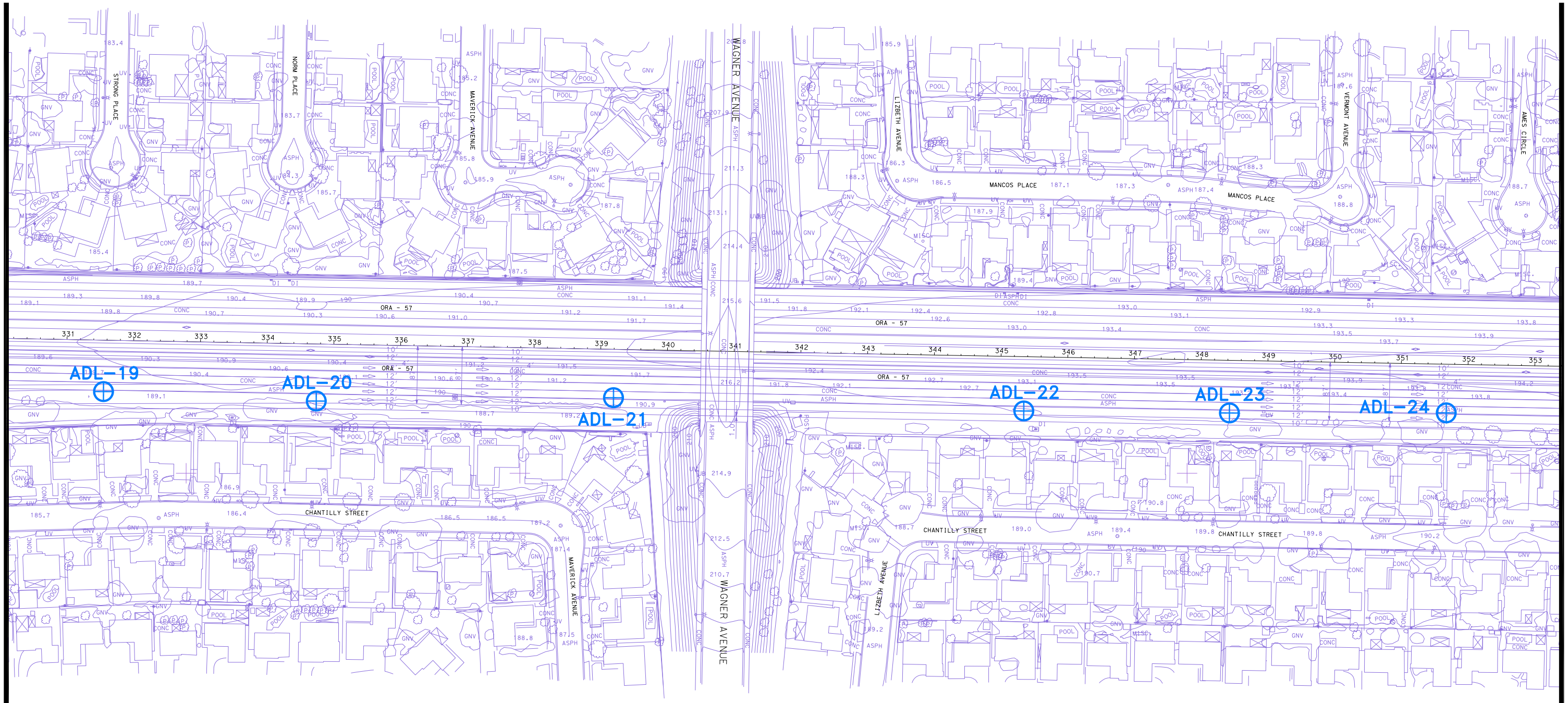
ADL BORING LOCATION MAP

NORTHBOUND SR-57 WIDENING
BETWEEN KATELLA AVENUE AND LINCOLN AVENUE
ORANGE COUNTY, CALIFORNIA

FIGURE 2C

Leighton

MATCHLINE SEE FIGURE 2C



MATCHLINE SEE FIGURE 2E

LEGEND

ADL-35
T.D.4'

LOCATION OF COMPLETED ADL BORINGS

N

0 150 300
SCALE FEET

Proj: 602231-002	Eng/Geol: DJC/ELB	
Scale: 1"=150'	Date: 4/09	
Drafted By: BQT	Checked By: BQT	P:\DRAFTING\602231\002\OF_2009-03-12\FIGURES.DWG (04-15-09 4:51:55PM) Plotted by: btran

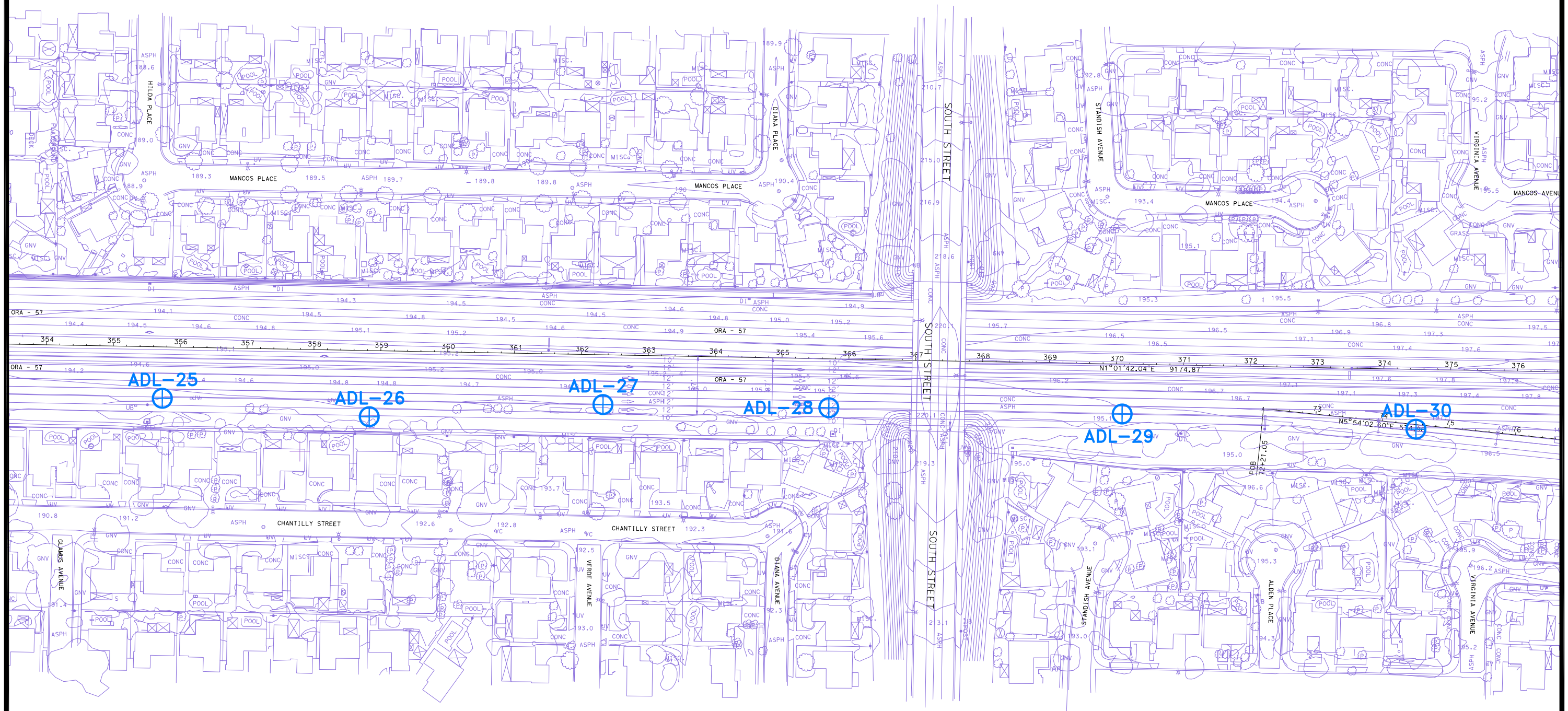
ADL BORING LOCATION MAP

NORTHBOUND SR-57 WIDENING
BETWEEN KATELLA AVENUE AND LINCOLN AVENUE
ORANGE COUNTY, CALIFORNIA

FIGURE 2D

Leighton

MATCHLINE SEE FIGURE 2D



MATCHLINE SEE FIGURE 2F

LEGEND

ADL-35
T.D.4'

LOCATION OF COMPLETED ADL BORINGS

N

0 150 300
SCALE FEET

Proj: 602231-002	Eng/Geol: DJC/ELB	
Scale: 1"=150'	Date: 4/09	
Drafted By: BQT	Checked By: BQT	P:\DRAFTING\602231\002\OF_2009-03-12\FIGURES.DWG (04-15-09 4:52:33PM) Plotted by: btran

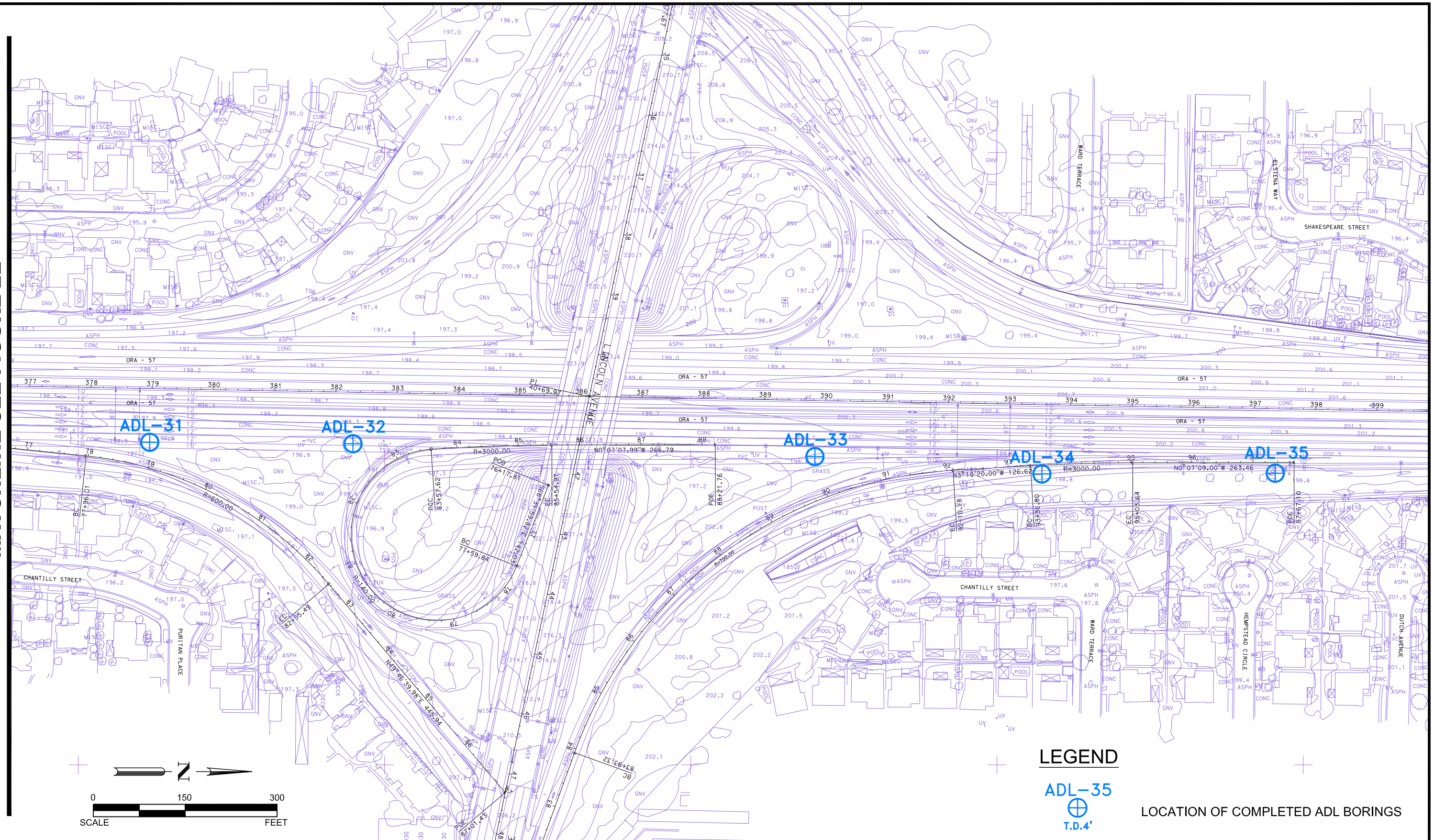
ADL BORING LOCATION MAP

NORTHBOUND SR-57 WIDENING
BETWEEN KATELLA AVENUE AND LINCOLN AVENUE
ORANGE COUNTY, CALIFORNIA

FIGURE 2E

Leighton

MATCHLINE SEE FIGURE 2E



LEGEND

ADL-35
T.D.4'

LOCATION OF COMPLETED ADL BORINGS

Proj: 602231-002	Eng/Geol: DJC/ELB	
Scale: 1"=150'	Date: 4/09	
Drafted By: BQT	Checked By: BQT	P:\DRAFTING\602231\002\OF_2009-03-12\FIGURES.DWG (04-15-09 4:53:11PM) Plotted by: btran

ADL BORING LOCATION MAP

NORTHBOUND SR-57 WIDENING
BETWEEN KATELLA AVENUE AND LINCOLN AVENUE
ORANGE COUNTY, CALIFORNIA

FIGURE 2F

Leighton

APPENDIX A

APPENDIX A

REFERENCES

California Department of Transportation (Caltrans), Standard Environmental Reference, Volume 1: Guidance for Compliance, Chapter 10: Hazardous Waste, www.dot.ca.gov/ser/envhand.htm

Department of Toxic Substance Control, Variance, September 22, 2000, extended to June 30, 2009

Leighton Consulting, Inc., 2009, Work Plan and Site Specific Health and Safety Plan Aerially Deposited Lead Survey Northbound SR-57 Widening Project Katella Avenue to Lincoln Avenue, Orange County, California, revised February 4, 2009.

United States Environmental Protection Agency, ProUCL , Version 4.0, April 2007.

United States Environmental Protection Agency, SW-846, Chapter Nine, 3rd Edition, 1986.

APPENDIX B

STATE OF CALIFORNIA · DEPARTMENT OF TRANSPORTATION

ENCROACHMENT PERMIT

TR-0120 (REV. 6/2000)

Permit No.	12-08-N-DP-0771
Dist/Co/Rte/PM	12-ORA-57 PM 12.247-PM 15.168
Date	01/16/2009
Fee Paid	$ EA 0F0400
Deposit	$ EA 0F0400
Performance Bond Amount (1)	$ 0.00
Payment Bond Amount (2)	$ 0.00
Bond Company	
Bond Number (1)	
Bond Number (2)	

In compliance with (Check one):

☒ Your application of December 24, 2008

☐ Utility Notice No. _____ of _____

☐ Agreement No. 12-571 of _____

☐ R/W Contract No. _____ of _____

TO: LEIGHTON CONSULTING, INC.
17781 COWAN
IRVINE, CA 92614
Attn: TAE KUK KIM 949-250-1421

, PERMITTEE

and subject to the following, PERMISSION IS HEREBY GRANTED to:

Perform the work authorized under Caltrans Encroachment Permit No. 1208-NSV-0702 issued to OCTA, in accordance with all the terms and conditions of the original permit.

All work to be performed within the State Right of Way shall conform to the current Caltrans Standard Plans and Standard Specifications, the Encroachment Permits Manual, the Caltrans MUTCD, the attached provisions and permit plans stamp-dated DECEMBER 24, 2008.

Permittee shall contact TOM SHAMSABADI, State Permit Inspector, at 949-440-4493 a minimum of five working days prior to the start of work within State right of way.

Lane closure on Route 57 shall be between the hours of 10:00 PM and 4:45 AM, Sunday night to Friday morning only.

THIS PERMIT IS NOT A PROPERTY RIGHT AND DOES NOT TRANSFER WITH THE PROPERTY TO A NEW OWNER.

The following attachments are also included as part of this permit *(Check applicable)*:

☒ Yes ☐ No General Provisions
☐ Yes ☒ No Utility Maintenance Provisions
☐ Yes ☒ No Storm Water Special Provisions
☐ Yes ☒ No Special Provisions
☐ Yes ☒ No A Cal-OSHA permit, if required: Permit No. _____
☐ Yes ☒ No As-Built Plans Submittal Route Slip for Locally Advertised Projects
☐ Yes ☒ No Storm Water Pollution Prevention Plan / Water Pollution Control Plan

In addition to fee, the permittee will be billed actual costs for:

☐ Yes ☒ No Review
☐ Yes ☒ No Inspection
☒ Yes ☐ No Field Work

(if any Caltrans effort expended)

☐ Yes ☒ No The information in the environmental documentation has been reviewed and considered prior to approval of this permit.

This permit is void unless the work is completed before May 31, 2009
This permit is to be strictly construed and no other work other than specifically mentioned is hereby authorized.
No project work shall be commenced until all the other necessary permits and the environmental clearances have been obtained.

PERMIT ENGINEER: Shawn Romouzi
RELATED PERMIT(S): 12-08-N-SV-0702
COPIES TO:
Permittee
File: 08-0771
File: 08-0702
T. Shamsabadi, Permits
Maintenance (2)

APPROVED:

Cindy Quon, District Director

BY:

MORY MOHTASHAMI , P.E., District Permit Engineer

FM 91 1436 (D12 Permit App.)

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

STANDARD ENCROACHMENT PERMIT APPLICATION

TR-0100 (REV. 07/2007)

FOR CALTRANS USE	
PERMIT NO.	1208-NDP-0771
DIST/CO/RTE/PM	12-ORA-57-12.247/15.168
SIMPLEX STAMP	080771
	12 67N
DATE OF SIMPLEX STAMP	12/17/08

Permission is requested to encroach on the State Highway right-of-way as follows:
(Complete all BOXES [write N/A if not applicable])
This application is not complete until all requirements have been approved.

1. COUNTY	2. ROUTE	3. POSTMILE
Orange	57	12.247/15.168

4. ADDRESS OR STREET NAME	5. CITY
SR-57	Orange/ Anaheim

6. CROSS STREET *(Distance and direction from site)*	7. PORTION OF RIGHT-OF-WAY
Approx. 1650' South of Katella Ave to 1650' North of Lincoln Ave	SR-91 westbound shoulder

8. WORK TO BE PERFORMED BY	9. EST. START DATE	10. EST. COMPLETION DATE
☑ OWN FORCES ☐ CONTRACTOR	January 1, 2009	February 1, 2009

11. EXCAVATION	MAX. DEPTH	AVG. DEPTH	AVG. WIDTH	LENGTH	SURFACE TYPE
	80 feet	10 feet	4.5 inches	N/A	AC/PCC/Dirt

12. EST. COST IN STATE HIGHWAY RIGHT-OF-WAY	FUNDING SOURCE(S)
N/A	☐ FEDERAL ☑ STATE ☐ LOCAL ☐ PRIVATE

13. PIPES	PRODUCT TYPE	DIAMETER	VOLTAGE / PSIG	14. CALTRANS PROJECT E.A. NUMBER
	N/A	N/A	N/A	EA 0F0400

15. ☑ **Double Permit** **Parent Permit Number** 1208-NSV-0702
Applicant's Reference Number / Utility Work Order Number _____

16. **Have your plans been reviewed by another Caltrans branch?** ☑ **NO** ☐ **YES** (If "YES") **Who?**_____

17. **Completely describe work to be done within STATE highway right-of-way :**
Attach 6 complete sets of **FOLDED** plans (folded 8.5" x 11"), and any applicable specifications, calculations, maps, etc.
All dimensions shall be in U.S. Customary (English) Units.

Perform geotechnical borings and aerially deposited lead (ADL) sampling. This investigation is necessary as part of the SR-57 Widening PS&E, which will develop final design plans for a widening along northbound of SR-57, starting from approximately 1,650 feet south of Katella Avenue to approximately 1,650 feet north of Lincoln Avenue. Fifteen 8-inch diameter hollow-stem auger exploratory borings and thirty five 2-inch to 4-inch diameter hand auger and/or geoprobe borings to collect soil samples and document subsurface conditions at the site will be taken. The approximate site location is shown on Figure 1 and the proposed boring locations and total depth are shown on Plates 1 and 2. The borings are within Caltrans R/W in the shoulder or travel lane of SR-57 Northbound. Traffic control will be provided by a Caltrans-approved firm and the traffic control plan is shown on Figure 2. Utilities will be cleared with USA. The borings will be backfilled with soil and concrete mix immediately after drilling. The pavement surface will be patched with concrete mix, if penetrated. Any excess cutting or drilling spoils will be cleaned up and disposed off-site, and the site will be left in its original condition.

18. **Is a city, county, or other agency involved in the approval of this project?**

☑ YES ***(If "YES", check type of project and attach environmental documentation and conditions of approval.)***

☐ COMMERCIAL DEVELOPMENT ☐ BUILDING ☐ GRADING ☑ OTHER pavement widening

☑ CATEGORICALLY EXEMPT ☐ NEGATIVE DECLARATION ☐ ENVIRONMENTAL IMPACT REPORT ☐ OTHER_____

☐ NO ***(If "NO", please check the category below which best describes the project, and complete page 4 of this application.)***

☐ DRIVEWAY OR ROAD APPROACH, RECONSTRUCTION, MAINTENANCE, OR RESURFACING
☐ PUBLIC UTILITY MODIFICATIONS, EXTENSIONS, HOOKUPS
☐ FLAGS, SIGNS, BANNERS, DECORATIONS, PARADES AND CELEBRATIONS
☐ OTHER_____
☐ FENCE
☐ MAILBOX
☐ EROSION CONTROL
☐ LANDSCAPING

19. Will this project cause a substantial change in the significance of a historical resource (45 years or older), or cultural resource? ☐ YES ☑ NO
(If "YES", provide a description)

20. Is this project on an existing highway or street where the activity involves removal of a scenic resource including a significant tree or stand of trees, a rock outcropping or a historic building? ☐ YES ☑ NO (If "YES", provide a description)

21. **Is work being done on applicant's property?** ☐ YES ☑ NO (If "YES", attach site and grading plans.)

ADA NOTICE: For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3880 or write to Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814

STANDARD ENCROACHMENT PERMIT APPLICATION

TR-0100 (REV. 07/2007)

PERMIT NO.

22. Will this proposed project require the disturbance of soil? ☑ YES ☐ NO

If "YES", estimate the area within State Highway right-of-way in square feet AND acres: 1.4 (ft²) AND _____ (acres)

estimate the area outside of State Highway right-of-way in square feet AND acres: _____ (ft²) AND _____ (acres)

23. Will this proposed project require dewatering? ☐ YES ☑ NO

If "YES", estimate total gallons AND gallons/month. _____ (gallons) AND _____ (gallons/month)

SOURCE*: ☐ STORM WATER ☐ NON-STORM WATER

(*See Caltrans SWMP for definitions of non-storm water discharge: http://www.dot.ca.gov/hq/env/stormwater/index.htm)

24. How will any storm water or ground water be disposed of from within or near the limits of this proposed project?

☐ Storm Drain System ☐ Combined Sewer / Storm System ☐ Storm Water Retention Basin

☑ Other (explain): N/A

PLEASE READ THE FOLLOWING CLAUSES PRIOR TO SIGNING THIS ENCROACHMENT PERMIT APPLICATION.

The applicant, understands and herein agrees to that an encroachment permit can be denied, and/or a bond required for non-payment of prior or present encroachment permit fees. Encroachment Permit fees may still be due when an application is withdrawn or denied, and that a denial may be appealed, in accordance with the California Streets and Highways Code, Section 671.5. All work shall be done in accordance with Caltrans rules and regulations subject to inspection and approval.

The applicant, understands and herein agrees to the general provisions, special provisions and conditions of the encroachment permit, and to indemnify and hold harmless the State, its officers, directors, agents, employees and each of them (Indemnitees) from and against any and all claims, demands, causes of action, damages, costs, expenses, actual attorneys' fees, judgments, losses and liabilities of every kind and nature whatsoever (Claims) arising out of or in connection with the issuance and/or use of this encroachment permit and the placement and subsequent operation and maintenance of said encroachment for: 1) bodily injury and/or death to persons including but not limited to the Applicant, the State and its officers, directors, agents and employees, the Indemnities, and the public; and 2) damage to property of anyone. Except as provided by law, the indemnification provisions stated above shall apply regardless of the existence or degree of fault of Indemnities. The Applicant, however, shall not be obligated to indemnify Indemnities for Claims arising from the sole negligence and willful misconduct of State, its officers, directors, agents or employees.

DISCHARGES OF STORM WATER AND NON-STORM WATER: Work within State Highway right-of-way shall be conducted in compliance with all applicable requirements of the National Pollutant Discharge Elimination System (NPDES) permit issued to the Department of Transportation (Department), to govern the discharge of storm water and non-storm water from its properties. Work shall also be in compliance with all other applicable Federal, State and Local laws and regulations, and with the Department's Encroachment Permits Manual and encroachment permit. Compliance with the Departments NPDES permit requires amongst other things, the preparation and submission of a Storm Water Pollution Protection Plan (SWPPP), or a Water Pollution Control Program (WPCP), and the approval of same by the appropriate reviewing authority prior to the start of any work. Information on the requirements may also be reviewed on the Department's Construction Website at:

http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm

25. NAME of APPLICANT or ORGANIZATION *(Print or Type)* Leighton Consulting, Inc.	E-MAIL ADDRESS tkim@leightongroup.com
ADDRESS of APPLICANT or ORGANIZATION WHERE PERMIT IS TO BE MAILED *(Include City and Zip Code)* 17781 Cowan, Irvine, CA 92614	
PHONE NUMBER 949) 250-1421	FAX NUMBER 949) 250-1114

26. NAME of AUTHORIZED AGENT / ENGINEER *(Print or Type)* Tae Kuk Kim	IS LETTER OF AUTHORIZATION ATTACHED? ☐ YES ☑ NO	E-MAIL ADDRESS tkim@leightongroup.com
ADDRESS of AUTHORIZED AGENT / ENGINEER *(Include City and Zip Code)* 17781 Cowan, Irvine, CA 92614		
PHONE NUMBER 949) 250-1421	FAX NUMBER 949) 250-1114	

27. SIGNATURE of APPLICANT or AUTHORIZED AGENT	28. PRINT OR TYPE NAME Tae Kuk Kim	29. TITLE Project Engineer	30. DATE 12/12/2008

PERMIT NO.
WORK ORDER/REFERENCE NUMBER

FEE CALCULATION -- FOR CALTRANS USE

☐ CASH ☐ CREDIT CARD NAME ON CARD _____ PHONE NUMBER _____

☐ CHECK NUMBER _____ NAME ON CHECK _____ PHONE NUMBER _____

☐ EXEMPT ☐ PROJECT EA _ _ _ _ _ _ ☐ DEFERRED BILLING (Utility)

CALCULATED BY	(1)		(2)		
REVIEW 1. _____ HOURS @ $_____ * 2. _____ HOURS @ $_____ *	1. FEE / DEPOSIT $_____	DATE	2. FEE / DEPOSIT $_____	DATE	TOTAL FEE / DEPOSIT $_____ $_____
INSPECTION 1. _____ HOURS @ $_____ * 2. _____ HOURS @ $_____ *	1. FEE / DEPOSIT $_____	DATE	2. FEE / DEPOSIT $_____	DATE	TOTAL FEE / DEPOSIT $_____ $_____
FIELD WORK _____ HOURS @ $_____ *	$_____		$_____		$_____
EQUIPMENT & MATERIALS	DEPOSIT $_____	DATE	DEPOSIT $_____	DATE	DEPOSIT $_____
CASH DEPOSIT IN LIEU OF BOND	$_____		$_____		$_____
TOTAL COLLECTED	$_____		$_____		
CASHIER'S INITIALS	_____		_____		$_____

** The current hourly rate is set annually by Headquarters Accounting. District Office staff do not have authority to modify this rate.*

PERFORMANCE BOND ☐	DATE	AMOUNT $
PAYMENT BOND ☐	DATE	AMOUNT $
LIABILITY INSURANCE REQUIRED?	☐ YES ☐ NO	AMOUNT $

INSTRUCTIONS
for completing page 4

This page needs to be completed when the proposed project DOES NOT involve a City, County or other public agency.

Your answers to these questions will assist departmental staff in identifying any physical, biological, social or economic resources that may be affected by your proposed project within the State highway right-of-way. And, to determine which type of environmental studies may be required to approve your application for an encroachment permit.

It is the applicant's responsibility for the production of all required environmental documentation and supporting studies, in some cases this may be costly and time-consuming. If possible, attach photographs of the location of the proposed project.

Please answer these questions to the best of your ability. Provide a description of any "YES" answers (type, name, number, etc.)

1. Will any existing vegetation and/or landscaping within the highway right-of-way be disturbed?

2. Are there waterways (e.g. river, creek, pond, natural pool or dry streambed) adjacent to or within the limits of the project or highway right-of-way?

3. Is the proposed project located within five miles of the coast line?

4. Will the proposed project generate construction noise levels greater than 86 dBA (e.g. jack-hammering, pile driving)?

5. Will the proposed project incorporate land from a public park, recreation area or wildlife refuge open to the public?

6. Are there any recreational trails or paths within the limits of the proposed project or highway right-of-way?

7. Will the proposed project impact any structures, buildings, rail lines, or bridges within highway right-of-way?

8. Will the proposed project impact access to any businesses or residences?

9. Will the proposed project impact any existing public utilities or public services?

10. Will the proposed project impact existing pedestrian facilities, such as sidewalks, crosswalks, or overcrossings?

11. Will new lighting be constructed within or adjacent to highway right-of-way?

STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION
ENCROACHMENT PERMIT GENERAL PROVISIONS
TR-0045 (REV. 06/2006)

1. **AUTHORITY:** The Department's authority to issue encroachment permits is provided under, Div. 1, Chpt. 3, Art. 1, Sect. 660 to 734 of the Streets and Highways Code.

2. **REVOCATION:** Encroachment permits are revocable on five days notice unless otherwise stated on the permit and except as provided by law for public corporations, franchise holders, and utilities. These General Provisions and the Encroachment Permit Utility Provisions are subject to modification or abrogation at any time. Permittees' joint use agreements, franchise rights, reserved rights or any other agreements for operating purposes in State highway right of way are exceptions to this revocation.

3. **DENIAL FOR NONPAYMENT OF FEES:** Failure to pay permit fees when due can result in rejection of future applications and denial of permits.

4. **ASSIGNMENT:** No party other than the permittee or permittee's authorized agent is allowed to work under this permit.

5. **ACCEPTANCE OF PROVISIONS:** Permittee understands and agrees to accept these General Provisions and all attachments to this permit, for any work to be performed under this permit.

6. **BEGINNING OF WORK:** When traffic is not impacted (see Number 35), the permittee shall notify the Department's representative, two (2) days before the intent to sart permitted work. Permittee shall notify the Department's Representative if the work is to be interrupted for a period of five (5) days or more, unless otherwise agreed upon. All work shall be performed on weekdays during regular work hours, excluding holidays, unless otherwise specified in this permit.

7. **STANDARDS OF CONSTRUCTION:** All work performed within highway right of way shall conform to recognized construction standards and current Department Standard Specifications, Department Standard Plans High and Low Risk Facility Specifications, and Utility Special Provisions. Where reference is made to "Contractor and Engineer," these are amended to be read as "Permittee and Department representative."

8. **PLAN CHANGES:** Changes to plans, specifications, and permit provisions are not allowed without prior approval from the State representative.

9. **INSPECTION AND APPROVAL:** All work is subject to monitoring and inspection. Upon completion of work, permittee shall request a final inspection for acceptance and approval by the Department. The local agency permittee shall not give final construction approval to its contractor until final acceptance and approval by the Department is obtained.

10. **PERMIT AT WORKSITE:** Permittee shall keep the permit package or a copy thereof, at the work site and show it upon request to any Department representative or law enforcement officer. If the permit package is not kept and made available at the work site, the work shall be suspended.

11. **CONFLICTING ENCROACHMENTS:** Permittee shall yield start of work to ongoing, prior authorized, work adjacent to or within the limits of the project site. When existing encroachments conflict with new work, the permittee shall bear all cost for rearrangements, (e.g., relocation, alteration, removal, etc.).

12. **PERMITS FROM OTHER AGENCIES:** This permit is invalidated if the permittee has not obtained all permits necessary and required by law, from the Public Utilities Commission of the State of California (PUC), California Occupational Safety and Health Administration (Cal-OSHA), or any other public agency having jurisdiction.

13. **PEDESTRIAN AND BICYCLIST SAFETY:** A safe minimum passageway of 4' shall be maintained through the work area at existing pedestrian or bicycle facilities. At no time shall pedestrians be diverted onto a portion of the street used for vehicular traffic. At locations where safe alternate passageways cannot be provided, appropriate signs and barricades shall be installed at the limits of construction and in advance of the limits of construction at the nearest crosswalk or intersection to detour pedestrians to facilities across the street.

14. **PUBLIC TRAFFIC CONTROL:** As required by law, the permittee shall provide traffic control protection warning signs, lights, safety devices, etc., and take all other measures necessary for traveling public's safety. Day and night time lane closures shall comply with the MUTCD and CA Supplement (Part 6, Temporary Traffic Control), Standard Plans, and Standard Specifications for traffic control systems. These General Provisions are not intended to impose upon the permittee, by third parties, any duty or standard of care, greater than or different from, as required by law.

15. **MINIMUM INTERFERENCE WITH TRAFFIC:** Permittee shall plan and conduct work so as to create the least possible inconvenience to the traveling public; traffic shall not be unreasonably delayed. On conventional highways, permittee shall place properly attired flagger(s) to stop or warn the traveling public in compliance with the MUTCD and CA Supplement (Chapter 6E, Flagger Control).

16. **STORAGE OF EQUIPMENT AND MATERIALS:** The storage of equipment or materials **is not** allowed within State highway right-of-way, **unless specified** within the Special Provisions of this specific encroachment permit. If Encroachment Permit Special Provisions allow for the storage of equipment or materials within the State right of way, the equipment and material storage shall comply with Standard Specifications, Standard Plans, Special Provisions, and the Highway Design Manual. The clear recovery zone widths must be followed and are the minimum desirable for the type of facility indicated below: freeways and expressways - 30', conventional highways (no curbs) - 20', conventional highways (with curbs) – 1.5'. If a fixed object cannot be eliminated, moved outside the clear recovery zone, or modified to be made yielding, it should be shielded by a guardrail or a crash cushion.

17. **CARE OF DRAINAGE:** Permittee shall provide alternate drainage for any work interfering with an existing drainage facility in compliance with the Standard Specifications, Standard Plans and/or as directed by the Department's representative.

18. **RESTORATION AND REPAIRS IN RIGHT OF WAY:** Permittee is responsible for restoration and repair of State highway right of way resulting from permitted work (State Streets and Highways Code, Sections 670 et. seq.).

19. **RIGHT OF WAY CLEAN UP:** Upon completion of work, permittee shall remove and dispose of all scraps, brush, timber, materials, etc. off the right of way. The aesthetics of the highway shall be as it was before work started.

20. **COST OF WORK:** Unless stated in the permit, or a separate written agreement, the permittee shall bear all costs incurred for work within the State right of way and waives all claims for indemnification or contribution from the State.

21. **ACTUAL COST BILLING:** When specified in the permit, the Department will bill the permittee actual costs at the currently set hourly rate for encroachment permits.

22 **AS-BUILT PLANS:** When required, permittee shall submit one (1) set of as-built plans within thirty (30) days after completion and approval of work in compliance with requirements listed as follows:

1. Upon completion of the work provided herein, the permittee shall send one vellum or paper set of As-Built plans, to the State representative. Mylar or paper sepia plans are not acceptable.
2. All changes in the work will be shown on the plans, as issued with the permit, including changes approved by Encroachment Permit Rider.
3. The plans are to be stamped or otherwise noted AS-BUILT by the permittee's representative who was responsible for overseeing the work. Any original plan that was approved with a State stamp, or Caltrans representative signature, shall be used for producing the As-Built plans.
4. If As-Built plans include signing or striping, the dates of signing or striping removal, relocation, or installation shall be shown on the plans when required as a condition of the permit. When the construction plans show signing and striping for staged construction on separate sheets, the sheet for each stage shall show the removal, relocation or installation dates of the appropriate staged striping and signing.
5. As-Built plans shall contain the Permit Number, County, Route, and Post Mile on each sheet.
6. Disclaimer statement of any kind that differ from the obligations and protections provided by Sections 6735 through 6735.6 of the California Business and Professions Code, shall not be included on the As-Built plans. Such statements constitute non-compliance with Encroachment Permit requirements, and may result in the Department of Transportation retaining Performance Bonds or deposits until proper plans are submitted. Failure to comply may also result in denial of future permits, or a provision requiring a public agency to supply additional bonding.

23. **PERMITS FOR RECORD PURPOSES ONLY:** When work in the right of way is within an area under a Joint Use Agreement (JUA) or a Consent to Common Use Agreement (CCUA), a fee exempt permit is issued to the permittee for the purpose of providing a notice and record of work. The Permittee's prior rights shall be preserved without the intention of creating new or different rights or obligations. "Notice and Record Purposes Only" shall be stamped across the face of the permit.

24. **BONDING:** The permittee shall file bond(s), in advance, in the amount set by the Department. Failure to maintain bond(s) in full force and effect will result in the Department stopping of all work and revoking permit(s). Bonds are not required of public corporations or privately owned utilities, unless permittee failed to comply with the provision and conditions under a prior permit. The surety company is responsible for any latent defects as provided in California Code of Civil Procedures, Section 337.15. Local agency permittee shall comply with requirements established as follows: In recognition that project construction work done on State property will not be directly funded and paid by State, for the purpose of protecting stop notice claimants and the interests of State relative to successful project completion, the local agency permittee agrees to require the construction contractor furnish both a payment and performance bond in the local agency's name with both bonds complying with the requirements set forth in Section 31.02 of State's current Standard Specifications before performing any project construction work. The local agency permittee shall defend, indemnify, and hold harmless the State, its officers and employees from all project construction related claims by contractors and all stop notice or mechanic's lien claimants. The local agency also agrees to remedy, in a timely manner and to State's satisfaction, any latent defects occurring as a result of the project construction work.

25. **FUTURE MOVING OF INSTALLATIONS:** Permittee understands and agrees to rearrange a permitted installation upon request by the Department, for State construction, reconstruction, or maintenance work on the highway. The permittee at his sole expense, unless under a prior agreement, JUA, or a CCUA, shall comply with said request.

26. **ARCHAEOLOGICAL/HISTORICAL:** If any archaeological or historical resources are revealed in the work vicinity, the permittee shall immediately stop work, notify the Department's representative, retain a qualified archaeologist who shall evaluate the site, and make recommendations to the Department representative regarding the continuance of work.

27. **PREVAILING WAGES:** Work performed by or under a permit may require permittee's contractors and subcontractors to pay appropriate prevailing wages as set by the Department of Industrial Relations. Inquiries or requests for interpretations relative to enforcement of prevailing wage requirements are directed to State of California Department of Industrial Relations, 525 Golden Gate Avenue, San Francisco, California 94102.

28. **RESPONSIBILITY FOR DAMAGE:** The State of California and all officers and employees thereof, including but not limited to the Director of Transportation and the Deputy Director, shall not be answerable or accountable in any manner for injury to or death of any person, including but not limited to the permittee, persons employed by the permittee, persons acting in behalf of the permittee, or for damage to property from any cause. The permittee shall be responsible for any liability imposed by law and for injuries to or death of any person, including but not limited to the permittee, persons employed by the permittee, persons acting in behalf of the permittee, or for damage to property arising out of work, or other activity permitted and done by the permittee under a permit, or arising out of the failure on the permittee's part to perform his obligations under any permit in respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity or at any subsequent time, work or other activity is being performed under the obligations provided by and contemplated by the permit.

The permittee shall indemnify and save harmless the State of California, all officers, employees, and State's contractors, thereof, including but not limited to the Director of Transportation and the Deputy Director, from all claims, suits or actions of every name, kind and description brought for or on account of injuries to or death of any person, including but not limited to the permittee, persons employed by the permittee, persons acting in behalf of the permittee

and the public, or damage to property resulting from the performance of work or other activity under the permit, or arising out of the failure on the permittee's part to perform his obligations under any permit in respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity or at any subsequent time, work or other activity is being performed under the obligations provided by and contemplated by the permit, except as otherwise provided by statute.

The duty of the permittee to indemnify and save harmless includes the duties to defend as set forth in Section 2778 of the Civil Code. The permittee waives any and all rights to any type of expressed or implied indemnity against the State, its officers, employees, and State contractors. It is the intent of the parties that the permittee will indemnify and hold harmless the State, its officers, employees, and State's contractors, from any and all claims, suits or actions as set forth above regardless of the existence or degree of fault or negligence, whether active or passive, primary or secondary, on the part of the State, the permittee, persons employed by the permittee, or acting on behalf of the permittee.

For the purpose of this section, "State's contractors" shall include contractors and their subcontractors under contract to the State of California performing work within the limits of this permit.

29. **NO PRECEDENT ESTABLISHED:** This permit is issued with the understanding that it does not establish a precedent.

30. **FEDERAL CIVIL RIGHTS REQUIREMENTS FOR PUBLIC ACCOMMODATION:**
A. The permittee, for himself, his personal representative, successors in interest, and assigns as part of the consideration hereof, does hereby covenant and agree that:
1. No person on the grounds of race, color, or national origin shall be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities.
2. That in connection with the construction of any improvements on said lands and the furnishings of services thereon, no discrimination shall be practiced in the selection and retention of first-tier subcontractors in the selection of second-tier subcontractors.
3. That such discrimination shall not be practiced against the public in their access to and use of the facilities and services provided for public accommodations (such as eating, sleeping, rest, recreation), and operation on, over, or under the space of the right of way.
4. That the permittee shall use the premises in compliance with all other requirements imposed pursuant to Title 15, Code of Federal Regulations, Commerce and Foreign Trade, Subtitle A. Office of the Secretary of Commerce, Part 8 (15 C.F.R. Part 8) and as said Regulations may be amended.
5.That in the event of breach of any of the above nondiscrimination covenants, the State shall have the right to terminate the permit and to re-enter and repossess said land and the land and the facilities thereon, and hold the same as if said permit had never been made or issued.

31. **MAINTENANCE OF HIGHWAYS:** The permittee agrees, by acceptance of a permit, to properly maintain any encroachment. This assurance requires the permittee to provide inspection and repair any damage, at permittee's expense, to State facilities resulting from the encroachment.

32. **SPECIAL EVENTS:** In accordance with subdivision (a) of Streets and Highways Code Section 682.5, the Department of Transportation shall not be responsible for the conduct or operation of the permitted activity, and the applicant agrees to defend, indemnify, and hold harmless the State and the city or county against any and all claims arising out of any activity for which the permit is issued.

Permittee understands and agrees that it will comply with the obligations of Titles II and III of the Americans with Disabilities Act of 1990 in the conduct of the event, and further agrees to indemnify and save harmless the State of California, all officers and employees thereof, including but not limited to the Director of Transportation, from any claims or liability arising out of or by virtue of said Act.

33. **PRIVATE USE OF RIGHT OF WAY:** Highway right of way shall not be used for private purposes without compensation to the State. The gifting of public property use and therefore public funds is prohibited under the California Constitution, Article 16.

34. **FIELD WORK REIMBURSEMENT:** Permittee shall reimburse State for field work performed on permittee's behalf to correct or remedy hazards or damaged facilities, or clear debris not attended to by the permittee.

35. **NOTIFICATION OF DEPARTMENT AND TMC:** The permittee shall notify the Department's representative and the Transportation Management Center (TMC) at least 7 days before initiating a lane closure or conducting an activity that may cause a traffic impact. A confirmation notification should occur 3 days before closure or other potential traffic impacts. In emergency situations when the corrective work or the emergency itself may affect traffic, TMC and the Department's representative shall be notified as soon as possible.

36. **SUSPENSION OF TRAFFIC CONTROL OPERATION:** The permittee, upon notification by the Department's representative, shall immediately suspend all lane closure operations and any operation that impedes the flow of traffic. All costs associated with this suspension shall be borne by the permittee.

37. **UNDERGROUND SERVICE ALERT (USA) NOTIFICATION:** Any excavation requires compliance with the provisions of Government Code Section 4216 et. seq., including , but not limited to notice to a regional notification center, such as Underground Service Alert (USA). The permittee shall provide notification at least 48 hours before performing any excavation work within the right of way.

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

CUSTOMER SERVICE QUESTIONNAIRE

TR-0164 (REV. 02/01)

PERMIT NUMBER

Dear Customer,

Our goal is to provide the best service possible to our customers. Please take a few minutes to complete this questionnaire. Your comments will enable us to see how we are doing overall and any areas which may need improvement.

PLEASE TELL US HOW WE'RE DOING ☑

INSIDE THE OFFICE	EXCELLENT	VERY GOOD	GOOD	POOR
Staff courteous and helpful				
Staff quick and efficient				
Explanations and instructions clear				
TELEPHONE ANSWERING				
Timely response				
Receiving information or answers				
INSPECTION				
Inspector courteous and helpfull				
Pre-construction meeting set and held in a timely manner				
Inspector at job site frequently				
Inspector able to answer questions and deal with problems				
OVERALL PERFORMANCE				
What would you say is our overall performance?				
Is there a staff person you would like to commend?	STAFF'S NAME:			

COMMENTS:

NAME (Optional)	BUSINESS PHONE NUMBER ( )	DATE

1. NPDES REQUIREMENTS: Permittee shall be responsible for full compliance with the Caltrans Storm Water Program and the Caltrans NPDES permit requirements. For additional information, visit the Caltrans Stormwater Website at http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm

2. RESPONSIBILITY FOR DEBRIS: Permittee shall be responsible for preventing all dirt, trash, debris and other construction waste from entering storm drains, local creeks, or other bodies of water.

3. VEHICLES AT THE WORK SITE: Permittee shall prevent all vehicles, equipment, etc. from leakage or mud tracking onto roadways.

4. VEHICLE FUEL AT THE WORKSITE: Permittee equipment fueling and maintenance activities shall not result in any pollution at the job site.

5. CLEANING VEHICLES AT WORKSITE: Permittee shall clean all equipment with clean water only in a bermed area or over a drip pan large enough to prevent run-off. No soaps, solvents, degreasers, etc shall be used in State right of way. Any water from this operation shall be collected and disposed of at an appropriate site.

6. WEATHER CONDITIONS AT WORKSITE: All paving, painting, grinding, and saw-cutting operations shall be performed during dry weather

7. FRESH AC: Fresh AC shall not be washed.

8. PROTECTION OF DRAINAGE: Permittee shall protect/cover gutters, ditches, drainage courses, and inlets with sand/gravel bags, fiber rolls, etc., to the satisfaction of the State representative during paving operations, saw-cutting, etc.

9. SAW CUTTING: No dry saw-cutting shall be allowed.

10. SPOILS & RESIDUE: Permittee shall vacuum or sweep any saw-cut spoils, debris, residue, etc. No spoils, debris, residue, etc. shall be washed into a drainage system.

11. PAINT: Rinsing of paintbrushes or materials is not permitted in state right-of-way. Oil based paint sludge and unusable thinner shall be disposed of at an approved hazardous waste site.

12. GROUT & MORTAR: All construction materials including concrete, grout, cement containing premixes and mortar shall be stored under cover and separated away from drainage areas. Stored materials shall not reach a storm drain.

13. CONCRETE EQUIPMENT/VEHICLES: Concrete equipment/trucks shall be washed out off of State right of way or in a designated washing area as required by Caltrans Standards.

14. SOIL DISTURBANCE: Soil disturbing activities shall be avoided during the rainy season. If grading activities during wet weather are allowed in your permit, all control measures necessary to prevent erosion shall be implemented.

15. EXISTING VEGETATION: Mature vegetation is the best form of erosion control. Disturbance to existing vegetation shall be minimized whenever possible.

16. SLOPES: In cases where slopes are disturbed during construction, soil shall be secured with erosion control and soil stabilization measures. Fiber rolls shall be placed downslope until the soil is secure.

17. CATCH BASINS: Sand, dirt, and similar materials shall be stored at least 3-meters (10-feet) from catch basins and covered with a tarp during wet weather or when rain is forecast.

18. SWEEPING: Roadways and other paved areas shall be swept daily. Roadways or work areas shall not be washed down with water.

19. CONTAMINATED WATER: The State representative shall be notified in case any unusual discoloration, odor, texture in ground water, in excavated material or abandoned underground tanks, pipes, or buried debris are encountered.

20. DIESEL FUELS: Use of diesel as a form-oil shall not be Permitted.

21. DEWATERING: Any effluent discharged into any storm water system requires a waste discharge permit from the Regional Water Quality Control Board. The permittee shall provide the State Representative with a copy of the Waste Discharge Permit.

State of California
WORK COMPLETION NOTICE
12-MP-0032 (REV. 05/07)

Permit no. _____

Dist./Co/Rte/PM_____

Inspector_____

Permittee _____

All work authorized by the above permit was completed on

Date: _____

Signed _____

CUSTOMER SERVICE QUESTIONNAIRE

PERFORMANCE	EXCELLENT	VERY GOOD	GOOD	POOR
INSIDE THE OFFICE				
Staff courteous and helpful				
Staff quick and efficient				
Explanations & instructions clear				
TELEPHONE ANSWERING				
Timely responses				
Give right information/answer				
INSPECTION				
Inspector courteous and helpful				
Pre-construction meeting set and held in a timely manner.				
Inspector at the job site frequently				
OVERALL PERFORMANCE				
What would you say is our overall performance				

Fill out the form immediately after completion of work and fax it to 949-724-2265

APPENDIX C

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

LABORATORY REPORT

Prepared For: Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project: CalTrans
SR-57, 602231-002

Sampled: 03/03/09
Received: 03/14/09
Issued: 04/07/09 16:37

NELAP #01108CA California ELAP#2706 CSDLAC #10256 AZ #AZ0671 NV #CA01531

The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica. The Chain of Custody, 1 page, is included and is an integral part of this report.
This entire report was reviewed and approved for release.

CASE NARRATIVE

SAMPLE RECEIPT: Samples were received intact, at 6°C, on ice and with chain of custody documentation on 03/04/09. Additional STLC tests were requested on 3/14/09. Additional DI-WET and TCLP tests were requested on 3/26/09.

HOLDING TIMES: All samples were analyzed within prescribed holding times and/or in accordance with the TestAmerica Sample Acceptance Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made.

SUBCONTRACTED: No analyses were subcontracted to an outside laboratory.

LABORATORY ID	CLIENT ID	MATRIX
ISC1454-02	09-061-S-BFM-29	Soil
ISC1454-03	09-061-S-BFM-31	Soil
ISC1454-04	09-061-S-BFM-32	Soil
ISC1454-05	09-061-S-BFM-33	Soil
ISC1454-06	09-061-S-BFM-34	Soil
ISC1454-07	09-061-S-BFM-35	Soil

Reviewed By:

TestAmerica Irvine

Patty Mata
Project Manager

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC1454

Sampled: 03/03/09
Received: 03/14/09

STLC METALS (DI WET)

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC1454-02 (09-061-S-BFM-29 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	ND	1	4/2/2009	4/2/2009	
Sample ID: ISC1454-03 (09-061-S-BFM-31 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	**0.020**	1	4/2/2009	4/2/2009	
Sample ID: ISC1454-04 (09-061-S-BFM-32 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	**0.042**	1	4/2/2009	4/2/2009	
Sample ID: ISC1454-05 (09-061-S-BFM-33 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	**0.034**	1	4/2/2009	4/2/2009	
Sample ID: ISC1454-06 (09-061-S-BFM-34 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	**0.15**	1	4/2/2009	4/2/2009	
Sample ID: ISC1454-07 (09-061-S-BFM-35 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	**0.016**	1	4/2/2009	4/2/2009	

TestAmerica Irvine

Patty Mata
Project Manager

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Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC1454

Sampled: 03/03/09
Received: 03/14/09

TCLP METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	TCLP Limit	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC1454-02 (09-061-S-BFM-29 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	ND	1	5.0	4/1/2009	4/2/2009	
Sample ID: ISC1454-03 (09-061-S-BFM-31 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	**1.6**	1	5.0	4/1/2009	4/2/2009	
Sample ID: ISC1454-04 (09-061-S-BFM-32 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	**0.90**	1	5.0	4/1/2009	4/2/2009	
Sample ID: ISC1454-05 (09-061-S-BFM-33 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	**1.3**	1	5.0	4/1/2009	4/2/2009	
Sample ID: ISC1454-06 (09-061-S-BFM-34 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	**0.73**	1	5.0	4/1/2009	4/2/2009	
Sample ID: ISC1454-07 (09-061-S-BFM-35 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	**1.9**	1	5.0	4/1/2009	4/2/2009	

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Project Manager

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Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC1454

Sampled: 03/03/09
Received: 03/14/09

WASTE EXTRACTION TEST (DI Water) - METALS

Analyte	Method	Batch	Extraction Start Date	Extraction End Date	Data Qualifiers
Sample ID: ISC1454-02 (09-061-S-BFM-29 - Soil)			**Sampled: 03/03/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	
Sample ID: ISC1454-03 (09-061-S-BFM-31 - Soil)			**Sampled: 03/03/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	
Sample ID: ISC1454-04 (09-061-S-BFM-32 - Soil)			**Sampled: 03/03/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	
Sample ID: ISC1454-05 (09-061-S-BFM-33 - Soil)			**Sampled: 03/03/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	
Sample ID: ISC1454-06 (09-061-S-BFM-34 - Soil)			**Sampled: 03/03/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	
Sample ID: ISC1454-07 (09-061-S-BFM-35 - Soil)			**Sampled: 03/03/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	

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Patty Mata
Project Manager

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC1454

Sampled: 03/03/09
Received: 03/14/09

TCLP EXTRACTION - Metals

Analyte	Method	Batch	Extraction Start Date	Extraction End Date	Data Qualifiers
Sample ID: ISC1454-02 (09-061-S-BFM-29 - Soil)			**Sampled: 03/03/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	
Sample ID: ISC1454-03 (09-061-S-BFM-31 - Soil)			**Sampled: 03/03/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	
Sample ID: ISC1454-04 (09-061-S-BFM-32 - Soil)			**Sampled: 03/03/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	
Sample ID: ISC1454-05 (09-061-S-BFM-33 - Soil)			**Sampled: 03/03/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	
Sample ID: ISC1454-06 (09-061-S-BFM-34 - Soil)			**Sampled: 03/03/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	
Sample ID: ISC1454-07 (09-061-S-BFM-35 - Soil)			**Sampled: 03/03/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	

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Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC1454

Sampled: 03/03/09
Received: 03/14/09

METHOD BLANK/QC DATA

TCLP METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9D01132 Extracted: 04/01/09										
Blank Analyzed: 04/02/2009 (9D01132-BLK1)										
Lead	ND	0.10	mg/l							
LCS Analyzed: 04/02/2009 (9D01132-BS1)										
Lead	1.91	0.10	mg/l	2.00		95	80-120			
Matrix Spike Analyzed: 04/02/2009 (9D01132-MS1)					**Source: ISC1453-03**					
Lead	2.26	0.10	mg/l	2.00	0.255	100	75-125			

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Project Manager

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17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC1454

Sampled: 03/03/09
Received: 03/14/09

METHOD BLANK/QC DATA

STLC METALS (DI WET)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9D02103 Extracted: 04/02/09										
Blank Analyzed: 04/02/2009 (9D02103-BLK1)										
Lead	ND	0.0050	mg/l							
LCS Analyzed: 04/02/2009 (9D02103-BS1)										
Lead	1.01	0.0050	mg/l	1.00		101	80-120			
Matrix Spike Analyzed: 04/02/2009 (9D02103-MS1)					**Source: ISC1453-03**					
Lead	1.13	0.0050	mg/l	1.00	0.103	103	75-125			
Matrix Spike Dup Analyzed: 04/02/2009 (9D02103-MSD1)					**Source: ISC1453-03**					
Lead	1.13	0.0050	mg/l	1.00	0.103	102	75-125	0	20	

TestAmerica Irvine

Patty Mata
Project Manager

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17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans SR-57, 602231-002 Report Number: ISC1454	Sampled: 03/03/09 Received: 03/14/09

DATA QUALIFIERS AND DEFINITIONS

ND Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.

RPD Relative Percent Difference

TestAmerica Irvine

Patty Mata
Project Manager

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans SR-57, 602231-002 Report Number: ISC1454	Sampled: 03/03/09 Received: 03/14/09

Certification Summary

TestAmerica Irvine

Method	Matrix	Nelac	California
6010B-DI WET	Soil	X	X
6010B-TCLP	Soil	X	X
DI WET-Met	Soil	X	X
EPA 1311-Met	Soil	X	X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at www.testamericainc.com

TestAmerica Irvine

Patty Mata
Project Manager

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TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue, Ste. 100 Irvine, CA 92614 (949) 261-1022 FAX (949) 261-1228

ADDITIONAL ANALYSIS REQUEST FORM

Date: 3/13/09 Project Manager: RM

Client: Leighton Consulting Contact: Kris Lutton

Project: CalTrans 602231-002, SR-57

Date Sampled: 3/2-3/3/09 Date Received: 3/4/09

ISC1454

Request Via:

- [ ] Telephone
- [ ] COC Form
- [ ] Fax
- [x] E-mail
- [ ] Other

Status:

- [ ] In Progress
- [x] Completed
- [ ] Received Today
- [ ] Received Yesterday
- [ ] On Hold
- [ ] Other

Turn Around Time:

- [ ] Same Day
- [ ] 24HR
- [ ] 48HR
- [ ] 3Day
- [ ] 5Day
- [x] Standard
- [ ] No Rush Charge

Work Order Number	Sample Description	Analysis Requested	Special Requirements
ISC0458-06	09-061-S-BFM-06	STLC-Lead	
29	-29		
31	-31		
32	32		
33	33		
34	34		
35	35		HS 3/16/09 10:05
37	37		

Need new work order.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

LABORATORY REPORT

Prepared For: Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project: CalTrans
S-57, 602231-002

Sampled: 03/03/09-03/04/09
Received: 03/14/09
Issued: 04/07/09 15:57

NELAP #01108CA California ELAP#2706 CSDLAC #10256 AZ #AZ0671 NV #CA01531

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This entire report was reviewed and approved for release.

CASE NARRATIVE

SAMPLE RECEIPT: Samples were received intact, at 6°C, on ice and with chain of custody documentation on 03/04/09. Additional STLC tests were requested on 3/14/09. Additional DI-WET and TCLP tests were requested on 3/26/09.

HOLDING TIMES: All samples were analyzed within prescribed holding times and/or in accordance with the TestAmerica Sample Acceptance Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made.

SUBCONTRACTED: No analyses were subcontracted to an outside laboratory.

LABORATORY ID	CLIENT ID	MATRIX
ISC1453-03	09-062-S-BFM-14	Soil
ISC1453-04	09-062-S-BFM-22	Soil
ISC1453-05	09-062-S-BFM-26	Soil
ISC1453-06	09-062-S-BFM-28	Soil

Reviewed By:

TestAmerica Irvine

Patty Mata
Project Manager

TestAmerica
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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
S-57, 602231-002
Report Number: ISC1453

Sampled: 03/03/09-03/04/09
Received: 03/14/09

STLC METALS (DI WET)

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC1453-03 (09-062-S-BFM-14 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	**0.10**	1	4/2/2009	4/2/2009	
Sample ID: ISC1453-04 (09-062-S-BFM-22 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	**0.040**	1	4/2/2009	4/2/2009	
Sample ID: ISC1453-05 (09-062-S-BFM-26 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	**0.030**	1	4/2/2009	4/2/2009	
Sample ID: ISC1453-06 (09-062-S-BFM-28 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/l								
Lead	6010B-DI WET	9D02103	0.0050	**0.10**	1	4/2/2009	4/2/2009	

TestAmerica Irvine

Patty Mata
Project Manager

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TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
S-57, 602231-002
Report Number: ISC1453

Sampled: 03/03/09-03/04/09
Received: 03/14/09

TCLP METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	TCLP Limit	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC1453-03 (09-062-S-BFM-14 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	**0.25**	1	5.0	4/1/2009	4/2/2009	
Sample ID: ISC1453-04 (09-062-S-BFM-22 - Soil)					**Sampled: 03/04/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	**1.2**	1	5.0	4/1/2009	4/2/2009	
Sample ID: ISC1453-05 (09-062-S-BFM-26 - Soil)					**Sampled: 03/04/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	**0.15**	1	5.0	4/1/2009	4/2/2009	
Sample ID: ISC1453-06 (09-062-S-BFM-28 - Soil)					**Sampled: 03/04/09**				
Reporting Units: mg/l									
Lead	6010B-TCLP	9D01132	0.10	**0.95**	1	5.0	4/1/2009	4/2/2009	

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S-57, 602231-002
Report Number: ISC1453

Sampled: 03/03/09-03/04/09
Received: 03/14/09

WASTE EXTRACTION TEST (DI Water) - METALS

Analyte	Method	Batch	Extraction Start Date	Extraction End Date	Data Qualifiers
Sample ID: ISC1453-03 (09-062-S-BFM-14 - Soil)			**Sampled: 03/03/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	
Sample ID: ISC1453-04 (09-062-S-BFM-22 - Soil)			**Sampled: 03/04/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	T5
Sample ID: ISC1453-05 (09-062-S-BFM-26 - Soil)			**Sampled: 03/04/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	
Sample ID: ISC1453-06 (09-062-S-BFM-28 - Soil)			**Sampled: 03/04/09**		
Extraction	DI WET-Met	9C31142	3/31/2009	4/2/2009	

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S-57, 602231-002
Report Number: ISC1453

Sampled: 03/03/09-03/04/09
Received: 03/14/09

TCLP EXTRACTION - Metals

Analyte	Method	Batch	Extraction Start Date	Extraction End Date	Data Qualifiers
Sample ID: ISC1453-03 (09-062-S-BFM-14 - Soil)			**Sampled: 03/03/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	
Sample ID: ISC1453-04 (09-062-S-BFM-22 - Soil)			**Sampled: 03/04/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	T5
Sample ID: ISC1453-05 (09-062-S-BFM-26 - Soil)			**Sampled: 03/04/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	
Sample ID: ISC1453-06 (09-062-S-BFM-28 - Soil)			**Sampled: 03/04/09**		
Extraction	EPA 1311-Met	9C31145	3/31/2009	4/1/2009	

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Sampled: 03/03/09-03/04/09
Received: 03/14/09

METHOD BLANK/QC DATA

TCLP METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9D01132 Extracted: 04/01/09										
Blank Analyzed: 04/02/2009 (9D01132-BLK1)										
Lead	ND	0.10	mg/l							
LCS Analyzed: 04/02/2009 (9D01132-BS1)										
Lead	1.91	0.10	mg/l	2.00		95	80-120			
Matrix Spike Analyzed: 04/02/2009 (9D01132-MS1)					**Source: ISC1453-03**					
Lead	2.26	0.10	mg/l	2.00	0.255	100	75-125			

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Report Number: ISC1453

Sampled: 03/03/09-03/04/09
Received: 03/14/09

METHOD BLANK/QC DATA

STLC METALS (DI WET)

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9D02103 Extracted: 04/02/09										
Blank Analyzed: 04/02/2009 (9D02103-BLK1)										
Lead	ND	0.0050	mg/l							
LCS Analyzed: 04/02/2009 (9D02103-BS1)										
Lead	1.01	0.0050	mg/l	1.00		101	80-120			
Matrix Spike Analyzed: 04/02/2009 (9D02103-MS1)					**Source: ISC1453-03**					
Lead	1.13	0.0050	mg/l	1.00	0.103	103	75-125			
Matrix Spike Dup Analyzed: 04/02/2009 (9D02103-MSD1)					**Source: ISC1453-03**					
Lead	1.13	0.0050	mg/l	1.00	0.103	102	75-125	0	20	

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans S-57, 602231-002 Report Number: ISC1453	Sampled: 03/03/09-03/04/09 Received: 03/14/09

DATA QUALIFIERS AND DEFINITIONS

T5	Less than the prescribed sample amount was available to perform the leachate extraction. The volume of extraction fluid was adjusted proportionately based on the method prescribed ratio of extraction fluid to sample weight.
ND	Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
RPD	Relative Percent Difference

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Certification Summary

TestAmerica Irvine

Method	Matrix	Nelac	California
6010B-DI WET	Soil	X	X
6010B-TCLP	Soil	X	X
DI WET-Met	Soil	X	X
EPA 1311-Met	Soil	X	X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at www.testamericainc.com

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ADDITIONAL ANALYSIS REQUEST FORM

Date: 3/13/09 Project Manager: [illegible]

Client: Leighton Consulting Contact: Kris Lutton

Project: Cal Trans 602231-002, SR-57

Date Sampled: 3/3/09-3/4/09 Date Received: 3/4/09

ISC1453

Request Via:

- [ ] Telephone
- [ ] COC Form
- [ ] Fax
- [x] E-mail
- [ ] Other

Status:

- [ ] In Progress
- [x] Completed
- [ ] Received Today
- [ ] Received Yesterday
- [ ] On Hold
- [ ] Other

Turn Around Time:

- [ ] Same Day
- [ ] 24HR
- [ ] 48HR
- [ ] 3Day
- [ ] 5Day
- [x] Standard
- [ ] No Rush Charge

Work Order Number	Sample Description	Analysis Requested	Special Requirements
ISC0457-05	09-062-S-BFM-05	STLC-Lead	
-09	09-062-S-BFM-09		
-14	-14		
-22	-22		
-26	-26		
-28	-28		

Need new work order

HS 3/16/09 10:10

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LABORATORY REPORT

Prepared For: Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project: CalTrans
SR-57 602231-002

Sampled: 02/26/09
Received: 02/26/09
Issued: 03/10/09 11:00

NELAP #01108CA California ELAP#2706 CSDLAC #10256 AZ #AZ0671 NV #CA01531

The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica. The Chain(s) of Custody, 6 pages, are included and are an integral part of this report.
This entire report was reviewed and approved for release.

CASE NARRATIVE

SAMPLE RECEIPT: Samples were received intact, at 5°C, on ice and with chain of custody documentation.

HOLDING TIMES: All samples were analyzed within prescribed holding times and/or in accordance with the TestAmerica Sample Acceptance Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made.

SUBCONTRACTED: No analyses were subcontracted to an outside laboratory.

LABORATORY ID	CLIENT ID	MATRIX
ISB3105-01	09-057-S-BFM-01	Soil
ISB3105-02	09-057-S-BFM-02	Soil
ISB3105-03	09-057-S-BFM-03	Soil
ISB3105-04	09-057-S-BFM-04	Soil
ISB3105-05	09-057-S-BFM-05	Soil
ISB3105-06	09-057-S-BFM-06	Soil
ISB3105-07	09-057-S-BFM-07	Soil
ISB3105-08	09-057-S-BFM-08	Soil
ISB3105-09	09-057-S-BFM-09	Soil
ISB3105-10	09-057-S-BFM-10	Soil
ISB3105-11	09-057-S-BFM-11	Soil

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Attention: Kris Lutton

Project ID: CalTrans
SR-57 602231-002
Report Number: ISB3105

Sampled: 02/26/09
Received: 02/26/09

LABORATORY ID	CLIENT ID	MATRIX
ISB3105-12	09-057-S-BFM-12	Soil
ISB3105-13	09-057-S-BFM-13	Soil
ISB3105-14	09-057-S-BFM-14	Soil
ISB3105-15	09-057-S-BFM-15	Soil
ISB3105-16	09-057-S-BFM-16	Soil
ISB3105-17	09-057-S-BFM-17	Soil
ISB3105-18	09-057-S-BFM-18	Soil
ISB3105-19	09-057-S-BFM-19	Soil
ISB3105-20	09-057-S-BFM-20	Soil
ISB3105-21	09-057-S-BFM-21	Soil
ISB3105-22	09-057-S-BFM-22	Soil
ISB3105-23	09-057-S-BFM-23	Soil
ISB3105-24	09-057-S-BFM-24	Soil
ISB3105-25	09-057-S-BFM-25	Soil
ISB3105-26	09-057-S-BFM-26	Soil
ISB3105-27	09-057-S-BFM-27	Soil
ISB3105-28	09-057-S-BFM-28	Soil
ISB3105-29	09-057-S-BFM-29	Soil
ISB3105-30	09-057-S-BFM-30	Soil
ISB3105-31	09-057-S-BFM-31	Soil
ISB3105-32	09-057-S-BFM-32	Soil
ISB3105-33	09-057-S-BFM-33	Soil
ISB3105-34	09-057-S-BFM-34	Soil
ISB3105-35	09-057-S-BFM-35	Soil
ISB3105-36	09-057-S-BFM-36	Soil
ISB3105-37	09-057-S-BFM-37	Soil
ISB3105-38	09-057-S-BFM-38	Soil
ISB3105-39	09-057-S-BFM-39	Soil
ISB3105-40	09-057-S-BFM-40	Soil
ISB3105-41	09-057-S-BFM-41	Soil
ISB3105-42	09-057-S-BFM-42	Soil
ISB3105-43	09-057-S-BFM-43	Soil
ISB3105-44	09-057-S-BFM-44	Soil
ISB3105-45	09-057-S-BFM-45	Soil
ISB3105-46	09-057-S-BFM-46	Soil
ISB3105-47	09-057-S-BFM-47	Soil
ISB3105-48	09-057-S-BFM-48	Soil
ISB3105-49	09-057-S-BFM-49	Soil
ISB3105-50	09-057-S-BFM-50	Soil
ISB3105-51	09-057-S-BFM-51	Soil
ISB3105-52	09-057-S-BFM-52	Soil
ISB3105-53	09-057-S-BFM-53	Soil
ISB3105-54	09-057-S-BFM-54	Soil

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Report Number: ISB3105

Sampled: 02/26/09
Received: 02/26/09

LABORATORY ID	CLIENT ID	MATRIX
ISB3105-55	09-057-S-BFM-55	Soil
ISB3105-56	09-057-S-BFM-56	Soil
ISB3105-57	09-057-S-BFM-57	Soil
ISB3105-58	09-057-S-BFM-58	Soil
ISB3105-59	09-057-S-BFM-59	Soil
ISB3105-60	09-057-S-BFM-60	Soil
ISB3105-61	09-057-S-BFM-61	Soil
ISB3105-62	09-057-S-BFM-62	Soil
ISB3105-63	09-057-S-BFM-63	Soil
ISB3105-64	09-057-S-BFM-64	Soil
ISB3105-65	09-057-S-BFM-65	Soil
ISB3105-66	09-057-S-BFM-66	Soil
ISB3105-67	09-057-S-BFM-67	Soil
ISB3105-68	09-057-S-BFM-68	Soil
ISB3105-69	09-057-S-BFM-69	Soil
ISB3105-70	09-057-S-BFM-70	Soil
ISB3105-71	09-057-S-BFM-71	Soil
ISB3105-72	09-057-S-BFM-72	Soil
ISB3105-73	09-057-S-BFM-73	Soil
ISB3105-74	09-057-S-BFM-74	Soil

Reviewed By:

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Project ID: CalTrans
SR-57 602231-002
Report Number: ISB3105

Sampled: 02/26/09
Received: 02/26/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISB3105-01 (09-057-S-BFM-01 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	**10**	1	3/6/2009	3/6/2009	
Sample ID: ISB3105-02 (09-057-S-BFM-02 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	**5.4**	1	3/6/2009	3/6/2009	
Sample ID: ISB3105-03 (09-057-S-BFM-03 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	**3.1**	1	3/6/2009	3/6/2009	
Sample ID: ISB3105-04 (09-057-S-BFM-04 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	ND	1	3/6/2009	3/6/2009	
Sample ID: ISB3105-05 (09-057-S-BFM-05 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	ND	1	3/6/2009	3/6/2009	
Sample ID: ISB3105-06 (09-057-S-BFM-06 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	**3.5**	1	3/6/2009	3/6/2009	
Sample ID: ISB3105-07 (09-057-S-BFM-07 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	**7.4**	1	3/6/2009	3/6/2009	
Sample ID: ISB3105-08 (09-057-S-BFM-08 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	**5.3**	1	3/6/2009	3/6/2009	
Sample ID: ISB3105-09 (09-057-S-BFM-09 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	**3.8**	1	3/6/2009	3/6/2009	
Sample ID: ISB3105-10 (09-057-S-BFM-10 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C06127	2.0	**15**	1	3/6/2009	3/6/2009	

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Project ID: CalTrans
SR-57 602231-002
Report Number: ISB3105

Sampled: 02/26/09
Received: 02/26/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISB3105-11 (09-057-S-BFM-11 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**2.3**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-12 (09-057-S-BFM-12 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**3.0**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-13 (09-057-S-BFM-13 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**3.2**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-14 (09-057-S-BFM-14 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**3.8**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-15 (09-057-S-BFM-15 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07075	2.0	**2.9**	1	3/7/2009	3/9/2009	
Sample ID: ISB3105-16 (09-057-S-BFM-16 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**4.2**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-17 (09-057-S-BFM-17 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**3.5**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-18 (09-057-S-BFM-18 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**3.6**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-19 (09-057-S-BFM-19 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**3.9**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-20 (09-057-S-BFM-20 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07075	2.0	**5.4**	1	3/7/2009	3/9/2009	

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Attention: Kris Lutton

Project ID: CalTrans
SR-57 602231-002
Report Number: ISB3105

Sampled: 02/26/09
Received: 02/26/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISB3105-21 (09-057-S-BFM-21 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**3.2**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-22 (09-057-S-BFM-22 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**3.2**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-23 (09-057-S-BFM-23 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**4.2**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-24 (09-057-S-BFM-24 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	**4.2**	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-25 (09-057-S-BFM-25 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	ND	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-26 (09-057-S-BFM-26 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.2**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-27 (09-057-S-BFM-27 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	ND	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-28 (09-057-S-BFM-28 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.3**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-29 (09-057-S-BFM-29 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.8**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-30 (09-057-S-BFM-30 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**4.2**	1	3/7/2009	3/8/2009	

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SR-57 602231-002
Report Number: ISB3105

Sampled: 02/26/09
Received: 02/26/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISB3105-31 (09-057-S-BFM-31 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.4**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-32 (09-057-S-BFM-32 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.5**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-33 (09-057-S-BFM-33 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.6**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-34 (09-057-S-BFM-34 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**8.9**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-35 (09-057-S-BFM-35 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	ND	1	3/7/2009	3/7/2009	
Sample ID: ISB3105-36 (09-057-S-BFM-36 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.7**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-37 (09-057-S-BFM-37 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07075	2.0	ND	1	3/7/2009	3/9/2009	
Sample ID: ISB3105-38 (09-057-S-BFM-38 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**11**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-39 (09-057-S-BFM-39 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**4.7**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-40 (09-057-S-BFM-40 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**3.7**	1	3/7/2009	3/8/2009	

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Report Number: ISB3105

Sampled: 02/26/09
Received: 02/26/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISB3105-41 (09-057-S-BFM-41 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.3**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-42 (09-057-S-BFM-42 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	ND	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-43 (09-057-S-BFM-43 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**53**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-44 (09-057-S-BFM-44 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**74**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-45 (09-057-S-BFM-45 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**52**	1	3/7/2009	3/8/2009	M2
Sample ID: ISB3105-46 (09-057-S-BFM-46 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**2.9**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-47 (09-057-S-BFM-47 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**4.9**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-48 (09-057-S-BFM-48 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	ND	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-49 (09-057-S-BFM-49 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	ND	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-50 (09-057-S-BFM-50 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07042	2.0	ND	1	3/7/2009	3/7/2009	

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METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISB3105-51 (09-057-S-BFM-51 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	ND	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-52 (09-057-S-BFM-52 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07075	2.0	**100**	1	3/7/2009	3/9/2009	
Sample ID: ISB3105-53 (09-057-S-BFM-53 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07075	2.0	**6.5**	1	3/7/2009	3/9/2009	
Sample ID: ISB3105-54 (09-057-S-BFM-54 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	ND	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-55 (09-057-S-BFM-55 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	ND	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-56 (09-057-S-BFM-56 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.6**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-57 (09-057-S-BFM-57 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**6.6**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-58 (09-057-S-BFM-58 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**2.1**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-59 (09-057-S-BFM-59 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**3.1**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-60 (09-057-S-BFM-60 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	ND	1	3/7/2009	3/8/2009	

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METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISB3105-61 (09-057-S-BFM-61 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**47**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-62 (09-057-S-BFM-62 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**57**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-63 (09-057-S-BFM-63 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**2.8**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-64 (09-057-S-BFM-64 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**2.0**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-65 (09-057-S-BFM-65 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07075	2.0	**13**	1	3/7/2009	3/9/2009	
Sample ID: ISB3105-66 (09-057-S-BFM-66 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07063	2.0	**2.4**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-67 (09-057-S-BFM-67 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07075	2.0	**3.6**	1	3/7/2009	3/9/2009	
Sample ID: ISB3105-68 (09-057-S-BFM-68 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07075	2.0	**3.1**	1	3/7/2009	3/9/2009	
Sample ID: ISB3105-69 (09-057-S-BFM-69 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	ND	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-70 (09-057-S-BFM-70 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**9.4**	1	3/7/2009	3/8/2009	

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METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISB3105-71 (09-057-S-BFM-71 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**15**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-72 (09-057-S-BFM-72 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**2.0**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-73 (09-057-S-BFM-73 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07064	2.0	**3.9**	1	3/7/2009	3/8/2009	
Sample ID: ISB3105-74 (09-057-S-BFM-74 - Soil)								
Reporting Units: mg/kg								
Lead	EPA 6010B	9C07075	2.0	**2.6**	1	3/7/2009	3/9/2009	

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Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISB3105-15 (09-057-S-BFM-15 - Soil)								
Reporting Units: pH Units								
pH	EPA 9045C	9B27140	0.100	**8.75**	1	2/27/2009	2/27/2009	
Sample ID: ISB3105-20 (09-057-S-BFM-20 - Soil)								
Reporting Units: pH Units								
pH	EPA 9045C	9B27140	0.100	**7.73**	1	2/27/2009	2/27/2009	
Sample ID: ISB3105-37 (09-057-S-BFM-37 - Soil)								
Reporting Units: pH Units								
pH	EPA 9045C	9C03099	0.100	**7.47**	1	3/3/2009	3/3/2009	
Sample ID: ISB3105-52 (09-057-S-BFM-52 - Soil)								
Reporting Units: pH Units								
pH	EPA 9045C	9B27140	0.100	**8.78**	1	2/27/2009	2/27/2009	
Sample ID: ISB3105-53 (09-057-S-BFM-53 - Soil)								
Reporting Units: pH Units								
pH	EPA 9045C	9B27140	0.100	**8.13**	1	2/27/2009	2/27/2009	
Sample ID: ISB3105-65 (09-057-S-BFM-65 - Soil)								
Reporting Units: pH Units								
pH	EPA 9045C	9B27140	0.100	**8.06**	1	2/27/2009	2/27/2009	
Sample ID: ISB3105-74 (09-057-S-BFM-74 - Soil)								
Reporting Units: pH Units								
pH	EPA 9045C	9B27140	0.100	**8.70**	1	2/27/2009	2/27/2009	

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METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C06127 Extracted: 03/06/09										
Blank Analyzed: 03/06/2009 (9C06127-BLK1)										
Lead	ND	2.0	mg/kg							
LCS Analyzed: 03/06/2009 (9C06127-BS1)										
Lead	48.4	2.0	mg/kg	50.0		97	80-120			
Matrix Spike Analyzed: 03/06/2009 (9C06127-MS1)					**Source: ISB3105-01**					
Lead	60.1	2.0	mg/kg	50.0	10.4	99	75-125			
Matrix Spike Dup Analyzed: 03/06/2009 (9C06127-MSD1)					**Source: ISB3105-01**					
Lead	84.3	2.0	mg/kg	50.0	10.4	148	75-125	33	20	*M1, R-3*
Batch: 9C07042 Extracted: 03/07/09										
Blank Analyzed: 03/07/2009 (9C07042-BLK1)										
Lead	ND	2.0	mg/kg							
LCS Analyzed: 03/07/2009 (9C07042-BS1)										
Lead	50.0	2.0	mg/kg	50.0		100	80-120			
Matrix Spike Analyzed: 03/07/2009 (9C07042-MS1)					**Source: ISC0661-01**					
Lead	54.8	2.0	mg/kg	50.0	13.2	83	75-125			
Matrix Spike Dup Analyzed: 03/07/2009 (9C07042-MSD1)					**Source: ISC0661-01**					
Lead	54.8	2.0	mg/kg	50.0	13.2	83	75-125	0	20	
Batch: 9C07063 Extracted: 03/07/09										
Blank Analyzed: 03/08/2009 (9C07063-BLK1)										
Lead	ND	2.0	mg/kg							

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METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C07063 Extracted: 03/07/09										
LCS Analyzed: 03/08/2009 (9C07063-BS1)										
Lead	47.8	2.0	mg/kg	50.0		96	80-120			
Matrix Spike Analyzed: 03/08/2009 (9C07063-MS1)					**Source: ISB3105-26**					
Lead	51.8	2.0	mg/kg	50.0	2.20	99	75-125			
Matrix Spike Dup Analyzed: 03/08/2009 (9C07063-MSD1)					**Source: ISB3105-26**					
Lead	51.0	2.0	mg/kg	50.0	2.20	98	75-125	2	20	
Batch: 9C07064 Extracted: 03/07/09										
Blank Analyzed: 03/08/2009 (9C07064-BLK1)										
Lead	ND	2.0	mg/kg							
LCS Analyzed: 03/08/2009 (9C07064-BS1)										
Lead	45.9	2.0	mg/kg	50.0		92	80-120			
Matrix Spike Analyzed: 03/08/2009 (9C07064-MS1)					**Source: ISB3105-45**					
Lead	65.5	2.0	mg/kg	50.0	51.5	28	75-125			*M2*
Matrix Spike Dup Analyzed: 03/08/2009 (9C07064-MSD1)					**Source: ISB3105-45**					
Lead	63.0	2.0	mg/kg	50.0	51.5	23	75-125	4	20	*M2*
Batch: 9C07075 Extracted: 03/07/09										
Blank Analyzed: 03/09/2009 (9C07075-BLK1)										
Lead	ND	2.0	mg/kg							

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METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C07075 Extracted: 03/07/09										
LCS Analyzed: 03/09/2009 (9C07075-BS1)										
Lead	48.7	2.0	mg/kg	50.0		97	80-120			
Matrix Spike Analyzed: 03/09/2009 (9C07075-MS1)					**Source: ISB3105-68**					
Lead	52.1	2.0	mg/kg	50.0	3.11	98	75-125			
Matrix Spike Dup Analyzed: 03/09/2009 (9C07075-MSD1)					**Source: ISB3105-68**					
Lead	49.7	2.0	mg/kg	50.0	3.11	93	75-125	5	20	

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Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9B27140 Extracted: 02/27/09										
Duplicate Analyzed: 02/27/2009 (9B27140-DUP1)					**Source: ISB3105-74**					
pH	8.70	0.100	pH Units		8.70			0	5	
Batch: 9C03099 Extracted: 03/03/09										
Duplicate Analyzed: 03/03/2009 (9C03099-DUP1)					**Source: ISB3105-37**					
pH	7.51	0.100	pH Units		7.47			1	5	

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Project Manager

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans SR-57 602231-002 Report Number: ISB3105	Sampled: 02/26/09 Received: 02/26/09

DATA QUALIFIERS AND DEFINITIONS

M1	The MS and/or MSD were above the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
M2	The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
R-3	The RPD exceeded the acceptance limit due to sample matrix effects.
ND	Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
RPD	Relative Percent Difference

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Project Manager

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans SR-57 602231-002 Report Number: ISB3105	Sampled: 02/26/09 Received: 02/26/09

Certification Summary

TestAmerica Irvine

Method	Matrix	Nelac	California
EPA 6010B	Soil	X	X
EPA 9045C	Soil	X	X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at www.testamericainc.com

TestAmerica Irvine

Patty Mata
Project Manager

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TAL-0013(1007)

CHAIN OF CUSTODY FORM

17461 Derian Ave., #100, Irvine, CA 92614 (949) 261-1022 FAX (949) 260-3297
1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370-4667 FAX (909) 370-1046
9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851
2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

ISB3105

Client Name/Address: Leighton Consulting, Inc. 17781 Cowan Irvine, CA 92614

Project/PO Number: SR-57 602231-002

Project Manager: Kris Lutton

Phone Number: 949-253-9836

Sampler: BFM/MDW

Fax Number: 949-250-1114

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD 6010B	pH								Special Instructions
09-057-S-BFM-01	S	SLEEVE	1	2-26-09	0910	NONE	X									run STLC and
09-057-S-BFM-02					0912		X									TCLP if TTLC
09-057-S-BFM-03					0914		X									is greater than
09-057-S-BFM-04					0916		X									50 mg/kg
09-057-S-BFM-05					0918		X									
09-057-S-BFM-06					0940		X									
09-057-S-BFM-07					0942		X									
09-057-S-BFM-08					0950		X									
09-057-S-BFM-09					0952		X									
09-057-S-BFM-10					0954		X									
09-057-S-BFM-11					0956		X									
09-057-S-BFM-12					1010		X									
09-057-S-BFM-13					1012		X									
09-057-S-BFM-14					1014		X									

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	2-26-09/1625			same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal X
Relinquished By:	Date/Time:	Received in Lab By: [signature]	Date/Time: 2/26/09 1625	Sample Integrity: (Check) intact X on ice X

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

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5.3C

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CHAIN OF CUSTODY FORM

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TAL-0013(1007)

Client Name/Address: Leighton Consulting, 17781 Cowan Irvine, CA

Project/PO Number: SR-57 602231002

Project Manager: Kris Lutton

Phone Number: 949-250-1421

Sampler: BFM/MDW

Fax Number: 949-250-1114

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	Lead	ID								Special Instructions
09-057-S-BFM-15	S	Sleeve	1	2-26-09	1016	none	X	X								run STLC and
09-057-S-BFM-16					1030		X									TCLP if TTLC
09-057-S-BFM-17					1032		X									is greater than
09-057-S-BFM-18					1034		X									50 mg/kg
09-057-S-BFM-19					1036		X									
09-057-S-BFM-20					1052		X	X								
09-057-S-BFM-21					1054		X									
09-057-S-BFM-22					1056		X									
09-057-S-BFM-23					1058		X									
09-057-S-BFM-24					1120		X									
09-057-S-BFM-25					1122		X									
09-057-S-BFM-26					1124		X									
09-057-S-BFM-27					1126		X									
09-057-S-BFM-28					1128		X									

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	2-26-09/1625			same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal X
Relinquished By:	Date/Time:	Received in Lab By: [signature]	Date/Time: 2-26-09 1625	Sample Integrity: (Check) intact X on ice X

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2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

TAL-0013(1007)

Client Name/Address: LCI

Project/PO Number: SR-57 602231002

Project Manager: KRIS LUTTON

Phone Number: 9492539836

Sampler: BFM / MDW

Fax Number:

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD 6010B	pH								Special Instructions
09-057-S-BFM-29	S	SLEEVE	1	2-26-09	1140	NONE	X									run STLC and
09-057-S-BFM-30					1142		X									TCLP if TTLC
09-057-S-BFM-31					1144		X									is greater than
09-057-S-BFM-32					1146		X									50 mg/kg
09-057-S-BFM-33					1148		X									
09-057-S-BFM-34					1205		X									
09-057-S-BFM-35					1207		X									
09-057-S-BFM-36					1209		X									
09-057-S-BFM-37					1211		X	X								
09-057-S-BFM-38					1225		X									
09-057-S-BFM-39					1227		X									
09-057-S-BFM-40					1229		X									
09-057-S-BFM-41					1231		X									
09-057-S-BFM-42					1233		X									

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
BM	2-26-09/1625			same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal X
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:	Sample Integrity: (Check)
		[illegible]	2/26/09 1625	intact X on ice X

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5.3 C

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2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

CHAIN OF CUSTODY FORM

TAL-0013(1007)

Client Name/Address: Leighton Consulting, 17781 Cowan Irvine, CA

Project/PO Number: SR-57 602231002

Project Manager: Kris Lutton

Phone Number: MOW ~~Kris Lutton~~ 949-260-1421

Sampler: MOW/BFM

Fax Number: 949-250-1114

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	Lead	Hg								Special Instructions
09-057-S-BFM-43	S	sleeve	1	2-26-09	1245	none	X									run STLC and
09-057-S-BFM-44					1247		X									TCLP if TTLC
09-057-S-BFM-45					1249		X									is greater than
09-057-S-BFM-46					1251		X									50 mg/kg
09-057-S-BFM-47					1300		X									
09-057-S-BFM-48					1302		X									
09-057-S-BFM-49					1304		X									
09-057-S-BFM-50					1306		X									
09-057-S-BFM-51					1308		X									
09-057-S-BFM-52					1318		X	X								
09-057-S-BFM-53					1320		X	X								
09-057-S-BFM-54					1322		X									
09-057-S-BFM-55					1324		X									
09-057-S-BFM-56					1326		X									

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	2-26-09 / 1625			same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal X
Relinquished By:	Date/Time:	Received in Lab By: [signature]	Date/Time: 2-26-09 1625	Sample Integrity: (Check) intact X on ice X

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

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TAL-0013(1007)

Client Name/Address: LCI

Project/PO Number: SR-57 602231-002

Project Manager: KRIS LUTTON

Phone Number: 949-253-9836

Sampler: BFM/MDW

Fax Number:

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD 6010B	pH								Special Instructions
09-057-S-BFM-57	S	SLEEVE	1	2-26-09	1335	NONE	X									run STLC and
09-057-S-BFM-58					1337		X									TCLP if TTLC
09-057-S-BFM-59					1339		X									is greater than
09-057-S-BFM-60					1341		X									50 mg/kg
09-057-S-BFM-61					1355		X									
09-057-S-BFM-62					1357		X									
09-057-S-BFM-63					1359		X									
09-057-S-BFM-64					1401		X									
09-057-S-BFM-65					1410		X	X								
09-057-S-BFM-66					1412		X									
09-057-S-BFM-67					1414		X									
09-057-S-BFM-68					1416		X									
09-057-S-BFM-69					1418		X									
09-057-S-BFM-70					1430		X									

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	2-26-09/1625			same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal X
Relinquished By:	Date/Time:	Received in Lab By: [signature]	Date/Time: 2-26-09 1625	Sample Integrity: (Check) intact X on ice X

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2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

TAL-0013(1007)

Client Name/Address: Leighton Consulting, 17281 Cowan Irvine, CA

Project/PO Number: SR-57, 602231002

Project Manager: Kris Lutton

Phone Number: 949-250-1421

Sampler: MOW/BFM

Fax Number: 949-250-1419

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	Lead	HP								Special Instructions
09-057-S-BFM-71	S	Sleeve	1	2-26-09	1432	none	X									run STLC ~~if~~ MOW and
09-057-S-BFM-72	↓	↓	↓	↓	1434	↓	X									TCLP if TTLC
09-057-S-BFM-73					1436		X									is greater
09-057-S-BFM-74	↓	↓	↓	↓	1438	↓	X	X								than 50 mg/kg

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	2-26-09 / 1625			same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal X
Relinquished By:	Date/Time:	Received in Lab By: [signature]	Date/Time: 2-26-09 1625	Sample Integrity: (Check) intact X on ice X

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LABORATORY REPORT

Prepared For: Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project: CalTrans
SR-57, 602231-002

Sampled: 03/02/09-03/03/09
Received: 03/04/09
Issued: 03/13/09 16:40

NELAP #01108CA California ELAP#2706 CSDLAC #10256 AZ #AZ0671 NV #CA01531

The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica. The Chain(s) of Custody, 4 pages, are included and are an integral part of this report.
This entire report was reviewed and approved for release.

CASE NARRATIVE

SAMPLE RECEIPT: Samples were received intact, at 4°C, on ice and with chain of custody documentation.

HOLDING TIMES: All samples were analyzed within prescribed holding times and/or in accordance with the TestAmerica Sample Acceptance Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made.

SUBCONTRACTED: No analyses were subcontracted to an outside laboratory.

LABORATORY ID	CLIENT ID	MATRIX
ISC0458-01	09-061-S-BFM-01	Soil
ISC0458-02	09-061-S-BFM-02	Soil
ISC0458-03	09-061-S-BFM-03	Soil
ISC0458-04	09-061-S-BFM-04	Soil
ISC0458-05	09-061-S-BFM-05	Soil
ISC0458-06	09-061-S-BFM-06	Soil
ISC0458-07	09-061-S-BFM-07	Soil
ISC0458-08	09-061-S-BFM-08	Soil
ISC0458-09	09-061-S-BFM-09	Soil
ISC0458-10	09-061-S-BFM-10	Soil
ISC0458-11	09-061-S-BFM-11	Soil

TestAmerica Irvine

Patty Mata
Project Manager

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC0458

Sampled: 03/02/09-03/03/09
Received: 03/04/09

LABORATORY ID	CLIENT ID	MATRIX
ISC0458-12	09-061-S-BFM-12	Soil
ISC0458-13	09-061-S-BFM-13	Soil
ISC0458-14	09-061-S-BFM-14	Soil
ISC0458-15	09-061-S-BFM-15	Soil
ISC0458-16	09-061-S-BFM-16	Soil
ISC0458-17	09-061-S-BFM-17	Soil
ISC0458-18	09-061-S-BFM-18	Soil
ISC0458-19	09-061-S-BFM-19	Soil
ISC0458-20	09-061-S-BFM-20	Soil
ISC0458-21	09-061-S-BFM-21	Soil
ISC0458-22	09-061-S-BFM-22	Soil
ISC0458-23	09-061-S-BFM-23	Soil
ISC0458-24	09-061-S-BFM-24	Soil
ISC0458-25	09-061-S-BFM-25	Soil
ISC0458-26	09-061-S-BFM-26	Soil
ISC0458-27	09-061-S-BFM-27	Soil
ISC0458-28	09-061-S-BFM-28	Soil
ISC0458-29	09-061-S-BFM-29	Soil
ISC0458-30	09-061-S-BFM-30	Soil
ISC0458-31	09-061-S-BFM-31	Soil
ISC0458-32	09-061-S-BFM-32	Soil
ISC0458-33	09-061-S-BFM-33	Soil
ISC0458-34	09-061-S-BFM-34	Soil
ISC0458-35	09-061-S-BFM-35	Soil
ISC0458-36	09-061-S-BFM-36	Soil
ISC0458-37	09-061-S-BFM-37	Soil
ISC0458-38	09-061-S-BFM-38	Soil
ISC0458-39	09-061-S-BFM-39	Soil
ISC0458-40	09-061-S-BFM-40	Soil
ISC0458-41	09-061-S-BFM-41	Soil
ISC0458-42	09-061-S-BFM-42	Soil
ISC0458-43	09-061-S-BFM-43	Soil
ISC0458-44	09-061-S-BFM-44	Soil
ISC0458-45	09-061-S-BFM-45	Soil
ISC0458-46	09-061-S-BFM-46	Soil

Reviewed By:

TestAmerica Irvine

Patty Mata
Project Manager

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC0458

Sampled: 03/02/09-03/03/09
Received: 03/04/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0458-01 (09-061-S-BFM-01 - Soil)					**Sampled: 03/02/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**20**	0.985	3/11/2009	3/12/2009	
Sample ID: ISC0458-02 (09-061-S-BFM-02 - Soil)					**Sampled: 03/02/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**2.8**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-03 (09-061-S-BFM-03 - Soil)					**Sampled: 03/02/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	4.0	**5.0**	2.01	3/11/2009	3/12/2009	
Sample ID: ISC0458-04 (09-061-S-BFM-04 - Soil)					**Sampled: 03/02/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	4.0	**4.0**	1.99	3/11/2009	3/12/2009	
Sample ID: ISC0458-05 (09-061-S-BFM-05 - Soil)					**Sampled: 03/02/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**30**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-06 (09-061-S-BFM-06 - Soil)					**Sampled: 03/02/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	4.0	**64**	1.99	3/11/2009	3/12/2009	
Sample ID: ISC0458-07 (09-061-S-BFM-07 - Soil)					**Sampled: 03/02/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**4.1**	0.985	3/11/2009	3/12/2009	
Sample ID: ISC0458-08 (09-061-S-BFM-08 - Soil)					**Sampled: 03/02/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	4.0	**4.8**	2.01	3/11/2009	3/12/2009	
Sample ID: ISC0458-09 (09-061-S-BFM-09 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**6.7**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-10 (09-061-S-BFM-10 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**5.6**	1	3/11/2009	3/12/2009	

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Project Manager

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THE LEADER IN ENVIRONMENTAL TESTING

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC0458

Sampled: 03/02/09-03/03/09
Received: 03/04/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0458-11 (09-061-S-BFM-11 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**5.0**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-12 (09-061-S-BFM-12 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**6.8**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-13 (09-061-S-BFM-13 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**13**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-14 (09-061-S-BFM-14 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**6.9**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-15 (09-061-S-BFM-15 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**6.6**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-16 (09-061-S-BFM-16 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**5.3**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-17 (09-061-S-BFM-17 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**6.5**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-18 (09-061-S-BFM-18 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**10**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-19 (09-061-S-BFM-19 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**7.0**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-20 (09-061-S-BFM-20 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**8.9**	1	3/11/2009	3/12/2009	

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Sampled: 03/02/09-03/03/09
Received: 03/04/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0458-21 (09-061-S-BFM-21 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**6.3**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-22 (09-061-S-BFM-22 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**2.6**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-23 (09-061-S-BFM-23 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**3.7**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-24 (09-061-S-BFM-24 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**6.7**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-25 (09-061-S-BFM-25 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**14**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-26 (09-061-S-BFM-26 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**29**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-27 (09-061-S-BFM-27 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**6.3**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-28 (09-061-S-BFM-28 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11170	2.0	**13**	1	3/11/2009	3/12/2009	
Sample ID: ISC0458-29 (09-061-S-BFM-29 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**120**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-30 (09-061-S-BFM-30 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**11**	1	3/12/2009	3/12/2009	

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Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC0458

Sampled: 03/02/09-03/03/09
Received: 03/04/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0458-31 (09-061-S-BFM-31 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**320**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-32 (09-061-S-BFM-32 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**140**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-33 (09-061-S-BFM-33 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**100**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-34 (09-061-S-BFM-34 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**93**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-35 (09-061-S-BFM-35 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**180**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-36 (09-061-S-BFM-36 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**4.8**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-37 (09-061-S-BFM-37 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**110**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-38 (09-061-S-BFM-38 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**8.1**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-39 (09-061-S-BFM-39 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**5.7**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-40 (09-061-S-BFM-40 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**5.5**	1	3/12/2009	3/13/2009	

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SR-57, 602231-002
Report Number: ISC0458

Sampled: 03/02/09-03/03/09
Received: 03/04/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0458-41 (09-061-S-BFM-41 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**3.7**	1	3/12/2009	3/13/2009	
Sample ID: ISC0458-42 (09-061-S-BFM-42 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**7.5**	1	3/12/2009	3/13/2009	
Sample ID: ISC0458-43 (09-061-S-BFM-43 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**4.8**	1	3/12/2009	3/12/2009	
Sample ID: ISC0458-44 (09-061-S-BFM-44 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**2.2**	1	3/12/2009	3/13/2009	
Sample ID: ISC0458-45 (09-061-S-BFM-45 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**3.4**	1	3/12/2009	3/13/2009	
Sample ID: ISC0458-46 (09-061-S-BFM-46 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C12001	2.0	**4.5**	1	3/12/2009	3/13/2009	

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Sampled: 03/02/09-03/03/09
Received: 03/04/09

INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0458-02 (09-061-S-BFM-02 - Soil)					**Sampled: 03/02/09**			
Reporting Units: pH Units								
pH	EPA 9045C	9C05116	0.100	**6.60**	1	3/5/2009	3/5/2009	
Sample ID: ISC0458-05 (09-061-S-BFM-05 - Soil)					**Sampled: 03/02/09**			
Reporting Units: pH Units								
pH	EPA 9045C	9C05116	0.100	**7.96**	1	3/5/2009	3/5/2009	
Sample ID: ISC0458-16 (09-061-S-BFM-16 - Soil)					**Sampled: 03/03/09**			
Reporting Units: pH Units								
pH	EPA 9045C	9C05116	0.100	**7.48**	1	3/5/2009	3/5/2009	
Sample ID: ISC0458-22 (09-061-S-BFM-22 - Soil)					**Sampled: 03/03/09**			
Reporting Units: pH Units								
pH	EPA 9045C	9C05116	0.100	**7.70**	1	3/5/2009	3/5/2009	
Sample ID: ISC0458-35 (09-061-S-BFM-35 - Soil)					**Sampled: 03/03/09**			
Reporting Units: pH Units								
pH	EPA 9045C	9C05116	0.100	**7.14**	1	3/5/2009	3/5/2009	
Sample ID: ISC0458-46 (09-061-S-BFM-46 - Soil)					**Sampled: 03/03/09**			
Reporting Units: pH Units								
pH	EPA 9045C	9C05116	0.100	**6.91**	1	3/5/2009	3/5/2009	

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SR-57, 602231-002
Report Number: ISC0458

Sampled: 03/02/09-03/03/09
Received: 03/04/09

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C11124 Extracted: 03/11/09										
Blank Analyzed: 03/12/2009 (9C11124-BLK1)										
Lead	ND	2.0	mg/kg							
LCS Analyzed: 03/12/2009 (9C11124-BS1)										
Lead	48.1	2.0	mg/kg	50.0		96	80-120			
Matrix Spike Analyzed: 03/12/2009 (9C11124-MS1)					**Source: ISC0457-19**					
Lead	57.7	4.0	mg/kg	49.8	7.28	101	75-125			
Matrix Spike Dup Analyzed: 03/12/2009 (9C11124-MSD1)					**Source: ISC0457-19**					
Lead	55.6	4.0	mg/kg	50.0	7.28	97	75-125	4	20	
Batch: 9C11170 Extracted: 03/11/09										
Blank Analyzed: 03/12/2009 (9C11170-BLK1)										
Lead	ND	2.0	mg/kg							
LCS Analyzed: 03/12/2009 (9C11170-BS1)										
Lead	47.7	2.0	mg/kg	50.0		95	80-120			
Matrix Spike Analyzed: 03/12/2009 (9C11170-MS1)					**Source: ISC0458-11**					
Lead	52.6	2.0	mg/kg	50.0	5.03	95	75-125			
Matrix Spike Dup Analyzed: 03/12/2009 (9C11170-MSD1)					**Source: ISC0458-11**					
Lead	51.9	2.0	mg/kg	50.0	5.03	94	75-125	1	20	
Batch: 9C12001 Extracted: 03/12/09										
Blank Analyzed: 03/12/2009 (9C12001-BLK1)										
Lead	ND	2.0	mg/kg							

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METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C12001 Extracted: 03/12/09										
LCS Analyzed: 03/12/2009 (9C12001-BS1)										
Lead	48.6	2.0	mg/kg	50.0		97	80-120			
Matrix Spike Analyzed: 03/12/2009 (9C12001-MS1)					**Source: ISC0458-43**					
Lead	53.8	2.0	mg/kg	50.0	4.78	98	75-125			
Matrix Spike Dup Analyzed: 03/12/2009 (9C12001-MSD1)					**Source: ISC0458-43**					
Lead	55.4	2.0	mg/kg	50.0	4.78	101	75-125	3	20	

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METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C05116 Extracted: 03/05/09										
Duplicate Analyzed: 03/05/2009 (9C05116-DUP1)					**Source: ISC0458-02**					
pH	6.66	0.100	pH Units		6.60			1	5	

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DATA QUALIFIERS AND DEFINITIONS

ND Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.

RPD Relative Percent Difference

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Certification Summary

TestAmerica Irvine

Method	Matrix	Nelac	California
EPA 6010B	Soil	X	X
EPA 9045C	Soil	X	X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at www.testamericainc.com

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TAL-0013(1007)

CHAIN OF CUSTODY FORM

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9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851
2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

ISC0458

Client Name/Address: LEIGHTON CONSULTING (LCI) 17781 COWAN IRVINE, CA 92614

Project/PO Number: 602231-002 SR-57

Project Manager: KRIS LUTTON

Phone Number: 949-253-9836

Sampler: BFM/MDW

Fax Number: 949-250-1114

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD	pH								Special Instructions
09-061-S-BFM-01	S	SLEEVE	1	3-3-09	1140	NONE	X									IF TTLC IS
09-061-S-BFM-02					1142		X	X								GREATER THAN
09-061-S-BFM-03					1144		X									50 mg/kg, run
09-061-S-BFM-04					1146		X									STLC & TCLP
09-061-S-BFM-05					1150		X	X								
09-061-S-BFM-06					1152		X									
09-061-S-BFM-07					1154		X									
09-061-S-BFM-08					1156		X									VB 3/5/09 10:00
09-061-S-BFM-09				3-3-09	0010		X									
09-061-S-BFM-10					0012		X									
09-061-S-BFM-11					0014		X									
09-061-S-BFM-12					0016		X									
09-061-S-BFM-13					0028		X									
09-061-S-BFM-14					0030		X									

Relinquished By:	Date/Time:	Received By:	Date/Time:
[signature]	3-4-09 / 1625	[signature]	3-4-09 1625
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal ✓

Sample Integrity: (Check)
intact ✗ on ice 3.5C

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

#31

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2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

TAL-0013(1007)

Client Name/Address: LCI

Project/PO Number: 602231-002 SR-57

Project Manager: KRIS LUTTON

Phone Number: 949-253-9836

Sampler: BFM/MDW

Fax Number: 949-250-1114

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD	pH								Special Instructions
09-061-S-BFM-15	S	SLEEVE	1	3-3-09	0032	NONE	X									IF TTLC IS
09-061-S-BFM-16					0034		X	X								GREATER THAN
09-061-S-BFM-17					0036		X									50 mg/kg, run
09-061-S-BFM-18		JAR			0045		X									STLC & TCLP
09-061-S-BFM-19					0047		X									
09-061-S-BFM-20					0050		X									
09-061-S-BFM-21					0055		X									
09-061-S-BFM-22		SLEEVE			0110		X	X								
09-061-S-BFM-23					0112		X									
09-061-S-BFM-24					0114		X									
09-061-S-BFM-25		JAR			0119		X									
09-061-S-BFM-26					0125		X									
09-061-S-BFM-27					0127		X									
09-061-S-BFM-28					0131		X									

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	3-4-09 1625	[signature]	3-4-09 1625	same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal ✓
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:	Sample Integrity: (Check)
				intact ✗ on ice 3.5°C

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

#31

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY FORM

17461 Derian Ave., #100, Irvine, CA 92614 (949) 261-1022 FAX (949) 260-3297
1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370-4667 FAX (909) 370-1046
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TAL-0013(1007)

Client Name/Address: LCI

Project/PO Number: 602231-002 SR-57

Project Manager: KRIS LUTTON

Phone Number: 949-253-9836

Sampler: BFM/MDW

Fax Number: 949-250-1114

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD	pH								Special Instructions
09-061-S-BFM-29	S	JAR	1	3-3-09	0134	NONE	X									IF TRC is
09-061-S-BFM-30					0138		X									>50 mg/kg
09-061-S-BFM-31					0143		X									run STLC!
09-061-S-BFM-32					0148		X									TCLP
09-061-S-BFM-33					0208		X									
09-061-S-BFM-34					0210		X									
09-061-S-BFM-35					0214		X	X								
09-061-S-BFM-36					0216		X									
09-061-S-BFM-37					0220		X									
09-061-S-BFM-38		SLEEVE			0238		X									
09-061-S-BFM-39					0240		X									
09-061-S-BFM-40					0242		X									
09-061-S-BFM-41					0244		X									
09-061-S-BFM-42					0246		X									

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	3-4-09 1625	[signature]	3-4-09 1625	same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal ✓
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:	Sample Integrity: (Check)
				intact X on ice 3.5C

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TAL-0013(1007)

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ISC0458

Client Name/Address: LCI

Project/PO Number: 602231-002 SR-57

Project Manager: KRIS LUTTON

Phone Number: 949-253-9836

Sampler: BFM/MDW

Fax Number: 949-250-1114

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD	pH								Special Instructions
09-061-S-BFM-43	S	SLEEVE	1	3-3-09	0258	NONE	X									IF TTLC IS
09-061-S-BFM-44	↓	↓	↓	↓	0300	↓	X									> 50 mg/kg
09-061-S-BFM-45	↓	↓	↓	↓	0302	↓	X									run STLC & TCLP
09-061-S-BFM-46	↓	↓	↓	↓	0304	↓	X	X								

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	3-4-09 1625	[signature]	3-4-09 1625	same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal ✓
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:	Sample Integrity: (Check)
				intact ✓ on ice 3.5°C

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THE LEADER IN ENVIRONMENTAL TESTING

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LABORATORY REPORT

Prepared For: Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project: CalTrans
S-57, 602231-002

Sampled: 03/03/09-03/04/09
Received: 03/04/09
Issued: 03/13/09 16:16

NELAP #01108CA California ELAP#2706 CSDLAC #10256 AZ #AZ0671 NV #CA01531

The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica. The Chain(s) of Custody, 3 pages, are included and are an integral part of this report.
This entire report was reviewed and approved for release.

CASE NARRATIVE

SAMPLE RECEIPT: Samples were received intact, at 4°C, on ice and with chain of custody documentation.

HOLDING TIMES: All samples were analyzed within prescribed holding times and/or in accordance with the TestAmerica Sample Acceptance Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made.

SUBCONTRACTED: No analyses were subcontracted to an outside laboratory.

LABORATORY ID	CLIENT ID	MATRIX
ISC0457-01	09-062-S-BFM-01	Soil
ISC0457-02	09-062-S-BFM-02	Soil
ISC0457-03	09-062-S-BFM-03	Soil
ISC0457-04	09-062-S-BFM-04	Soil
ISC0457-05	09-062-S-BFM-05	Soil
ISC0457-06	09-062-S-BFM-06	Soil
ISC0457-07	09-062-S-BFM-07	Soil
ISC0457-08	09-062-S-BFM-08	Soil
ISC0457-09	09-062-S-BFM-09	Soil
ISC0457-10	09-062-S-BFM-10	Soil
ISC0457-11	09-062-S-BFM-11	Soil

TestAmerica Irvine

Patty Mata
Project Manager

TestAmerica
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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
S-57, 602231-002
Report Number: ISC0457

Sampled: 03/03/09-03/04/09
Received: 03/04/09

LABORATORY ID	CLIENT ID	MATRIX
ISC0457-12	09-062-S-BFM-12	Soil
ISC0457-13	09-062-S-BFM-13	Soil
ISC0457-14	09-062-S-BFM-14	Soil
ISC0457-15	09-062-S-BFM-15	Soil
ISC0457-16	09-062-S-BFM-16	Soil
ISC0457-17	09-062-S-BFM-17	Soil
ISC0457-18	09-062-S-BFM-18	Soil
ISC0457-19	09-062-S-BFM-19	Soil
ISC0457-20	09-062-S-BFM-20	Soil
ISC0457-21	09-062-S-BFM-21	Soil
ISC0457-22	09-062-S-BFM-22	Soil
ISC0457-23	09-062-S-BFM-23	Soil
ISC0457-24	09-062-S-BFM-24	Soil
ISC0457-25	09-062-S-BFM-25	Soil
ISC0457-26	09-062-S-BFM-26	Soil
ISC0457-27	09-062-S-BFM-27	Soil
ISC0457-28	09-062-S-BFM-28	Soil
ISC0457-29	09-062-S-BFM-29	Soil
ISC0457-30	09-062-S-BFM-30	Soil

Reviewed By:

TestAmerica Irvine

Patty Mata
Project Manager

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Project ID: CalTrans
S-57, 602231-002
Report Number: ISC0457

Sampled: 03/03/09-03/04/09
Received: 03/04/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0457-01 (09-062-S-BFM-01 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**24**	0.995	3/11/2009	3/11/2009	M2
Sample ID: ISC0457-02 (09-062-S-BFM-02 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**11**	1.01	3/11/2009	3/11/2009	
Sample ID: ISC0457-03 (09-062-S-BFM-03 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	ND	0.995	3/11/2009	3/11/2009	
Sample ID: ISC0457-04 (09-062-S-BFM-04 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**2.0**	1	3/11/2009	3/11/2009	
Sample ID: ISC0457-05 (09-062-S-BFM-05 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**54**	0.995	3/11/2009	3/11/2009	
Sample ID: ISC0457-06 (09-062-S-BFM-06 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**3.5**	1	3/11/2009	3/11/2009	
Sample ID: ISC0457-07 (09-062-S-BFM-07 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	ND	1.01	3/11/2009	3/11/2009	
Sample ID: ISC0457-08 (09-062-S-BFM-08 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	ND	0.985	3/11/2009	3/11/2009	
Sample ID: ISC0457-09 (09-062-S-BFM-09 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**63**	1.01	3/11/2009	3/11/2009	
Sample ID: ISC0457-10 (09-062-S-BFM-10 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**12**	1	3/11/2009	3/11/2009	

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Report Number: ISC0457

Sampled: 03/03/09-03/04/09
Received: 03/04/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0457-11 (09-062-S-BFM-11 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**3.0**	1	3/11/2009	3/11/2009	
Sample ID: ISC0457-12 (09-062-S-BFM-12 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**2.2**	1.01	3/11/2009	3/11/2009	
Sample ID: ISC0457-13 (09-062-S-BFM-13 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**2.4**	0.995	3/11/2009	3/11/2009	
Sample ID: ISC0457-14 (09-062-S-BFM-14 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**290**	1	3/11/2009	3/11/2009	
Sample ID: ISC0457-15 (09-062-S-BFM-15 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**3.4**	0.985	3/11/2009	3/11/2009	
Sample ID: ISC0457-16 (09-062-S-BFM-16 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**3.5**	1	3/11/2009	3/11/2009	
Sample ID: ISC0457-17 (09-062-S-BFM-17 - Soil)					**Sampled: 03/03/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	10	ND	4.98	3/11/2009	3/12/2009	RL1
Sample ID: ISC0457-18 (09-062-S-BFM-18 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11123	2.0	**38**	0.985	3/11/2009	3/11/2009	
Sample ID: ISC0457-19 (09-062-S-BFM-19 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	4.0	**7.3**	1.99	3/11/2009	3/12/2009	
Sample ID: ISC0457-20 (09-062-S-BFM-20 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**4.3**	0.995	3/11/2009	3/12/2009	

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Project ID: CalTrans
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Report Number: ISC0457

Sampled: 03/03/09-03/04/09
Received: 03/04/09

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0457-21 (09-062-S-BFM-21 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**2.9**	1.01	3/11/2009	3/12/2009	
Sample ID: ISC0457-22 (09-062-S-BFM-22 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**190**	1	3/11/2009	3/12/2009	
Sample ID: ISC0457-23 (09-062-S-BFM-23 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	4.0	**5.1**	2	3/11/2009	3/12/2009	
Sample ID: ISC0457-24 (09-062-S-BFM-24 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**3.9**	0.985	3/11/2009	3/12/2009	
Sample ID: ISC0457-25 (09-062-S-BFM-25 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**3.6**	0.995	3/11/2009	3/12/2009	
Sample ID: ISC0457-26 (09-062-S-BFM-26 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**140**	0.985	3/11/2009	3/12/2009	
Sample ID: ISC0457-27 (09-062-S-BFM-27 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	4.0	**4.9**	2	3/11/2009	3/12/2009	
Sample ID: ISC0457-28 (09-062-S-BFM-28 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**550**	1.01	3/11/2009	3/12/2009	
Sample ID: ISC0457-29 (09-062-S-BFM-29 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	ND	1.01	3/11/2009	3/12/2009	
Sample ID: ISC0457-30 (09-062-S-BFM-30 - Soil)					**Sampled: 03/04/09**			
Reporting Units: mg/kg								
Lead	EPA 6010B	9C11124	2.0	**4.5**	1.01	3/11/2009	3/12/2009	

TestAmerica Irvine

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Project Manager

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Project ID: CalTrans
S-57, 602231-002
Report Number: ISC0457

Sampled: 03/03/09-03/04/09
Received: 03/04/09

INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0457-16 (09-062-S-BFM-16 - Soil)					**Sampled: 03/03/09**			
Reporting Units: pH Units								
pH	EPA 9045C	9C06099	0.100	**6.30**	1	3/6/2009	3/6/2009	

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Project ID: CalTrans
S-57, 602231-002
Report Number: ISC0457

Sampled: 03/03/09-03/04/09
Received: 03/04/09

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C11123 Extracted: 03/11/09										
Blank Analyzed: 03/11/2009 (9C11123-BLK1)										
Lead	ND	2.0	mg/kg							
LCS Analyzed: 03/11/2009 (9C11123-BS1)										
Lead	50.2	2.0	mg/kg	50.0		100	80-120			
Matrix Spike Analyzed: 03/11/2009 (9C11123-MS1)					**Source: ISC0457-01**					
Lead	58.8	2.0	mg/kg	50.0	23.5	70	75-125			*M2*
Matrix Spike Dup Analyzed: 03/11/2009 (9C11123-MSD1)					**Source: ISC0457-01**					
Lead	68.3	2.0	mg/kg	49.8	23.5	90	75-125	15	20	
Batch: 9C11124 Extracted: 03/11/09										
Blank Analyzed: 03/12/2009 (9C11124-BLK1)										
Lead	ND	2.0	mg/kg							
LCS Analyzed: 03/12/2009 (9C11124-BS1)										
Lead	48.1	2.0	mg/kg	50.0		96	80-120			
Matrix Spike Analyzed: 03/12/2009 (9C11124-MS1)					**Source: ISC0457-19**					
Lead	57.7	4.0	mg/kg	49.8	7.28	101	75-125			
Matrix Spike Dup Analyzed: 03/12/2009 (9C11124-MSD1)					**Source: ISC0457-19**					
Lead	55.6	4.0	mg/kg	50.0	7.28	97	75-125	4	20	

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Sampled: 03/03/09-03/04/09
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METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C06099 Extracted: 03/06/09										
Duplicate Analyzed: 03/06/2009 (9C06099-DUP1)					**Source: ISC0457-16**					
pH	6.23	0.100	pH Units		6.30			1	5	

TestAmerica Irvine

Patty Mata
Project Manager

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THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans S-57, 602231-002 Report Number: ISC0457	Sampled: 03/03/09-03/04/09 Received: 03/04/09

DATA QUALIFIERS AND DEFINITIONS

M2	The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
RL1	Reporting limit raised due to sample matrix effects.
ND	Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
RPD	Relative Percent Difference

TestAmerica Irvine

Patty Mata
Project Manager

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans S-57, 602231-002 Report Number: ISC0457	Sampled: 03/03/09-03/04/09 Received: 03/04/09

Certification Summary

TestAmerica Irvine

Method	Matrix	Nelac	California
EPA 6010B	Soil	X	X
EPA 9045C	Soil	X	X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at www.testamericainc.com

TestAmerica Irvine

Patty Mata
Project Manager

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THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013(1007)

CHAIN OF CUSTODY FORM

17461 Derian Ave., #100, Irvine, CA 92614 (949) 261-1022 FAX (949) 260-3297
1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370-4667 FAX (909) 370-1046
9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851
2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

ISC0457

Client Name/Address: LEIGHTON CONSULTING (LCI) 17781 COWAN IRVINE, CA 92614

Project/PO Number: 60 2231-002 SA-57

Project Manager: KRIS LUTTON

Phone Number: 949-253-9836

Sampler: BFM/MOW

Fax Number: 949-250-1114

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD	pH								Special Instructions
09-062-S-BFM-01	S	SLEEVE	1	3-3-09	2215	NONE	X									IF TTLC IS
09-062-S-BFM-02					2217		X									>50 mg/kg
09-062-S-BFM-03					2219		X									run STLC!
09-062-S-BFM-04					2229		X									TCLP
09-062-S-BFM-05					2240		X									
09-062-S-BFM-06					2242		X									
09-062-S-BFM-07					2244		X									
09-062-S-BFM-08					2246		X									
09-062-S-BFM-09					2305		X									
09-062-S-BFM-10					2307		X									
09-062-S-BFM-11					2309		X									
09-062-S-BFM-12					2311		X									
09-062-S-BFM-13					2313		X									
09-062-S-BFM-14					2330		X									

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	3-4-09 / 1625	[signature]	3-4-09 1625	same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal ✓
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:	Sample Integrity: (Check)
				intact ✓ on ice 3.5°C

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

#31

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

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1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370-4667 FAX (909) 370-1046
9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851
2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

CHAIN OF CUSTODY FORM

TAL-0013(1007)

Client Name/Address: LCI

Project/PO Number: 602231-002 SR-57

Project Manager: KRIS LUTTON

Phone Number: 949-253-4836

Sampler: BFM/MDW

Fax Number: 949-250-1114

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD	pH								Special Instructions
09-062-S-BFM-15	S	SLEEVE	1	3-3-09	2332	NONE	X									IF TTLC IS
09-062-S-BFM-16					2334		X	X								>50 mg/kg
09-062-S-BFM-17					2336		X									RUN STLC!
09-062-S-BFM-18				3-4-09	0010		X									TCLP
09-062-S-BFM-19					0012		X									
09-062-S-BFM-20					0014		X									
09-062-S-BFM-21					0016		X									
09-062-S-BFM-22					0030		X									
09-062-S-BFM-23					0032		X									
09-062-S-BFM-24					0034		X									
09-062-S-BFM-25					0036		X									
09-062-S-BFM-26					0050		X									
09-062-S-BFM-27					0052		X									
09-062-S-BFM-28		SAR			0054		X									

Analysis Required

Relinquished By:	Date/Time:	Received By:	Date/Time:
BFM	3-4-09 / 1625	[signature]	3-4-09 1625
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal ✓

Sample Integrity: (Check)
intact ✗ on ice 3.5C

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

#31

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THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY FORM

17461 Derian Ave., #100, Irvine, CA 92614 (949) 261-1022 FAX (949) 260-3297
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2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

TAL-0013(1007)

Client Name/Address: LCI

Project/PO Number: 602231-002 SR-57

Project Manager: KRIS LUTTON

Phone Number: 949-253-9836

Sampler: BFM/MDW

Fax Number: 949-250-1114

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	LEAD									Special Instructions
09-062-S-BFM-29	S	SLEEVE	1	3-4-09	0056	NONE	X									IF TTLC IS
09-062-S-BFM-30	↓	↓	↓	↓	0058	↓	X									>50 mg/kg
																run STLC !
																TCLP

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	3-4-09 1625	[signature]	3-4-09 1625	same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ____
				48 hours ____ normal ✓
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:	Sample Integrity: (Check)
				intact ✗ on ice 3.5°C

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

#31

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

LABORATORY REPORT

Prepared For: Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project: CalTrans
SR-57, 602231-002

Sampled: 02/26/09
Received: 03/10/09
Issued: 03/19/09 15:32

NELAP #01108CA California ELAP#2706 CSDLAC #10256 AZ #AZ0671 NV #CA01531

The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica. The Chain of Custody, 1 page, is included and is an integral part of this report.
This entire report was reviewed and approved for release.

CASE NARRATIVE

SAMPLE RECEIPT: Samples were received intact, at 5°C, on ice and with chain of custody documentation.

HOLDING TIMES: All samples were analyzed within prescribed holding times and/or in accordance with the TestAmerica Sample Acceptance Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made.

SUBCONTRACTED: No analyses were subcontracted to an outside laboratory.

LABORATORY ID	CLIENT ID	MATRIX
ISC0932-01	09-057-S-BFM-43	Soil
ISC0932-02	09-057-S-BFM-44	Soil
ISC0932-03	09-057-S-BFM-45	Soil
ISC0932-04	09-057-S-BFM-52	Soil
ISC0932-05	09-057-S-BFM-62	Soil

Reviewed By:

TestAmerica Irvine

Patty Mata
Project Manager

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC0932

Sampled: 02/26/09
Received: 03/10/09

STLC METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	STLC Limit	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC0932-01 (09-057-S-BFM-43 - Soil)									
Reporting Units: mg/l									
Lead	6010B-STLC	9C16112	0.10	**2.6**	1	5.0	3/16/2009	3/16/2009	
Sample ID: ISC0932-02 (09-057-S-BFM-44 - Soil)									
Reporting Units: mg/l									
Lead	6010B-STLC	9C16112	0.10	**4.1**	1	5.0	3/16/2009	3/16/2009	
Sample ID: ISC0932-03 (09-057-S-BFM-45 - Soil)									
Reporting Units: mg/l									
Lead	6010B-STLC	9C16112	0.10	**2.3**	1	5.0	3/16/2009	3/16/2009	
Sample ID: ISC0932-04 (09-057-S-BFM-52 - Soil)									
Reporting Units: mg/l									
Lead	6010B-STLC	9C16112	0.10	**3.7**	1	5.0	3/16/2009	3/16/2009	
Sample ID: ISC0932-05 (09-057-S-BFM-62 - Soil)									
Reporting Units: mg/l									
Lead	6010B-STLC	9C16112	0.10	**2.8**	1	5.0	3/16/2009	3/16/2009	

TestAmerica Irvine

Patty Mata
Project Manager

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC0932

Sampled: 02/26/09
Received: 03/10/09

WASTE EXTRACTION TEST (STLC) - Metals/Inorganics

Analyte	Method	Batch	Extraction Start Date	Extraction End Date	Data Qualifiers
Sample ID: ISC0932-01 (09-057-S-BFM-43 - Soil)					
Extraction	STLC-Met	9C14088	3/14/2009	3/16/2009	
Sample ID: ISC0932-02 (09-057-S-BFM-44 - Soil)					
Extraction	STLC-Met	9C14088	3/14/2009	3/16/2009	
Sample ID: ISC0932-03 (09-057-S-BFM-45 - Soil)					
Extraction	STLC-Met	9C14088	3/14/2009	3/16/2009	
Sample ID: ISC0932-04 (09-057-S-BFM-52 - Soil)					
Extraction	STLC-Met	9C14088	3/14/2009	3/16/2009	
Sample ID: ISC0932-05 (09-057-S-BFM-62 - Soil)					
Extraction	STLC-Met	9C14088	3/14/2009	3/16/2009	

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17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID:	CalTrans SR-57, 602231-002	Sampled: 02/26/09
	Report Number:	ISC0932	Received: 03/10/09

METHOD BLANK/QC DATA

STLC METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C16112 Extracted: 03/16/09										
Blank Analyzed: 03/16/2009 (9C16112-BLK1)										
Lead	ND	0.10	mg/l							
LCS Analyzed: 03/17/2009 (9C16112-BS1)										
Lead	19.1	0.10	mg/l	20.0		96	80-120			
Matrix Spike Analyzed: 03/16/2009 (9C16112-MS1)					**Source: ISC1049-01**					
Lead	19.0	0.10	mg/l	20.0	ND	95	75-125			
Matrix Spike Dup Analyzed: 03/16/2009 (9C16112-MSD1)					**Source: ISC1049-01**					
Lead	19.1	0.10	mg/l	20.0	ND	95	75-125	0	20	

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans SR-57, 602231-002 Report Number: ISC0932	Sampled: 02/26/09 Received: 03/10/09

DATA QUALIFIERS AND DEFINITIONS

ND Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.

RPD Relative Percent Difference

TestAmerica Irvine

Patty Mata
Project Manager

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans SR-57, 602231-002 Report Number: ISC0932	Sampled: 02/26/09 Received: 03/10/09

Certification Summary

TestAmerica Irvine

Method	Matrix	Nelac	California
6010B-STLC	Soil	X	X
STLC-Met	Soil	X	X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at www.testamericainc.com

TestAmerica Irvine

Patty Mata
Project Manager

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17461 Derian Avenue, Ste. 100 Irvine, CA 92614 (949) 261-1022 FAX (949) 261-1228

IS C0932

ADDITIONAL ANALYSIS REQUEST FORM

Date: 3/10/09 Project Manager: fm

Client: Leighton Consulting Contact: Kris Lutton

Project: CalTrans SR-57/602231-002

Date Sampled: 2/26/09 Date Received: 2/26/09

Request Via:

- [ ] Telephone
- [ ] COC Form
- [ ] Fax
- [x] E-mail
- [ ] Other

Status:

- [ ] In Progress
- [x] Completed
- [ ] Received Today
- [ ] Received Yesterday
- [ ] On Hold
- [ ] Other

Turn Around Time:

- [ ] Same Day
- [ ] 24HR
- [ ] 48HR
- [ ] 3Day
- [ ] 5Day
- [x] Standard
- [ ] No Rush Charge

Work Order Number	Sample Description	Analysis Requested	Special Requirements
IS B3105-43	09-057-S-BFM-43	STLC-Lead + TCLP-Lead	
44	-44		
45	-45		
52	-52		
62	-62		

Need new work order

0.0 3/11/09 10:00

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

LABORATORY REPORT

Prepared For: Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project: CalTrans
SR-57, 602231-002

Sampled: 03/02/09-03/03/09
Received: 03/14/09
Issued: 03/25/09 15:16

NELAP #01108CA California ELAP#2706 CSDLAC #10256 AZ #AZ0671 NV #CA01531

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This entire report was reviewed and approved for release.

CASE NARRATIVE

SAMPLE RECEIPT: Samples were received intact, at 6°C, on ice and with chain of custody documentation on 03/04/09. Additional STLC tests were requested on 3/14/09.

HOLDING TIMES: All samples were analyzed within prescribed holding times and/or in accordance with the TestAmerica Sample Acceptance Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made.

SUBCONTRACTED: No analyses were subcontracted to an outside laboratory.

LABORATORY ID	CLIENT ID	MATRIX
ISC1454-01	09-061-S-BFM-06	Soil
ISC1454-02	09-061-S-BFM-29	Soil
ISC1454-03	09-061-S-BFM-31	Soil
ISC1454-04	09-061-S-BFM-32	Soil
ISC1454-05	09-061-S-BFM-33	Soil
ISC1454-06	09-061-S-BFM-34	Soil
ISC1454-07	09-061-S-BFM-35	Soil
ISC1454-08	09-061-S-BFM-37	Soil

Reviewed By:

TestAmerica Irvine

Patty Mata
Project Manager

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC1454

Sampled: 03/02/09-03/03/09
Received: 03/14/09

STLC METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	STLC Limit	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC1454-01 (09-061-S-BFM-06 - Soil)					**Sampled: 03/02/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C23085	0.10	**0.11**	1	5.0	3/23/2009	3/23/2009	
Sample ID: ISC1454-02 (09-061-S-BFM-29 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C23085	0.10	**5.9**	1	5.0	3/23/2009	3/23/2009	
Sample ID: ISC1454-03 (09-061-S-BFM-31 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C23085	0.10	**42**	1	5.0	3/23/2009	3/23/2009	
Sample ID: ISC1454-04 (09-061-S-BFM-32 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C23085	0.10	**9.8**	1	5.0	3/23/2009	3/23/2009	
Sample ID: ISC1454-05 (09-061-S-BFM-33 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C23085	0.10	**7.4**	1	5.0	3/23/2009	3/23/2009	
Sample ID: ISC1454-06 (09-061-S-BFM-34 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C23085	0.10	**8.3**	1	5.0	3/23/2009	3/23/2009	
Sample ID: ISC1454-07 (09-061-S-BFM-35 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C23085	0.10	**12**	1	5.0	3/23/2009	3/23/2009	
Sample ID: ISC1454-08 (09-061-S-BFM-37 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C23085	0.10	**4.4**	1	5.0	3/23/2009	3/23/2009	

TestAmerica Irvine

Patty Mata
Project Manager

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THE LEADER IN ENVIRONMENTAL TESTING

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC1454

Sampled: 03/02/09-03/03/09
Received: 03/14/09

WASTE EXTRACTION TEST (STLC) - Metals/Inorganics

Analyte	Method	Batch	Extraction Start Date	Extraction End Date	Data Qualifiers
Sample ID: ISC1454-01 (09-061-S-BFM-06 - Soil)			**Sampled: 03/02/09**		
Extraction	STLC-Met	9C19133	3/19/2009	3/21/2009	
Sample ID: ISC1454-02 (09-061-S-BFM-29 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C19133	3/19/2009	3/21/2009	
Sample ID: ISC1454-03 (09-061-S-BFM-31 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C19133	3/19/2009	3/21/2009	
Sample ID: ISC1454-04 (09-061-S-BFM-32 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C19133	3/19/2009	3/21/2009	
Sample ID: ISC1454-05 (09-061-S-BFM-33 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C19133	3/19/2009	3/21/2009	
Sample ID: ISC1454-06 (09-061-S-BFM-34 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C19133	3/19/2009	3/21/2009	
Sample ID: ISC1454-07 (09-061-S-BFM-35 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C19133	3/19/2009	3/21/2009	
Sample ID: ISC1454-08 (09-061-S-BFM-37 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C19133	3/19/2009	3/21/2009	

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Project Manager

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
SR-57, 602231-002
Report Number: ISC1454

Sampled: 03/02/09-03/03/09
Received: 03/14/09

METHOD BLANK/QC DATA

STLC METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C23085 Extracted: 03/23/09										
Blank Analyzed: 03/23/2009 (9C23085-BLK1)										
Lead	ND	0.10	mg/l							
LCS Analyzed: 03/23/2009 (9C23085-BS1)										
Lead	19.3	0.10	mg/l	20.0		96	80-120			
Matrix Spike Analyzed: 03/23/2009 (9C23085-MS1)					**Source: ISC1895-01**					
Lead	20.2	0.10	mg/l	20.0	0.518	98	75-125			
Matrix Spike Dup Analyzed: 03/23/2009 (9C23085-MSD1)					**Source: ISC1895-01**					
Lead	20.1	0.10	mg/l	20.0	0.518	98	75-125	1	20	

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans SR-57, 602231-002 Report Number: ISC1454	Sampled: 03/02/09-03/03/09 Received: 03/14/09

DATA QUALIFIERS AND DEFINITIONS

ND Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.

RPD Relative Percent Difference

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Project Manager

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans SR-57, 602231-002 Report Number: ISC1454	Sampled: 03/02/09-03/03/09 Received: 03/14/09

Certification Summary

TestAmerica Irvine

Method	Matrix	Nelac	California
6010B-STLC	Soil	X	X
STLC-Met	Soil	X	X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at www.testamericainc.com

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Project Manager

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ADDITIONAL ANALYSIS REQUEST FORM

Date: 3/13/09 Project Manager: RM

Client: Leighton Consulting Contact: Kris Lutton

Project: CalTrans 602231-002, SR-57

Date Sampled: 3/2-3/3/09 Date Received: 3/4/09

ISC1454

Request Via:

- [ ] Telephone
- [ ] COC Form
- [ ] Fax
- [x] E-mail
- [ ] Other

Status:

- [ ] In Progress
- [x] Completed
- [ ] Received Today
- [ ] Received Yesterday
- [ ] On Hold
- [ ] Other

Turn Around Time:

- [ ] Same Day
- [ ] 24HR
- [ ] 48HR
- [ ] 3Day
- [ ] 5Day
- [x] Standard
- [ ] No Rush Charge

Work Order Number	Sample Description	Analysis Requested	Special Requirements
ISC0458-06	09-061-S-BFM-06	STLC-Lead	
29	-29		
31	-31		
32	32		
33	33		
34	34		
35	35		HS 3/16/09 10:05
37	37		

Need new work order.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

LABORATORY REPORT

Prepared For: Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project: CalTrans
S-57, 602231-002

Sampled: 03/03/09-03/04/09
Received: 03/14/09
Issued: 03/25/09 15:12

NELAP #01108CA California ELAP#2706 CSDLAC #10256 AZ #AZ0671 NV #CA01531

The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica. The Chain of Custody, 1 page, is included and is an integral part of this report.
This entire report was reviewed and approved for release.

CASE NARRATIVE

SAMPLE RECEIPT: Samples were received intact, at 6°C, on ice and with chain of custody documentation on 03/04/09. Additional STLC tests were requested on 3/14/09.

HOLDING TIMES: All samples were analyzed within prescribed holding times and/or in accordance with the TestAmerica Sample Acceptance Policy unless otherwise noted in the report.

PRESERVATION: Samples requiring preservation were verified prior to sample analysis.

QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.

COMMENTS: No significant observations were made.

SUBCONTRACTED: No analyses were subcontracted to an outside laboratory.

LABORATORY ID	CLIENT ID	MATRIX
ISC1453-01	09-062-S-BFM-05	Soil
ISC1453-02	09-062-S-BFM-09	Soil
ISC1453-03	09-062-S-BFM-14	Soil
ISC1453-04	09-062-S-BFM-22	Soil
ISC1453-05	09-062-S-BFM-26	Soil
ISC1453-06	09-062-S-BFM-28	Soil

Reviewed By:

TestAmerica Irvine

Patty Mata
Project Manager

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THE LEADER IN ENVIRONMENTAL TESTING

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
S-57, 602231-002
Report Number: ISC1453

Sampled: 03/03/09-03/04/09
Received: 03/14/09

STLC METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	STLC Limit	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: ISC1453-01 (09-062-S-BFM-05 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C20092	0.10	**2.0**	1	5.0	3/20/2009	3/20/2009	
Sample ID: ISC1453-02 (09-062-S-BFM-09 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C20092	0.10	**1.9**	1	5.0	3/20/2009	3/20/2009	
Sample ID: ISC1453-03 (09-062-S-BFM-14 - Soil)					**Sampled: 03/03/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C20092	0.10	**26**	1	5.0	3/20/2009	3/20/2009	
Sample ID: ISC1453-04 (09-062-S-BFM-22 - Soil)					**Sampled: 03/04/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C20092	0.10	**10**	1	5.0	3/20/2009	3/20/2009	
Sample ID: ISC1453-05 (09-062-S-BFM-26 - Soil)					**Sampled: 03/04/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C20092	0.10	**12**	1	5.0	3/20/2009	3/20/2009	
Sample ID: ISC1453-06 (09-062-S-BFM-28 - Soil)					**Sampled: 03/04/09**				
Reporting Units: mg/l									
Lead	6010B-STLC	9C20092	0.10	**34**	1	5.0	3/20/2009	3/20/2009	

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Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
S-57, 602231-002
Report Number: ISC1453

Sampled: 03/03/09-03/04/09
Received: 03/14/09

WASTE EXTRACTION TEST (STLC) - Metals/Inorganics

Analyte	Method	Batch	Extraction Start Date	Extraction End Date	Data Qualifiers
Sample ID: ISC1453-01 (09-062-S-BFM-05 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C17162	3/17/2009	3/19/2009	
Sample ID: ISC1453-02 (09-062-S-BFM-09 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C17162	3/17/2009	3/19/2009	
Sample ID: ISC1453-03 (09-062-S-BFM-14 - Soil)			**Sampled: 03/03/09**		
Extraction	STLC-Met	9C17162	3/17/2009	3/19/2009	
Sample ID: ISC1453-04 (09-062-S-BFM-22 - Soil)			**Sampled: 03/04/09**		
Extraction	STLC-Met	9C17162	3/17/2009	3/19/2009	
Sample ID: ISC1453-05 (09-062-S-BFM-26 - Soil)			**Sampled: 03/04/09**		
Extraction	STLC-Met	9C17162	3/17/2009	3/19/2009	
Sample ID: ISC1453-06 (09-062-S-BFM-28 - Soil)			**Sampled: 03/04/09**		
Extraction	STLC-Met	9C17162	3/17/2009	3/19/2009	

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Kris Lutton

Project ID: CalTrans
S-57, 602231-002
Report Number: ISC1453

Sampled: 03/03/09-03/04/09
Received: 03/14/09

METHOD BLANK/QC DATA

STLC METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 9C20092 Extracted: 03/20/09										
Blank Analyzed: 03/20/2009 (9C20092-BLK1)										
Lead	ND	0.10	mg/l							
LCS Analyzed: 03/20/2009 (9C20092-BS1)										
Lead	19.9	0.10	mg/l	20.0		99	80-120			
Matrix Spike Analyzed: 03/20/2009 (9C20092-MS1)					**Source: ISC0874-02**					
Lead	20.2	0.10	mg/l	20.0	0.354	99	75-125			
Matrix Spike Dup Analyzed: 03/20/2009 (9C20092-MSD1)					**Source: ISC0874-02**					
Lead	20.3	0.10	mg/l	20.0	0.354	100	75-125	0	20	

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Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans S-57, 602231-002 Report Number: ISC1453	Sampled: 03/03/09-03/04/09 Received: 03/14/09

DATA QUALIFIERS AND DEFINITIONS

ND Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.

RPD Relative Percent Difference

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Project Manager

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17461 Derian Avenue. Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

Leighton Consulting, Inc. 17781 Cowan, Suite 140 Irvine, CA 92614 Attention: Kris Lutton	Project ID: CalTrans S-57, 602231-002 Report Number: ISC1453	Sampled: 03/03/09-03/04/09 Received: 03/14/09

Certification Summary

TestAmerica Irvine

Method	Matrix	Nelac	California
6010B-STLC	Soil	X	X
STLC-Met	Soil	X	X

Nevada and NELAP provide analyte specific accreditations. Analyte specific information for TestAmerica may be obtained by contacting the laboratory or visiting our website at www.testamericainc.com

TestAmerica Irvine

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Project Manager

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17461 Derian Avenue, Ste. 100 Irvine, CA 92614 (949) 261-1022 FAX (949) 261-1228

ADDITIONAL ANALYSIS REQUEST FORM

Date: 3/13/09 Project Manager: [illegible]

Client: Leighton Consulting Contact: Kris Lutton

Project: Cal Trans 602231-002, SR-57

Date Sampled: 3/3/09-3/4/09 Date Received: 3/4/09

ISC1453

Request Via:

- [ ] Telephone
- [ ] COC Form
- [ ] Fax
- [x] E-mail
- [ ] Other

Status:

- [ ] In Progress
- [x] Completed
- [ ] Received Today
- [ ] Received Yesterday
- [ ] On Hold
- [ ] Other

Turn Around Time:

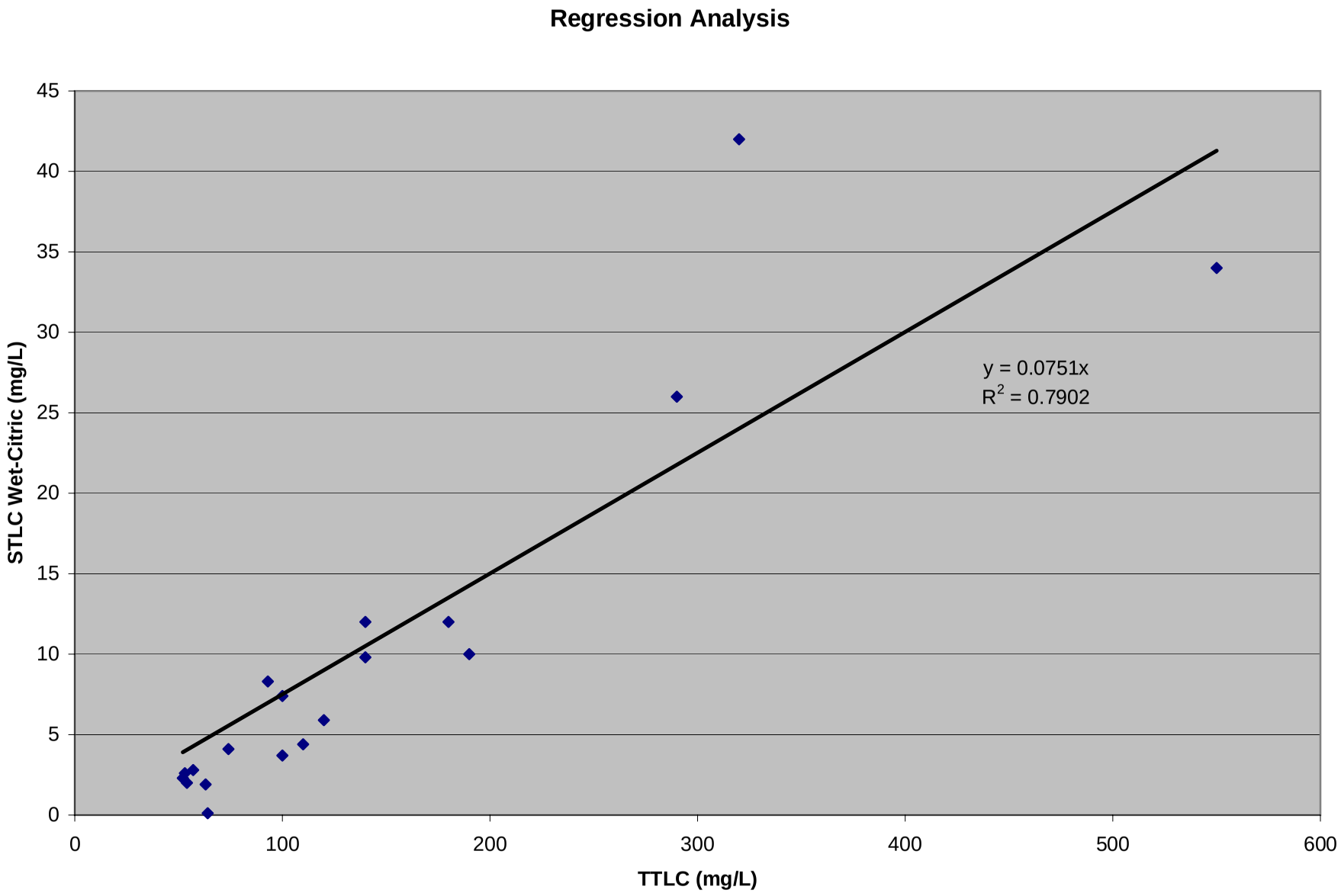
- [ ] Same Day
- [ ] 24HR
- [ ] 48HR
- [ ] 3Day
- [ ] 5Day
- [x] Standard
- [ ] No Rush Charge

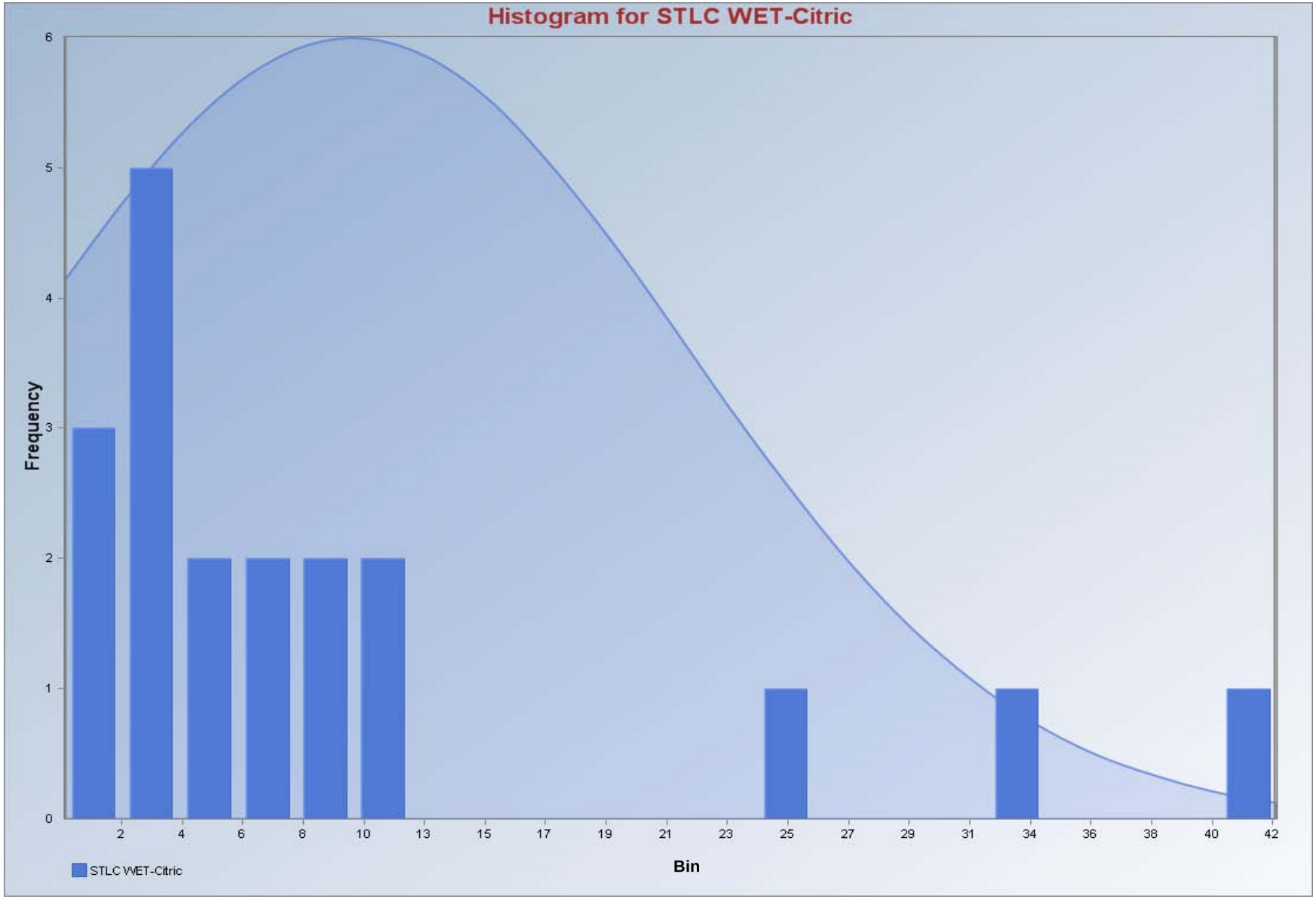
Work Order Number	Sample Description	Analysis Requested	Special Requirements
ISC0457-05	09-062-S-BFM-05	STLC-Lead	
-09	09-062-S-BFM-09		
-14	-14		
-22	-22		
-26	-26		
-28	-28		

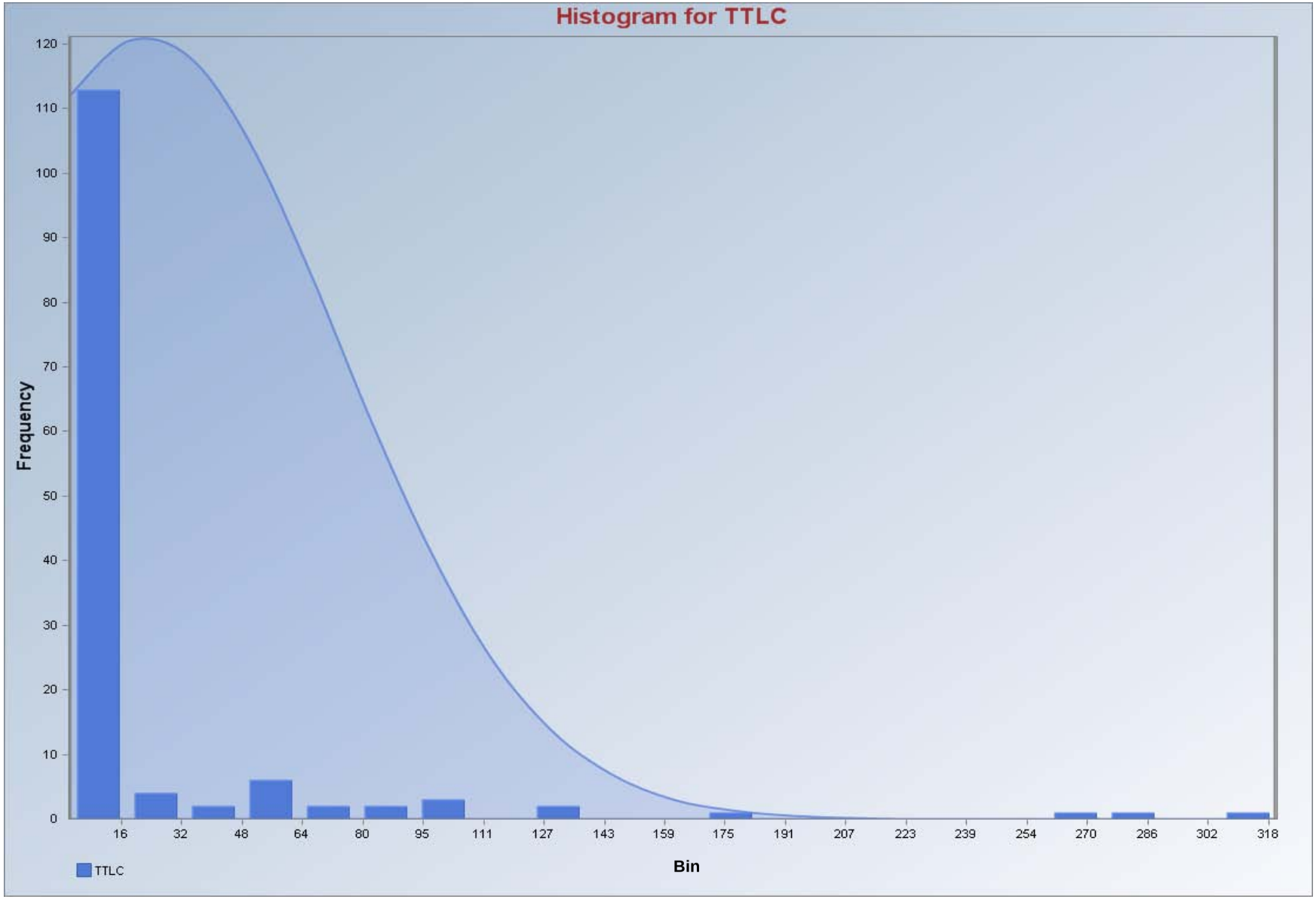
Need new work order

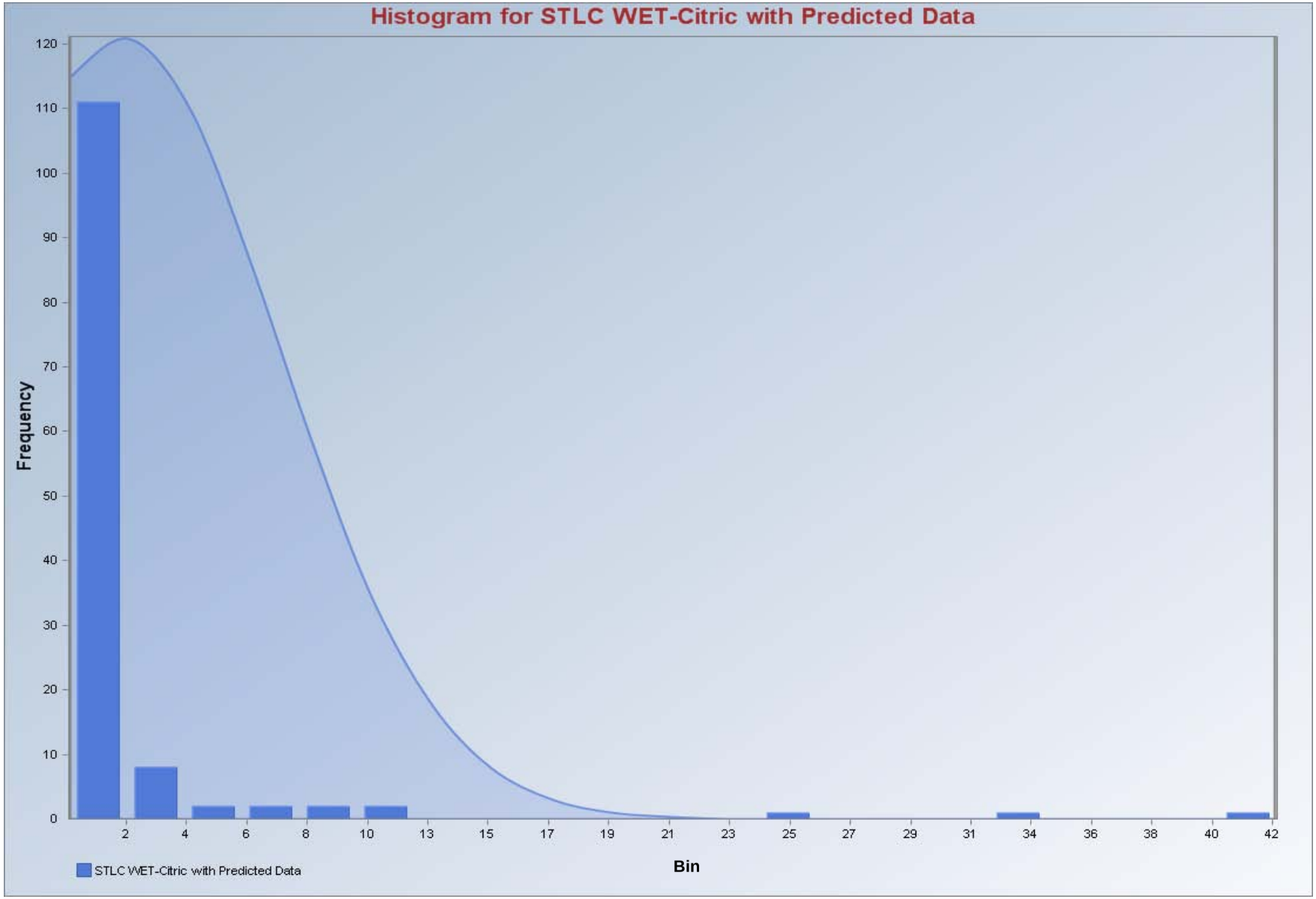
HS 3/16/09 10:10

APPENDIX D


Regression Analysis
STLC Wet-Citric (mg/L)
TTLC (mg/L)
y = 0.0751x
R2 = 0.7902
0
5
10
15
20
25
30
35
40
45
0
100
200
300
400
500
600


Histogram for STLC WET-Citric
Frequency
0
1
2
3
4
5
6
2
4
6
8
10
13
15
17
19
21
23
25
27
29
31
34
36
38
40
42
Bin
STLC WET-Citric


Histogram for TTLC
Frequency
120
110
100
90
80
70
60
50
40
30
20
10
0
16
32
48
64
80
95
111
127
143
159
175
191
207
223
239
254
270
286
302
318
Bin
TTLC


Histogram for STLC WET-Citric with Predicted Data
Frequency
120
110
100
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
13
15
17
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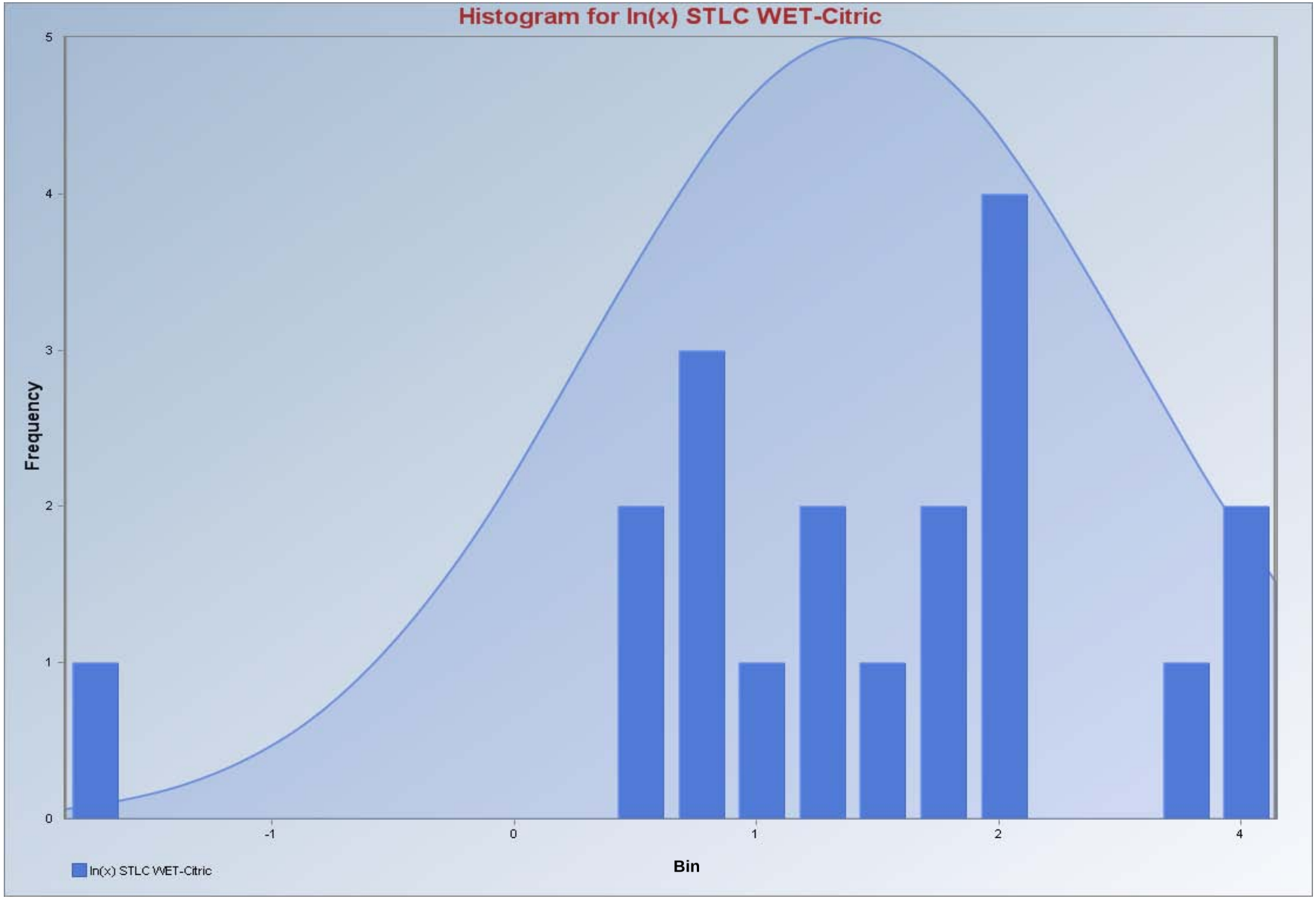
21
23
25
27
29
31
34
36
38
40
42
Bin
STLC WET-Citric with Predicted Data


Histogram for ln(x) STLC WET-Citric
Frequency
5
4
3
2
1
0
-1
0
1
2
4
Bin
ln(x) STLC WET-Citric

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

TRANSMITTAL

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: August 5, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail	X	Draft Report	X	Your Use
X	Courier/Overnight		Final Report		As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Foundation Report for Proposed Retaining Wall No 55E0111 at Abutment 3 of Ball Road Overcrossing (Bridge No. 55-0524), Northbound State Route 57, Orange County, California

LEIGHTON CONSULTING, INC.

By: Tae Kuk Kim/Djan Chandra

Distribution: (4) Addressee

17781 Cowan ■ Irvine, CA 92614-6009
949.250.1421 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

FOUNDATION REPORT FOR
PROPOSED RETAINING WALL NO. 55E0111 AT ABUTMENT 3 OF
BALL ROAD OVERCROSSING (BRIDGE NO. 55-0524),
NORTHBOUND STATE ROUTE 57,
ORANGE COUNTY, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 57
PROJECT POST MILES: 12.2/15.2, EA # 0F0401

Prepared For:

HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

August 5, 2010

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

August 5, 2010

Project No. 602231-002

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Attention: Mr. Scott Bacsikin

Subject: Foundation Report for Proposed Retaining Wall No. 55E0111 at Abutment 3 of Ball Road Overcrossing (Bridge No. 55-0524), Northbound State Route 57, Orange County, California

In response to your request, Leighton Consulting, Inc. has performed a geotechnical exploration for the proposed Retaining Wall No. 55E0111 at Abutment 3 of Ball Road overcrossing (Bridge No. 55-0524) at northbound State Route 57 (SR-57) in Orange County, California. The retaining wall is part of the proposed widening of northbound SR-57 from approximately 0.3 miles south of Katella Avenue to approximately 0.3 miles north of Lincoln Avenue. This project is sponsored by OCTA and Leighton Consulting has been retained as the geotechnical consultant by HDR Engineering, Inc. The purpose of our study was to evaluate the subsurface conditions at the project site and to provide geotechnical recommendations for design and construction of the proposed retaining wall. This report summarizes the results of our geotechnical exploration and presents the geotechnical recommendations.

A draft version of this report was issued on June 2, 2009 and subsequently revised on October 13, 2009 and February 15, 2010 to incorporate review comments from Caltrans and additional design information from HDR. An addendum report providing response to Caltrans final review comments was issued on May 20, 2010 and approved by Caltrans. Caltrans review comments and our response are included in Appendix C of this report.

17781 Cowan ■ Irvine, CA 92614-6009
949.250.1421 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

Ball Road is located approximately 26 feet above the SR-57 grade. Based on the available borings, the subject portion of Ball Road is underlain by approximately 35 feet of man-made fill consisting mainly of medium dense sand and silty sand, and very stiff silty clay and silt. The fill is further underlain by alluvium consisting predominantly of medium dense sand and silty sand to the maximum depth of our boring of 81½ feet below the street grade. Groundwater was not encountered during our field exploration.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Reviewed by:

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/lr

Distribution: (4) Addressee

Leighton

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1.0 INTRODUCTION

1.1 Project Overview

The California Department of Transportation (Caltrans), District 12, in cooperation with the Orange County Transportation Authority (OCTA), proposes to widen northbound State Route 57 (SR-57) between approximately 0.3 miles south of Katella Avenue (Post Mile 12.2) and 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project segment of SR-57 is approximately 3 miles long, passing through the City of Anaheim in Orange County, California. The purpose of the proposed project is to improve both existing and future mobility, reduce congestion and improve mainline merge and diverge movements.

This segment of SR-57 is relatively flat with elevations ranging from 186 feet above mean sea level (msl) at Katella Avenue to 200 feet msl at Lincoln Avenue. The southern portion of this segment is higher than the surrounding areas while the northern portion is lower. SR-57 was constructed in 1974 and currently has four general purpose lanes and a high-occupancy vehicle (HOV) lane in each direction. Six grade separations exist within this segment; namely at Katella Avenue, Douglass Road, Ball Road, Wagner Avenue, South Street and Lincoln Avenue. We understand that the project consists of widening of approximately 3 miles of northbound SR-57 by approximately 35 feet to provide standard lane widths, an additional general purpose lane (fifth lane) and a standard 10-foot wide inside shoulder.

1.2 Project Description

As part of the northbound SR-57 widening project, the existing sloped embankment at the front of Abutment 3 of Ball Road overcrossing will be removed and the remaining embankment will be retained by a tieback wall and a Type 1 retaining wall at each end. These walls are collectively identified as Retaining Wall No. 55E0111. Based on the provided plan and information, the proposed tieback wall has a maximum height of approximately 15 feet with two to three rows of tiebacks. The Type 1 retaining walls have a maximum height of 8 feet. The walls will be located approximately 5½ feet from the center of the existing CIDH piles for Abutment 3. Details of the tieback wall are shown in the attached layout plan prepared by HDR. The approximate location of the project site is shown in Figure 1, *Site Location Map*.

Based on the as-built plan (Caltrans, 1974), the existing Ball Road overcrossing (Bridge No. 55-0524) was constructed in 1974 and is supported on two abutments and one bent.

The existing bridge is approximately 239 feet long and 102 feet wide. The as-built elevations of the bridge range from 208.50 to 212.26 feet from west to east. Datum for all elevations referenced in this report is mean sea level (msl). Additionally, the as-built plan was based on the old datum (NGVD29) and approximately 1.84 feet should be added to the as-built elevations to convert them to the current elevations (Datum NAVD88). The elevation of SR-57 freeway is approximately 185 feet. The *General Plan*, *Foundation Plan* and layout plan of the proposed retaining wall prepared by HDR are included at the end of the text of this report.

1.3 Purpose and Scope

The purpose of this report is to review existing geotechnical data, perform subsurface exploration, laboratory testing and geotechnical analysis to provide geotechnical design recommendations for the proposed project.

Our scope of work for this project included the following tasks:

- *Literature Review*: We reviewed various documents pertinent to the project site including the as-built Log of Test Borings (LOTBs) prepared by Caltrans for the existing Bridge No. 55-0524. The as-built LOTBs are included as Sheet 4 of 4 of the attached LOTBs. A list of references used in preparation of this report is presented in Section 6.0.

- *Site Reconnaissance:* We performed a site reconnaissance to visually evaluate the accessibility of the site for drilling equipment and locate and mark the proposed boring location.

- *Subsurface Exploration*: We performed a subsurface exploration that consisted of drilling, logging and sampling of one 8-inch diameter hollow-stem auger boring to a depth of 81½ feet below the existing grade of Ball Road. Log of the boring is included in Sheet 1 of 4 of the attached LOTBs.

- *Laboratory Testing*: Laboratory testing was performed on selected soil samples collected from our field exploration to evaluate the engineering properties of the soils. The laboratory test results are included in Appendix A.

- *Seismic Analysis*: Based upon the encountered subsurface conditions and regional seismicity of the area, we performed ground motion analysis for the project site for use in structural analysis and design.

- *Geotechnical Design and Analysis*: Geotechnical analysis was performed on the collected data to develop recommendations for design and construction. Results of the analysis are included in Appendix B.

- *Report Preparation*: Relevant geotechnical data were compiled in this report along with our findings and recommendations for the proposed project.

2.0 GEOTECHNICAL FIELD AND LABORATORY INVESTIGATIONS

2.1 Subsurface Exploration

Our field exploration consisted of advancing one hollow-stem boring to a depth of 81½ feet below the existing grade of Ball Road. The boring was located within the embankment behind the existing Abutment 3 of Ball Road overcrossing. The approximate location of the boring is shown in the LOTBs.

Standard Penetration Test (SPT) was performed within the hollow-stem boring using a 140-pound automatic hammer falling freely for 30 inches. The samplers were driven for a total penetration of 18 inches and the blow counts were recorded for the last 12 inches of penetration. Relatively undisturbed samples were collected from the boring using the Modified California Ring sampler. The field sampling procedures were conducted in accordance with ASTM Standard Specifications D 1586 and D 3550 for SPT and split-barrel sampling of soil. In addition to driven samples, representative bulk soil samples were also collected from the boring.

The test boring was logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. All samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the boring was backfilled with soil cutting mixed with cement, tamped and capped with cold mix asphalt. Geotechnical log of the boring is included in the LOTBs.

2.2 Geotechnical Laboratory Testing

Laboratory tests were performed on representative soil samples to determine the geotechnical engineering properties of subsurface materials. The following laboratory tests were performed:

- In-situ moisture content and density;
- Grain-size distribution;
- Percent passing No. 200 sieve;
- Direct shear; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests, except corrosivity tests, were performed in general accordance with ASTM procedures. The corrosivity tests were performed in accordance with Caltrans procedures. Results of the laboratory tests are presented in Appendix A.

3.0 GEOTECHNICAL FINDINGS

3.1 Geologic Setting

The subject site is located in the Tustin Plain within the southeastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. In general, the Tustin Plain consists of approximately 1,400 feet of unconsolidated to semi-consolidated Quaternary-age alluvial sediments. Underlying the Quaternary alluvial deposits are Tertiary-age bedrock units consisting of sandstone, siltstone, shale and conglomerate on the order of 31,000 feet in thickness.

The site lies near the lower reaches of the Santa Ana River. The surface distribution of Holocene sediments, as recorded in early editions of regional soil survey maps (Eckmann et al., 1916), suggests that the Santa Ana River has recently wandered back and forth across the Orange County coastal plain from Alamitos Bay to Newport Bay. Historical accounts and documents further support the process of widespread sheet flooding being the dominant depositional process associated with the Santa Ana River prior to the construction of Prado Dam in 1941 (California Department of Water Resources, 1957). Currently, the Santa Ana River is located approximately 500 feet from the Ball Road overcrossing. Geology map of the area is presented in Figure 2.

3.2 Subsurface Earth Materials

The subsurface soils encountered in our boring consist of approximately 35 feet of embankment fill for Ball Road overcrossing underlain by alluvial deposits. The upper 10 feet of the fill consists of medium dense sand and the fill below 10 feet to 35 feet consists of interbedded layers of very stiff silty clay and silt, and medium dense silty sand. The alluvium below the fill consists mainly of sand and silty sand with consistency that increases with depth from loose to dense.

We have performed direct shear tests on representative samples collected from our boring. The cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils were found to range from 150 to 400 psf and 30 to 42 degrees, respectively. The test results are presented in Appendix A. Based on these test results, SPT blowcounts, and soil types, the shear strength parameters and unit weights selected for design are presented in Table 1.

Table 1 – Generalized Soil Profile and Design Parameters

Depth below Street Grade[1] (feet)	Elevation (feet)	Generalized Soil Type	Total Unit Weight (pcf)	Friction Angle[2] (degrees)	Undrained Cohesion, Cu[2] (psf)
0 to 10	211 to 201	**Fill**: Sand	120	32	-
10 to 30	201 to 181	Silty Clay/ Silt	120	28	500
30 to 35	181 to 176	Silty Sand	120	32	-
35 to 81.5	176 to 129.5	**Alluvium**: Sand/ Silty Sand	110	32 to 34	-

[1]Ball Road street grade; cutoff elevation of the existing Abutment 3 piles is 196.0 feet; elevation of top of retaining wall is 199 feet.

[2]Ultimate shear strength parameters based on SPT blow counts (NAFVAC, 1986) and laboratory test results.

3.3 Groundwater

Groundwater was not encountered during our field exploration to the maximum depth explored (elevation of 129.5 feet). Groundwater was also not encountered in Caltrans borings in 1969 to the maximum depth explored (elevation of 108 feet). The historically high groundwater table is on the order of 30 feet below the freeway grade (elevation of 155 feet, CDMG, 1997). Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff.

3.4 Engineering Properties of Subsurface Materials

Engineering properties of the subsurface materials were modeled based on results of geotechnical field and laboratory tests performed during our exploration. Results of these laboratory tests that are applicable to the proposed project are presented in Appendix A. These test results are briefly discussed below:

3.4.1 Shear Strength

Based on direct shear test results, the cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils ranges from 150 to 400 psf and 30 to 42 degrees, respectively. The shear strength parameters used for design are presented in Table 1.

3.4.2 Corrosion Potential

Representative samples of the subsurface soils were subjected to analytical testing to evaluate the potential for corrosion to concrete and ferrous metals. The test results are included in Appendix A and indicate the tested soils exhibited chloride concentration of 34 parts per million (ppm), sulfate concentration of 647 ppm, minimum resistivity of 552 ohm-cm, and pH level of 6.75. Caltrans specifications define a corrosive soil as a material in which any of the conditions exist: a chloride content greater than 500 ppm; soluble sulfate content greater than 2,000 ppm; or a pH of 5.5 or less. Based on the guidelines established by Caltrans, the subsurface soils at the Abutment 3 location are not considered corrosive to ferrous metal in direct contact with the soils. Based on the laboratory test results, no special measures are required for corrosion protection of structural concrete and reinforcing steel for structural concrete. Corrosion mitigation measure for the tieback anchors should be performed in accordance with the Caltrans *Corrosion Guidelines* (Caltrans, 2003).

3.4.3 Expansion Potential

Based on our boring and previous borings, the near-surface soils on both street and freeway levels consisted mainly of sand. It is our opinion that the on-site near-surface soils are considered to have low expansion potential.

3.5 Faulting and Seismicity

Our review of available in-house literature indicates that there are no known active or potentially active faults that have been mapped at the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in southern California. According to the California Geological Survey fault database, the closest

active faults that could affect the site are the Puente Hills Blind Thrust, Whittier, and San Joaquin Hills Blind Thrust faults located approximately 12.1 kilometers (km), 12.3 km and 14.4 km, respectively, from the site. Other known regional active faults that could affect the site include the Newport-Inglewood (L.A. Basin), Elsinore (Glen Ivy), Chino Central Ave (Elsinore), San Jose and Newport-Inglewood (Offshore) faults. The locations of these faults with respect to the site are shown in Figure 3.

We have performed seismic analysis for the site using the Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (2009). Distance of faults to the site was estimated using Caltrans ARS online program and peak ground acceleration for each fault was estimated using Caltrans excel worksheet. The estimated peak ground accelerations caused by various faults near the site are summarized in the following table.

Table 2 – Peak Bedrock Accelerations

Fault	Magnitude	Distance (km)	Peak Ground Acceleration
Peralta Hills	6.2	3.5	0.39g
Compton-Los Alamitos Blind Thrust	6.8	11.8	0.38g
Puente Hills Blind Thrust	7.3	12.3	0.34g
Elsinore fault zone (Whittier section)	7.6	12.4	0.29g
San Joaquin Hills Blind Thrust	6.6	14.4	0.25g
Elsinore fault zone (Chino section)	7.6	16.4	0.34g

As shown in the table above, the Peralta Hills fault is the nearest fault to the site at a distance of approximately 3.5 km. A maximum earthquake magnitude of 6.2 has been estimated for this fault, resulting in a peak horizontal ground acceleration of about 0.39g at the site. This fault, however, is not included in the latest California Geological Survey fault database.

We have also performed probabilistic seismic analysis using Caltrans ARS online program. The peak ground acceleration was calculated to be 0.48g with a deaggregated moment magnitude (Mw) of 6.6. We have used this ground acceleration and earthquake magnitude in our liquefaction analysis.

3.6 Seismic Hazards

3.6.1 Fault Rupture

Based on available literature and reports, no known active faults are known to traverse the project site, and the site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. As such, the principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in the region as discussed in Section 3.5.

3.6.2 Liquefaction

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading.

The site is located within an area designated as potentially liquefiable on the *California Seismic Hazard Zone Map* (CDMG, 1998). Based on our boring, the subsurface soils below the historically high groundwater table of 30 feet below the freeway grade (elevation of 155 feet) consisted of medium dense to dense sand and silty sand with SPT N values ranging from 20 to 46.

We performed liquefaction analysis using the procedures outlined by Youd et al. (2001) and in accordance with the guidelines provided in the *Special Publication 117*. The historically high groundwater level and a peak ground acceleration of 0.48g with a moment magnitude (Mw) of 6.6 were used in the analysis. The results of our evaluation for the boring indicated that the subsurface soils below the historically high groundwater table are not susceptible to liquefaction. The results of the analysis are included in Appendix B.

3.6.3 Seismically Induced Settlement

Seismically-induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). This settlement occurs primarily within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event. The seismically-

induced settlement, including that of the embankment fill, was estimated to be on the order of 1 inch. The magnitude of the estimated settlement is considered relatively minor.

3.6.4 Tsunami and Seiches

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Based on the absence of enclosed bodies of water near the site and the inland location of the site, seiches and tsunami risks at the site are considered negligible.

3.7 Slope Stability

For our slope stability analyses, we have considered three different sections of the proposed retaining wall: 1) with three rows of tiebacks, 2) with two row of tiebacks, and 3) Type 1 retaining wall without tieback. The slope stability analyses were performed using the Modified Bishop's method. For pseudo-static analysis, a horizontal seismic coefficient of 0.20g (Caltrans, 2004) was used. Our analysis indicates that the walls have a global factor of safety higher than 1.5 and 1.1 for static and pseudo-static conditions, respectively. The results are summarized in Table 3 and computer printouts of the analyses are attached to this report.

Table 3 – Summary of Slope Stability Analyses

Retaining Wall Type	Calculated Factor of Safety	
	Static	Pseudo-Static
Retaining Wall with 3-Row of Tiebacks	1.79	1.44
Retaining Wall with 2-Row of Tiebacks	2.95	2.26
Type 1 Retaining Wall	4.17	2.17

4.0 GEOTECHNICAL AND FOUNDATION DESIGN RECOMMENDATIONS

Based upon our evaluation of the soils and geologic information, we conclude that the proposed project is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in the design and construction of the project. The recommendations in this report are considered minimum and may be superseded by more stringent requirements of the structural engineer and/or the governing agencies. Leighton should be notified, in a timely manner, of changes in the project plans that might impact recommendations in this report.

4.1 As-Built Foundation Data

The as-built elevations of the bridge range from 208.50 to 212.26 feet from west to east. From south to north, the as-built elevations of the bridge at Abutment 3 range from 212.07 to 212.09 feet, respectively. The corresponding elevation of SR-57 Freeway is approximately 185 feet. Based on the as-built plan for the Ball Road Overcrossing (Caltrans, 1974), we have summarized the as-built foundation types and characteristics in Table 3. The nominal resistance shown in the table was calculated using the computer program *SHAFT* (O'Neill and Reese, 1999). The computer printouts are included in Appendix B. Elevations in Table 4 were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).

Table 4 – As-Built Bridge Foundation Data (Caltrans, 1974)

Structure(1)	Pile Size and Type	Pile Cutoff Elevation (feet)	Pile Tip Elevation (feet)	Nominal Resistance(2) (kips)	Allowable Capacity (3) (kips)
Abutment 3(4)	16-inch Diameter CIDH Pile	196.0	139.5	280(5)	140

(1)Elevations of freeway and Ball Road grade are approximately 185 and 211.5 feet, respectively.
(2)A minimum factor of safety of 2.0 should be applied to calculate the allowable capacity.
(3)Design load of 70 tons (140 kips) per as-built plan
(4)Abutment 3 is supported on a single row of 18 piles with minimum pile spacing of 3 times the pile diameter.
(5)The upper 11 feet of pile capacity within the existing fill was ignored.

4.2 Lateral Earth Pressure and Tieback Design Parameters

Based on the plan provided by the structural engineer, the proposed tieback system consists of 2 to 3 rows of tiebacks. The lateral loads on the retaining wall is expected to consist of the following: (a) the active earth pressure and passive earth pressure below the bottom of the excavation in accordance with Caltrans *Bridge Design Specification* (*BDS*, September 2004), (b) the surcharge pressure from Abutment 3 backfill, (c) the surcharge pressure corresponding to traffic loading, and (d) the seismic pressure resulting from the lateral loads of the existing piles. A diagram of these lateral earth pressures is provided in Figure 4. Under service loading, the pressures of (a), (b) and (c) should be used and, under seismic loading, the pressures of (a), (b) and (d) should be used.

The active and passive pressure coefficients (Ka and Kp) of 0.31 and 3.25, respectively, and an average soil unit weight (γ) of 120 pcf may be used to estimate the active and passive earth pressures. Traffic loading may be considered as equivalent to a vertical pressure produced by 2 feet of soils. The intensity of the pressure from the existing piles shown in Figure 4 was based on a lateral load of 40 kips per pile under the seismic loading (Caltrans, 1992).

The design values indicated above are based upon drained conditions. The tieback and Type 1 retaining walls should, therefore, be provided with a subdrain system to prevent buildup of hydrostatic pressure behind the wall. The *General Plan* shows that geocomposite drain is proposed behind the walls with weep holes at the bottom of the walls. The drainage systems shown on the plan are acceptable from a geotechnical standpoint.

The anchored portion of the tieback should extend into competent material at least 5 feet beyond the critical failure surface or H/5, where H is the height of the retaining wall, whichever is longer. The critical failure surface was determined from slope stability analysis where a tieback force is applied to achieve a factor of safety of 1.3 (Caltrans, 2004). Based on the slope stability analysis and Caltrans *BDS* (2004), the tieback anchors should have a minimum unbonded length of 15 feet. The slope stability analysis to determine the critical failure surface is presented in Appendix B.

The allowable pullout resistance of anchor should be estimated by multiplying ultimate anchor bond stress, bonded length and perimeter of the drilled hole, and dividing by a minimum factor of safety of 2.5 (Caltrans, 2004). For the purpose of estimating the anchor bond stress, an average soil unit weight (γ) of 120 pcf, an average soil internal friction angle of 28 degrees and cohesion of 500 psf may be used for the upper and

middle rows and an average soil unit weight (γ) of 120 pcf and an average soil internal friction angle of 32 degrees may be used for the lower row. The contractor is responsible for the final design of the bonded length of tieback anchors and the bonded length should be verified by load test of each anchor.

The tieback anchors should be installed at a minimum spacing of three times the diameter of the bond zone or 5 feet, whichever is greater. The preferred installation angle is between 5 and 20 degrees from horizontal to facilitate tendon installation and grouting, and to avoid application of excessive vertical loads that could induce downward movement of the wall. Tieback anchors should be located to maximize their distance from the existing abutment piles.

4.3 Allowable Bearing Capacity

An allowable soil bearing pressure of 2,500 psf may be used for design of tieback wall and Type 1 retaining wall footings having a minimum width of 12 inches and a minimum embedment of 18 inches below the lowest adjacent ground surface. This allowable bearing pressure is applicable for level ground conditions only and may be increased by one-third for short-term loading.

The frictional resistance between the wall (concrete) and the backfill soil may be computed using a coefficient of friction of 0.4, provided that no forms are used for the concrete surfacing against the soil.

4.4 Settlement and Lateral Displacement

The vertical component of the tension force of the tieback shown in the attached layout plan was calculated to be a maximum of 20.1 kips (approximately 1,210 psf). Settlement of the tieback wall due to this vertical pressure and settlement of the Type 1 retaining walls were estimated to be on the order of ½ inch. This magnitude of settlement is considered relatively minor for the proposed walls.

Tiebacks for the tieback wall will be installed as the excavation progresses. The tiebacks will be tensioned before additional excavation is made, providing lateral support for the wall. Lateral displacement of the tieback wall is expected to be negligible. For the Type 1 retaining walls, based on Caltrans *BDS* (2004), the lateral displacement is estimated to be on the order of 0.2 inches to mobilize the active earth pressure condition. Considering the

relatively minor lateral displacement and that these walls will be located to the north and south of the existing abutment, the estimated lateral displacement is not expected to impact the existing abutment piles.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Tieback Installation

Due to the close proximity of the proposed tieback wall to Abutment 3 and its existing piles, the contractor should exercise care to minimize impact to the piles and abutment from the installation of the tieback wall. We recommend that a monitoring program be implemented during the construction to monitor movement of Abutment 3. If excessive lateral and/or vertical movements are measured, construction should be suspended immediately and mitigation measurement should be implemented. The installation of the tieback anchors should be in accordance with the Caltrans *Standard Specifications*. All tieback anchors for walls should be load tested with either a proof test, performance test or creep test. The maximum test load for an anchor should generally be 1.5 times the design force of the anchor. The tests should be performed in accordance with Caltrans specifications.

5.2 Temporary Excavations

Excavations and removal of the existing sloped embankment fill are required to construct the proposed retaining wall. The excavation and removal should be properly shored by either bracing or sheeting. Design of shoring should be performed by the shoring contractor. For cantilever shoring, the active and passive pressure coefficients (Ka and Kp) of 0.31 and 3.25, respectively, and an average soil unit weight (γ) of 120 pcf may be used. For braced excavation, the lateral earth pressure is estimated as 24H pcf with a rectangular pressure distribution, where H is the depth (height) of excavation. The above lateral pressure is only appropriate for level backfill and a drained condition behind the shoring. Appropriate surcharge loads from traffic loading, heavy equipment, and stockpiles of materials should be incorporated in the shoring design. The final shoring plan should be reviewed by the geotechnical consultant.

5.3 Earthwork

Onsite soils to be used as compacted structural fill should be free of organic material and/or construction debris. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches for structural fill placement, moisture-conditioned as necessary to within two percent above optimum, and compacted to a minimum of 95 percent of the maximum

density as determined by Caltrans Test Method 216. Crushed aggregate base should be compacted to a minimum of 95 percent relative compaction. Subgrade within a depth of 30 inches below the finished grade should also be compacted to at least 95 percent relative compaction.

5.4 Additional Geotechnical Services

The proposed construction involves various activities that would require geotechnical observation and testing. These include:

- Placement of compacted fill;
- Shoring installation, if any;
- Installation of tieback anchors;
- Backfill of retaining walls; and
- When any unusual surface conditions are encountered.

These and other soils related activities should be observed and tested by a qualified representative of the geotechnical engineer. Geotechnical recommendations presented in this report are based on the conditions encountered at the test boring location and information gained from review of as-built plans as well as our understanding of the current project plan. Our recommendations should be revised, as necessary, based on the actual soil condition and any modification of the current plans, and incorporated into the final design plans and specifications. Conclusions and recommendations presented in this report should be reviewed and verified by the geotechnical engineer during site construction and revised accordingly, if exposed geotechnical conditions vary from our current understanding and interpretations.

6.0 REFERENCES

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ERIC A. JOHNSON No. C57355 Exp. 12/31/11 CIVIL STATE OF CALIFORNIA

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ORANGE, CA 92863

HDR ENGINEERING, INC.
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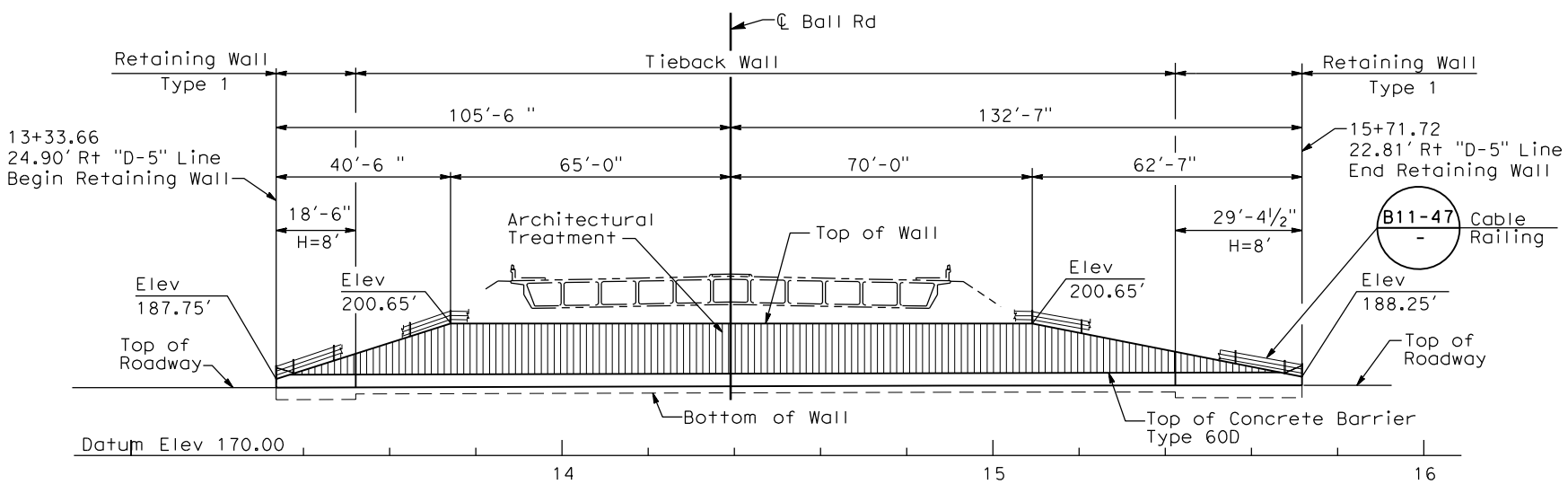
IRVINE, CA 92602-1377

NOTES:

For "General Notes" And "Standard Plans List" See "General Notes" Sheet.

LEGEND:

- Indicates Limits of Shotcrete
- Indicates New Construction
- Indicates Foundation or Hidden Lines
- Indicates Existing Structure
- RWLOL Indicates Retaining Wall Layout Line

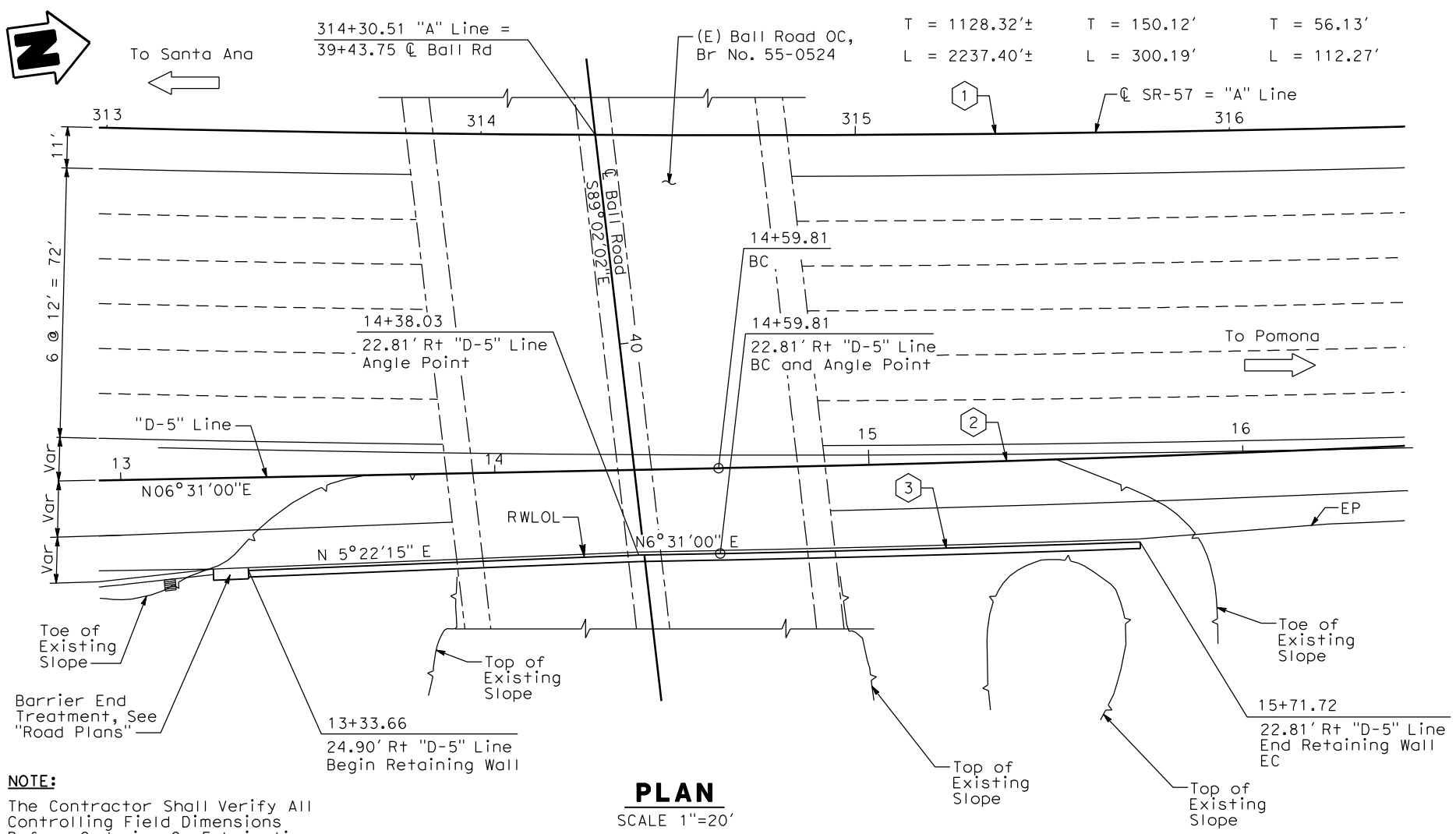


MIRROR ELEVATION

SCALE 1"=20'

CURVE DATA

(1) "A" Line	(2) "D-5" Line	(3) RWLOL
R = 7000.00'±	R = 7083.00'	R = 7105.81'
Δ = 18°18'48"±	Δ = 02°25'42"	Δ = 00°54'19"
T = 1128.32'±	T = 150.12'	T = 56.13'
L = 2237.40'±	L = 300.19'	L = 112.27'

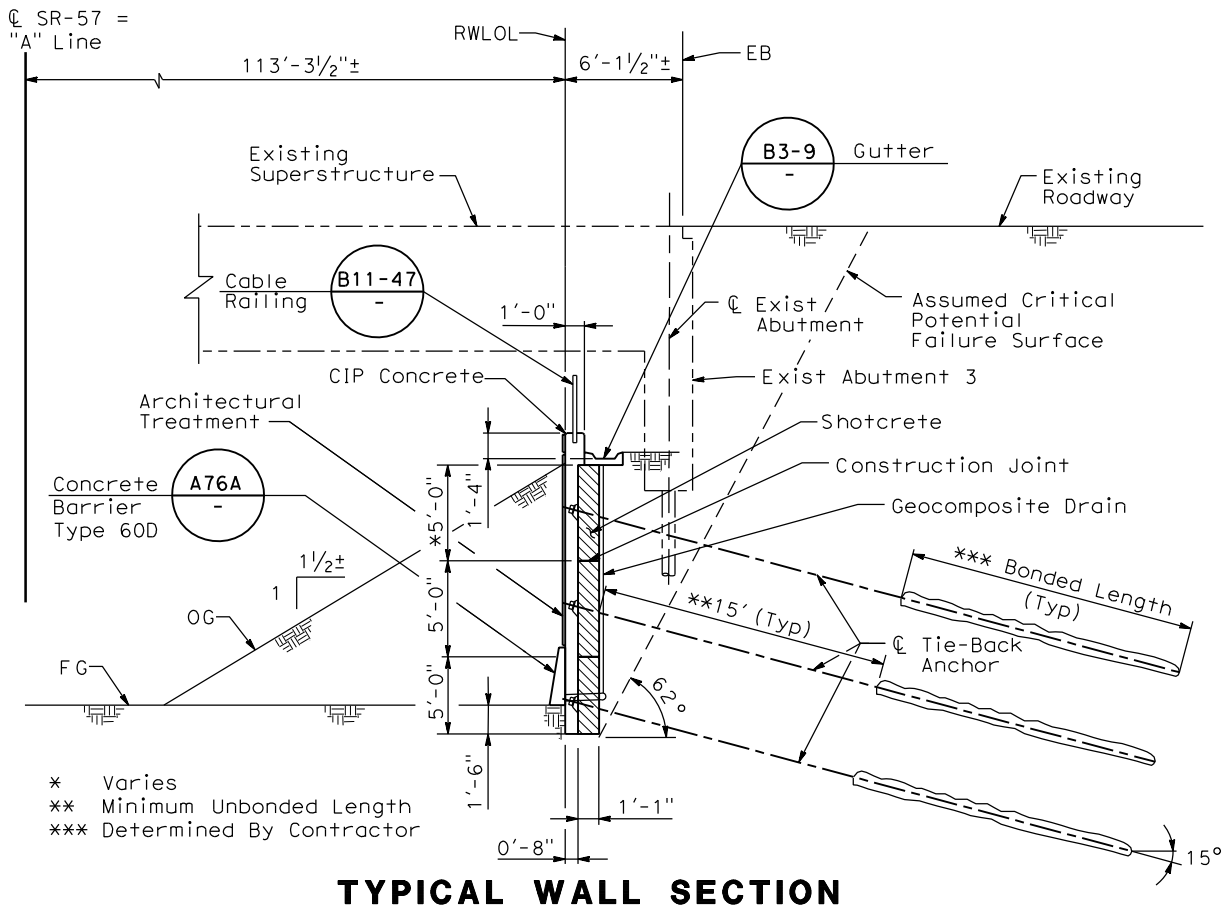


PLAN

SCALE 1"=20'

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.



TYPICAL WALL SECTION

SCALE: 1"=5'

DESIGN OVERSIGHT	DESIGN	BY D. Peavey	CHECKED E. Johnson	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS	BY E. Gray	CHECKED E. Johnson	LAYOUT	BY D. Peavey	CHECKED W. Chu
SIGN OFF DATE	QUANTITIES	BY D. Peavey	CHECKED E. Johnson	SPECIFICATIONS	BY E. Johnson	PLANS AND SPECS COMPARED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0111
POST MILES 13.4

BALL ROAD OC - RET WALL
GENERAL PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 1 OF 12

FILE => ...\d0108861\55E0111r-a-gp01.dgn

USERNAME => egray DATE PLOTTED => 08\02\10 TIME PLOTTED => 9:58:12 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ERIC A. JOHNSON No. C57355 Exp. 12/31/11 CIVIL STATE OF CALIFORNIA

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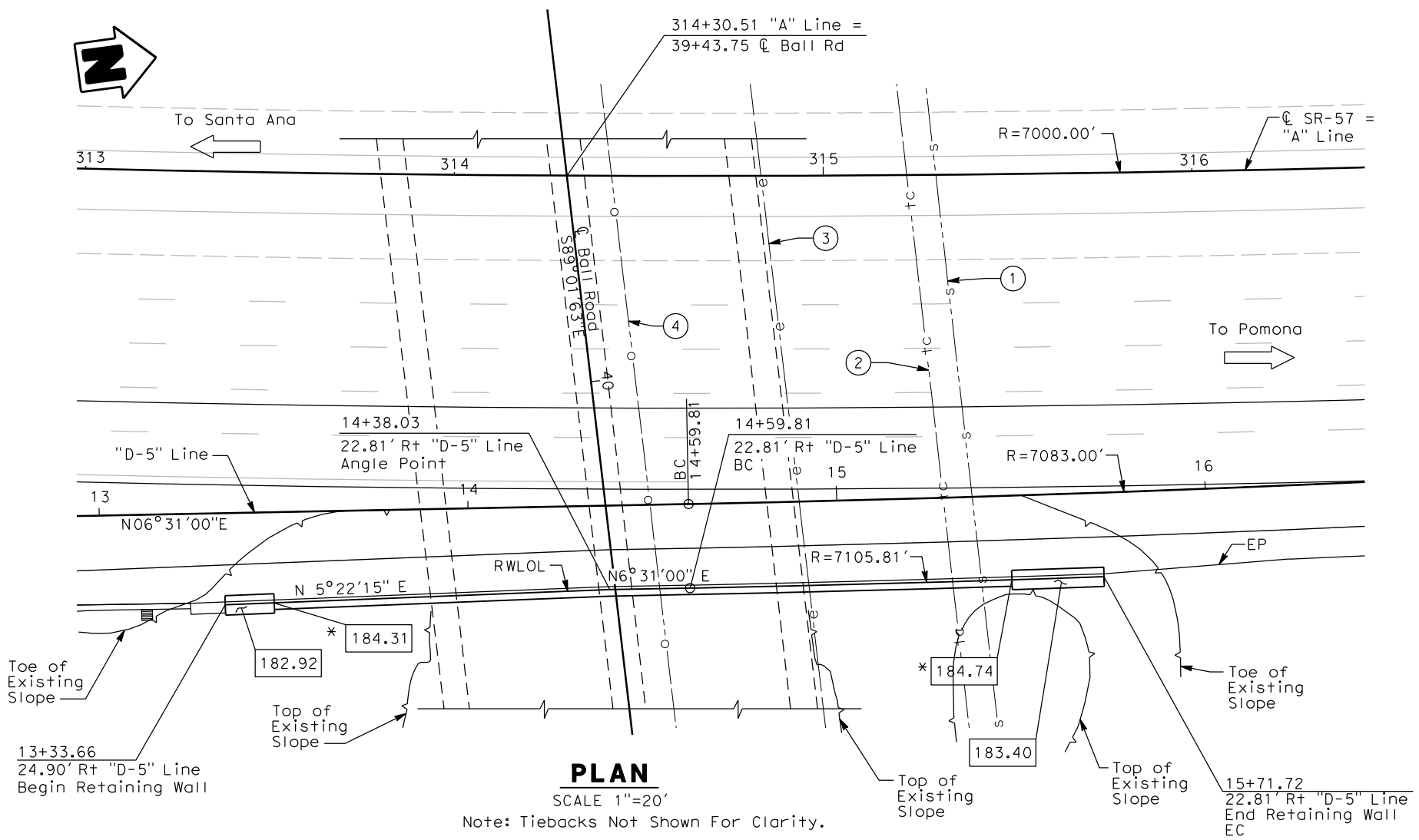
OCTA
550 S. MAIN STREET
ORANGE, CA 92863

HDR ENGINEERING, INC.
3230 EL CAMINO REAL, SUITE 200
IRVINE, CA 92602-1377



PLAN

SCALE 1"=20'

Note: Tiebacks Not Shown For Clarity.

EXISTING UTILITY LINES TABLE

(BASED ON AS-BUILT DATA)

NO.	UTILITY	OWNER	ACTION
1	8" VCP	City Of Anaheim	Protect in Place - Elevation 172.05
2	Conduit Bank	Pac Bell	Protect in Place - Elevation 172.66
3	UG Street Lighting	City Of Anaheim	Protect in Place - Within Bridge
4	16" Crude Oil	Four Corners	Protect in Place - Within Bridge

LEGEND

——— Indicates New Construction

— — — Indicates Existing

xxx.xx Denotes Bottom of Footing Elevation @ Type 1 Retaining Wall

* xxx.xx Denotes Bottom of Wall Elevation @ Tieback Wall

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

DESIGN OVERSIGHT

SIGN OFF DATE

SCALE: 1"=20'	VERT.DATUM	HORZ.DATUM
PHOTOGRAMMETRY AS OF:	ALIGNMENT TIES	
SURVEYED BY E. Martinez	DRAFTED BY	
FIELD CHECKED BY D. Williams	CHECKED BY	

	BY	CHECKED
DESIGN	D. Peavey	E. Johnson
DETAILS	E. Gray	E. Johnson
QUANTITIES	D. Peavey	E. Johnson

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0111
POST MILE 13.4

BALL ROAD OC - RET WALL
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 3 OF 12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ERIC A. JOHNSON No. C57355 Exp. 12/31/11 CIVIL STATE OF CALIFORNIA

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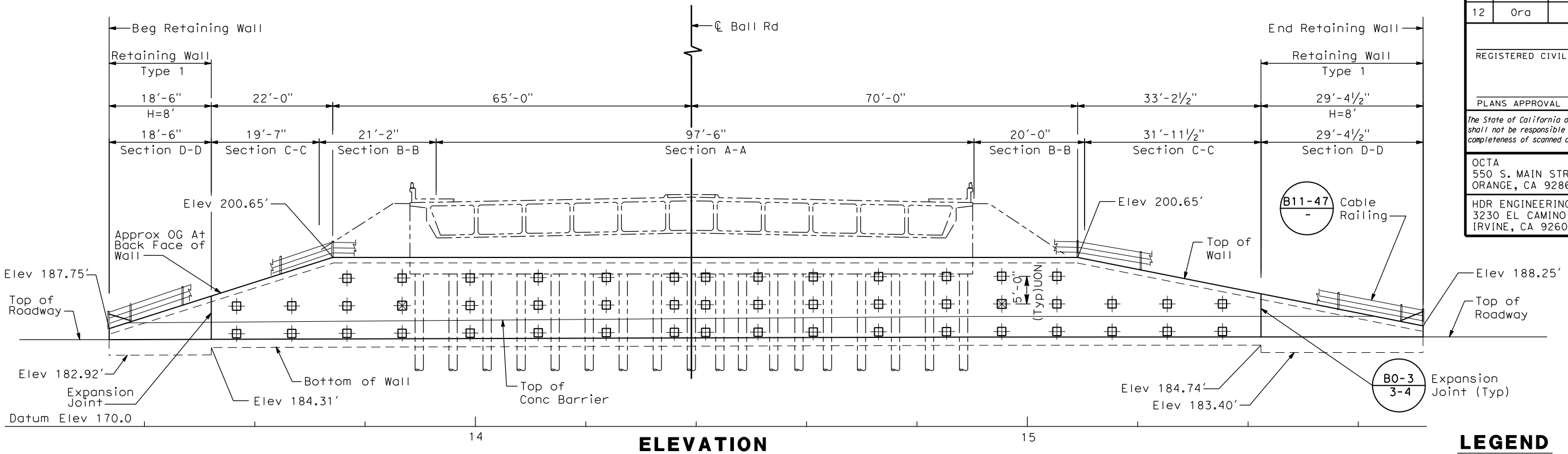
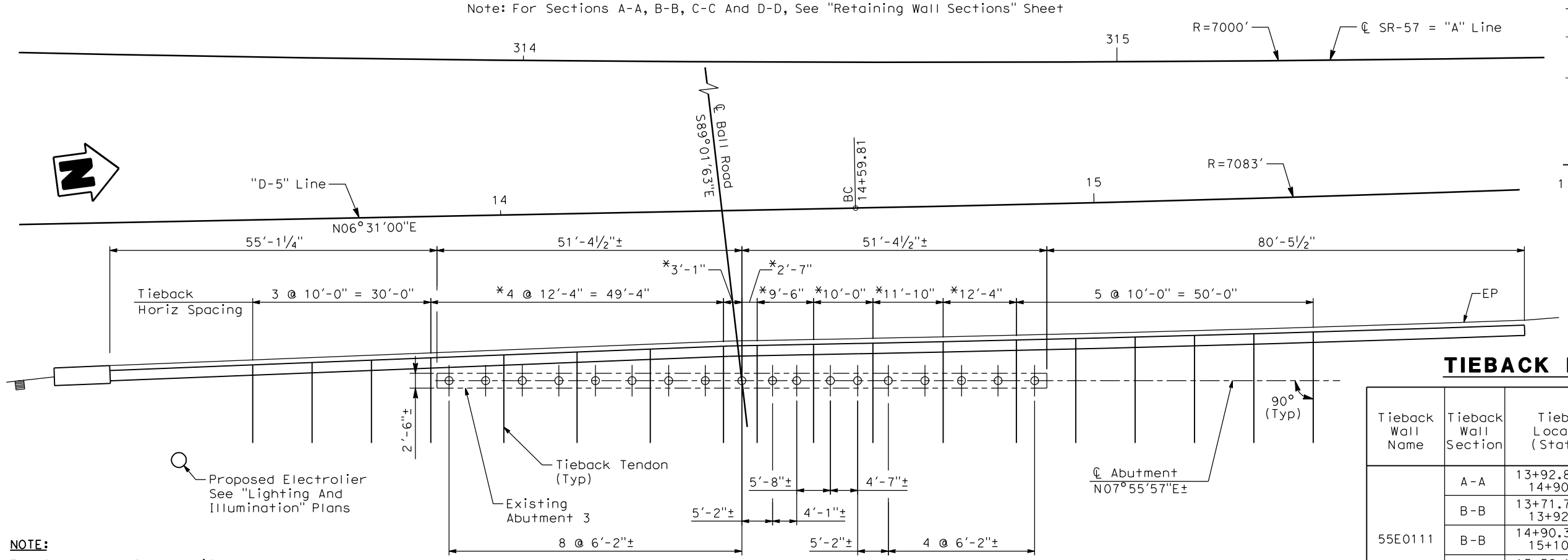
IRVINE, CA 92602-1377



ELEVATION

SCALE 1"=10'

Note: For Sections A-A, B-B, C-C And D-D, See "Retaining Wall Sections" Sheet



PLAN

SCALE 1"=10'

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

* These Dimensions Are Approximate. After Contractor Verification Of Existing Pile Locations, The Tieback Shall Be Placed Centered Between The Adjacent Piles.

LEGEND

- Indicates Existing 16" CIDH Piles.
- Indicates Location Of Tieback Assembly Or As Directed By The Engineer.
- Indicates Location Of Tieback Assembly Requiring Performance Test Or As Directed By The Engineer.

NOTES:

1. Prior To Installing Tiebacks, Contractor Shall Verify The Existing Footing And Pile Locations By Exposing, By Hand, One Pile At Each End Of Each Abutment.

TIEBACK DESIGN FORCE TABLE

Tieback Wall Name	Tieback Wall Section	Tieback Location (Station)	Lift Ht (Ft) / T (Kip) Upper	Lift Ht (Ft) / T (Kip) Middle	Lift Ht (Ft) / T (Kip) Lower
55E0111	A-A	13+92.87 To 14+90.37	4.5 / 44.2	5 / 24.1	5 / 20.1
	B-B	13+71.70 To 13+92.87	4.5 / 17.1	5 / 22.2	5 / 18.5
	B-B	14+90.37 To 15+10.37	4.5 / 17.1	5 / 22.2	5 / 18.5
	C-C	13+52.10 To 13+71.70	8 / 26.9	NA	5 / 19.6
	C-C	15+10.37 To 15+42.35	8 / 26.9	NA	5 / 19.6

DESIGN OVERSIGHT

SIGN OFF DATE

	BY	CHECKED
DESIGN	D. Peavey	E. Johnson
DETAILS	E. Gray	E. Johnson
QUANTITIES	D. Peavey	E. Johnson

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0111
POST MILE 13.4

BALL ROAD OC - RET WALL
RETAINING WALL LAYOUT

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 4 OF 12

DESIGN DETAIL SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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550 SOUTH MAIN STREET
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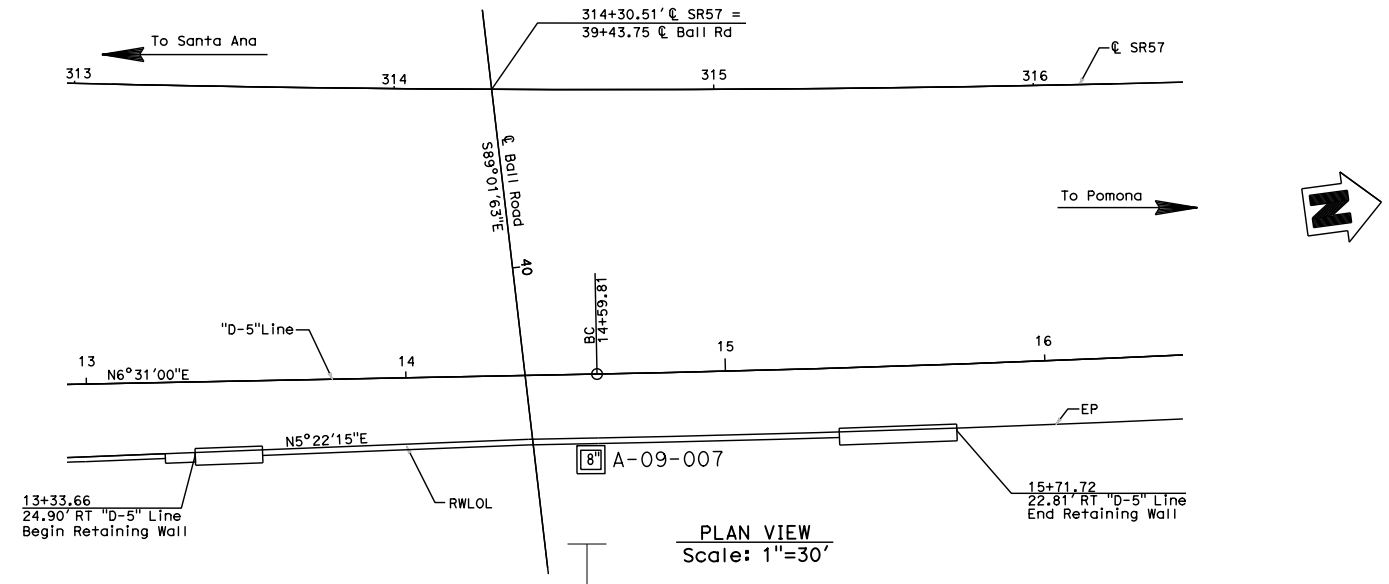
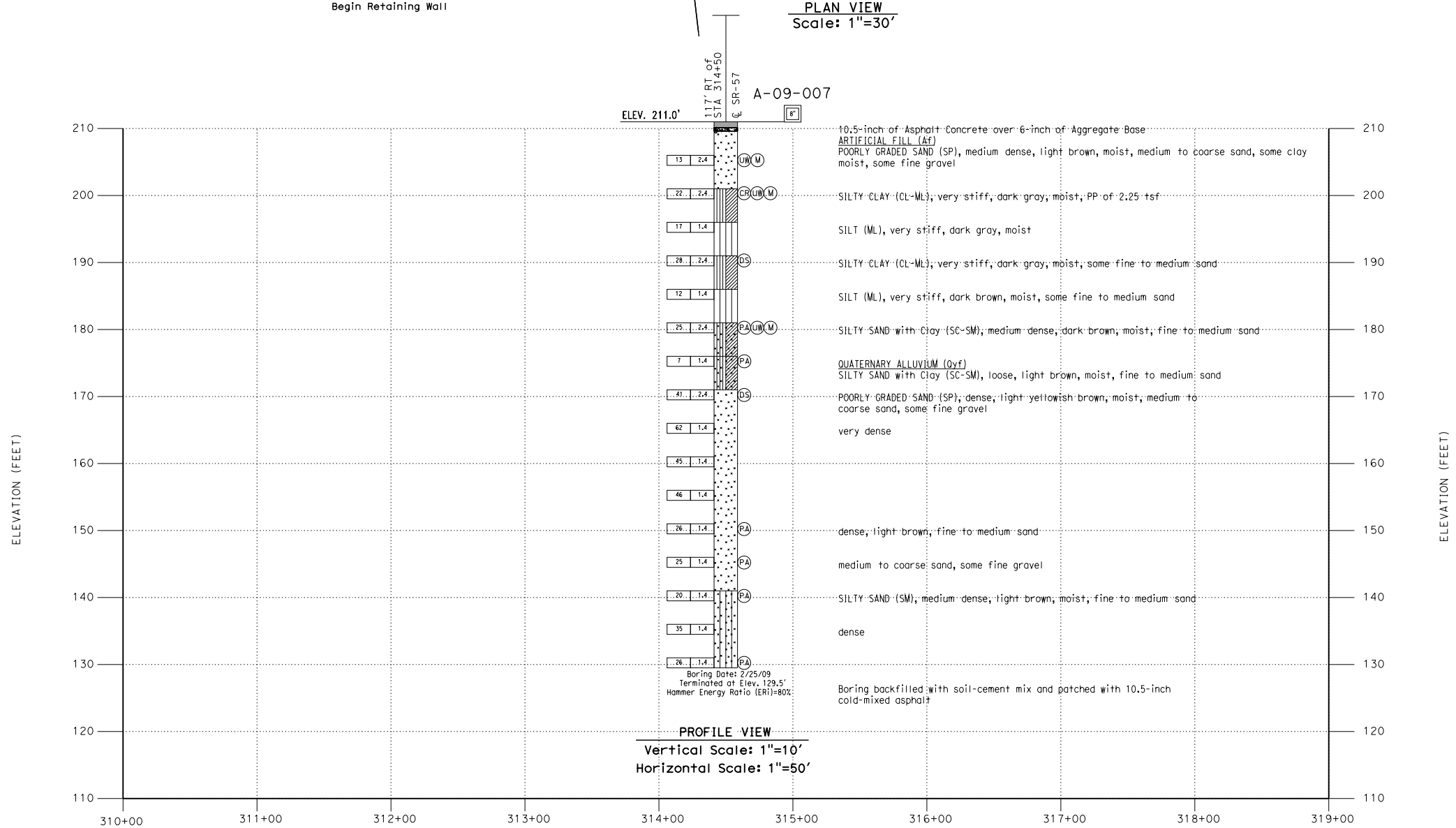
LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.



PLAN VIEW
Scale: 1"=30'



PROFILE VIEW
Vertical Scale: 1"=10'
Horizontal Scale: 1"=50'

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.

DESIGN OVERSIGHT	DRAWN BY Buu Tran	Amit Bakane FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55E0111
SIGN OFF DATE	CHECKED BY Taekuk Kim	DATE: 2/25/09			POST MILES 13.4

BALL ROAD OC-RET WALL
LOG OF TEST BORINGS 1 OF 4

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10

REVISION DATES

SHEET 9 OF 12

FILE => FIGURE-2-Ball-Road 1of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 14:05

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

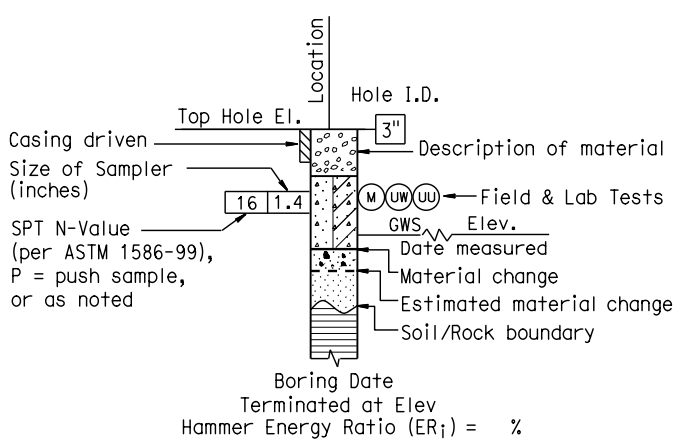
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
[ ]	O	Other

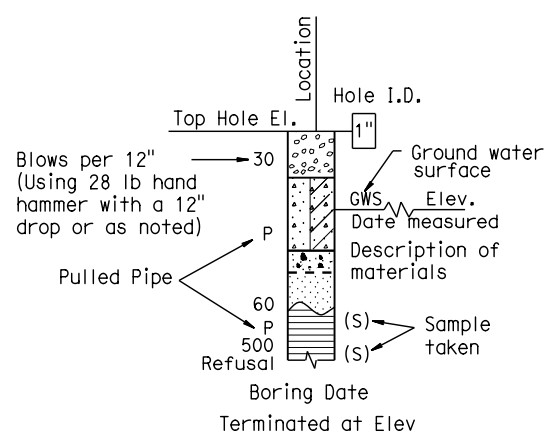
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

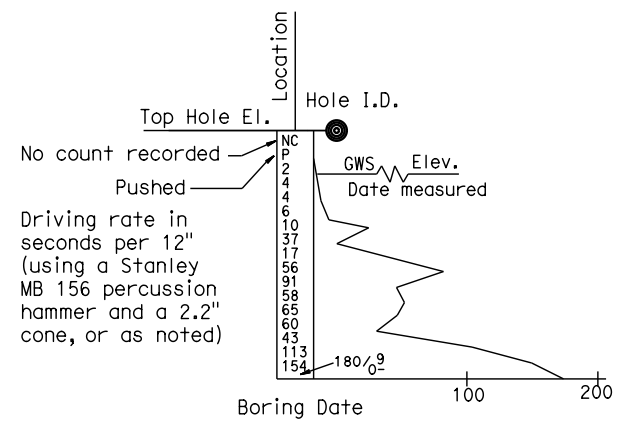
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



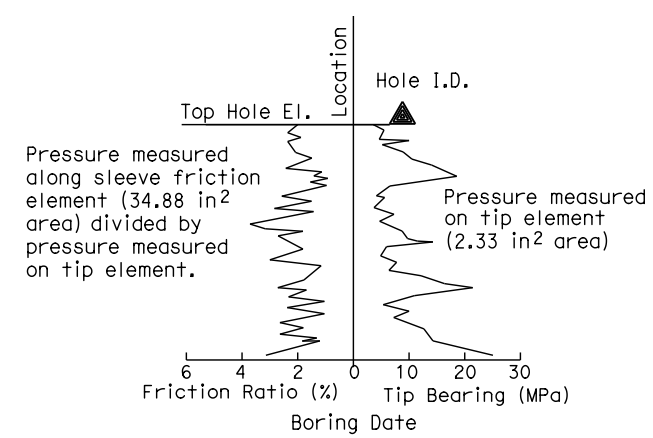
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT	DRAWN BY: Buu Tran	Amit Bakane FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55E0111
SIGN OFF DATE	CHECKED BY: Taekuk Kim	DATE: 2/25/09			POST MILES 13.4

BALL ROAD OC-RET WALL
LOG OF TEST BORINGS 2 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10

REVISION DATES

SHEET 10 OF 12

FILE => FIGURE-2-Ball-Road 2of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 14:06

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY Buu Tran

CHECKED BY Taekuk Kim

Amit Bakane
FIELD INVESTIGATION BY:
DATE: 2/25/09

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Djan Chandra
PROJECT ENGINEER

BRIDGE NO. 55E0111
POST MILES 13.4

BALL ROAD OC-RET WALL
LOG OF TEST BORINGS 3 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10

REVISION DATES

SHEET 11 OF 12

FILE => FIGURE-2-Ball-Road 3of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 14:07

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	ORA	57,91	12.5/16.0 / 26.9/31.0	311	443

A. E. Bachu
DESIGN OFFICE SUPERVISOR — REGISTERED CIVIL ENGINEER NO. 8558
DATE SIGNED December 18, 1972

BENCH MARK

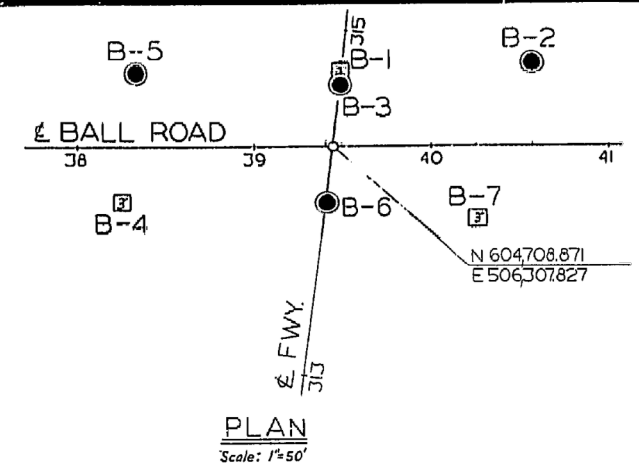
BM# J40-ANA-6J Elev 180.59

Fd city of Anaheim brass cap in south curb, 1 ft. east of end of curb return at southeast corner of Sunkist and Wagner No. 2700A.

To convert to current datum NAVD88, approximately 1.84 feet should be added to the as-built elevations.

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	12.2/15.2	12	12
REGISTERED ENGINEER-GEOTECHNICAL					
BALL ROAD OC-RET WALL					
LOG OF TEST BORINGS 4 OF 4					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU: 12231 EA: 0F0401	BRIDGE NO. 55E0111	

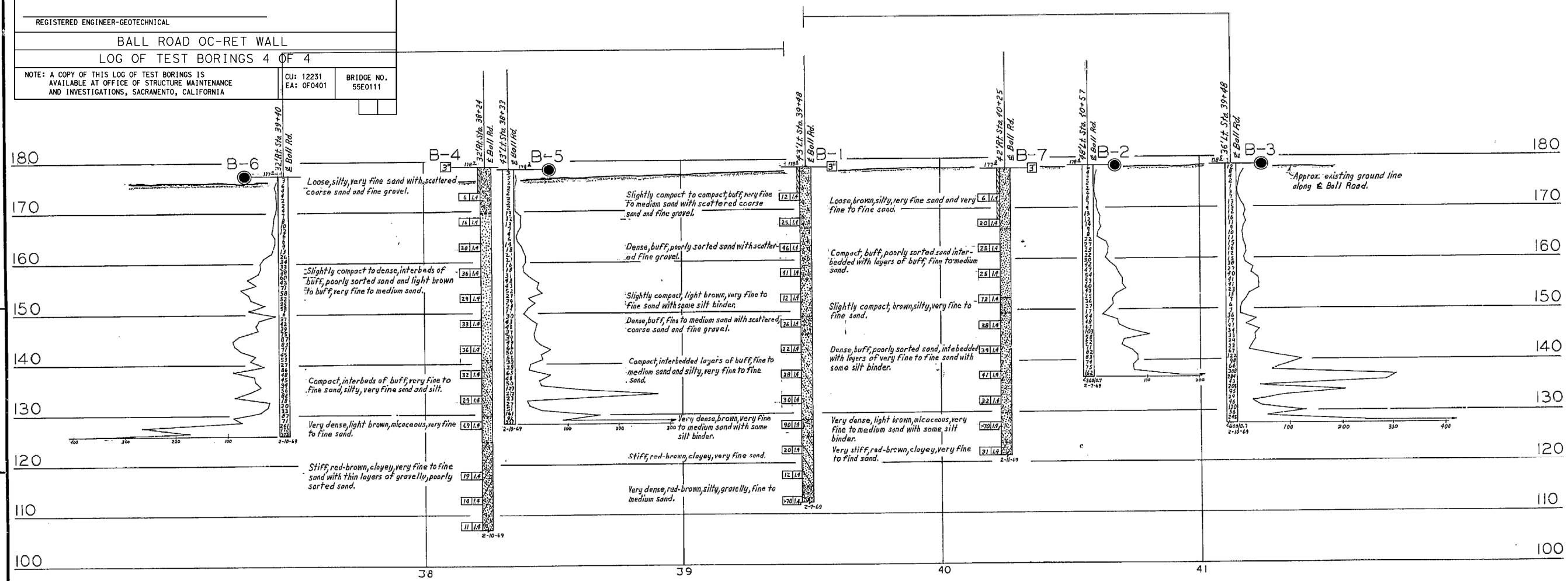
REGISTERED PROFESSIONAL ENGINEER — DYAN CHANDRA — No. 2376 — Exp. 6/30/11 — GEOTECHNICAL — STATE OF CALIFORNIA



PLAN

Scale: 1"=50'

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION DATE FEBRUARY 1969

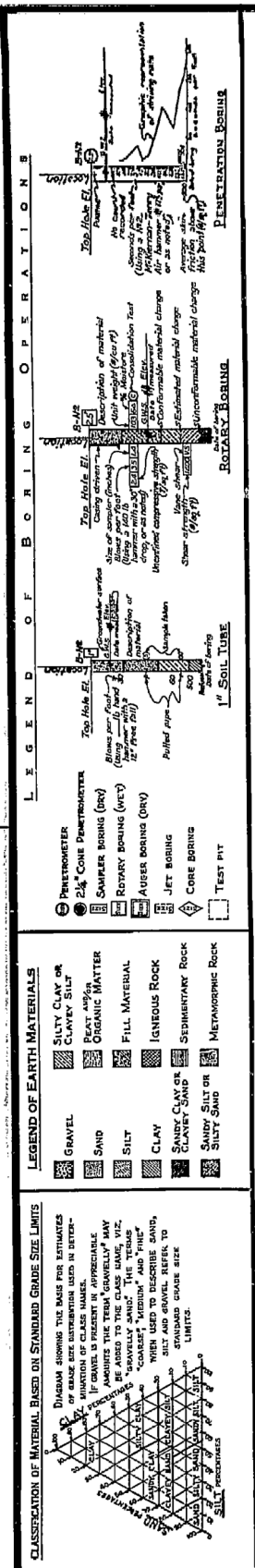


PROFILE

Scale: Vert. 1"=10' Horiz. 1"=20'

No AS BUILT CHANGES
CORRECTIONS BY R. STRUNGS
CONTRACT NO. 032021
DATE 10-10-74

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000 6373



NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

FIELD STUDY	by W. CAIN	2-11-69
DRAWN	by W. MARTIN	2-24-69
CHECKED	by R. GARCIA	3-20-69

Approval Recommended by Edward S. Flood, Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BALL ROAD OVEROSSING

LOG OF TEST BORINGS

BRIDGE No. 55-524	POST MILE 13.4	DRAWING NO.	SHEET 11 OF 11

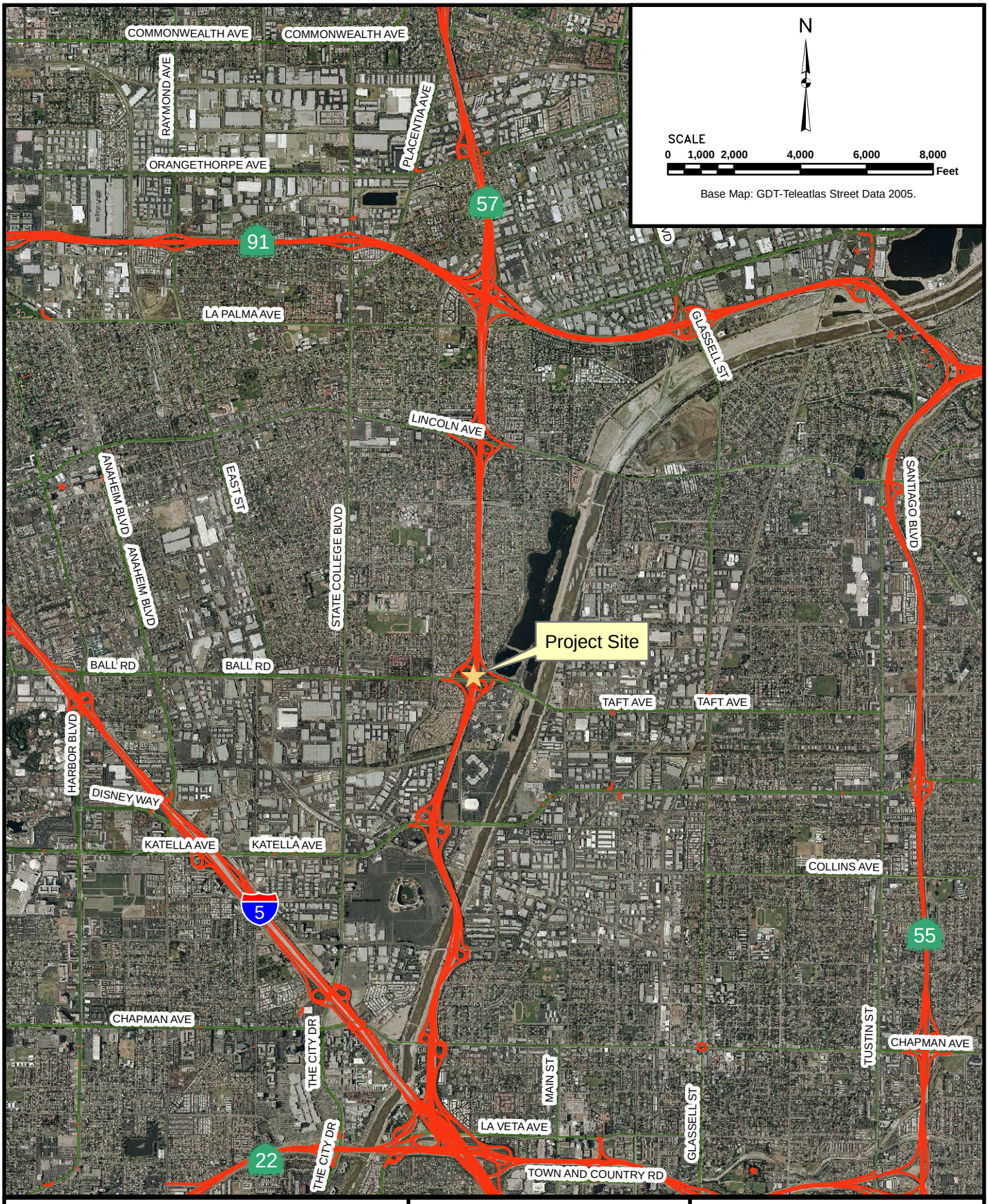
REVISION DATES (PRELIMINARY STAGE ONLY) 10/7/10

WO 032021
CU 07208

Disregard prints bearing a date later than Sales →

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 1/29/75 SIGNATURE Kirk Martin TITLE Microfilm Operator



Retaining Wall
at Ball Road Overcrossing
Northbound SR-57 Widening
Orange County, California

SITE LOCATION MAP

Project No.

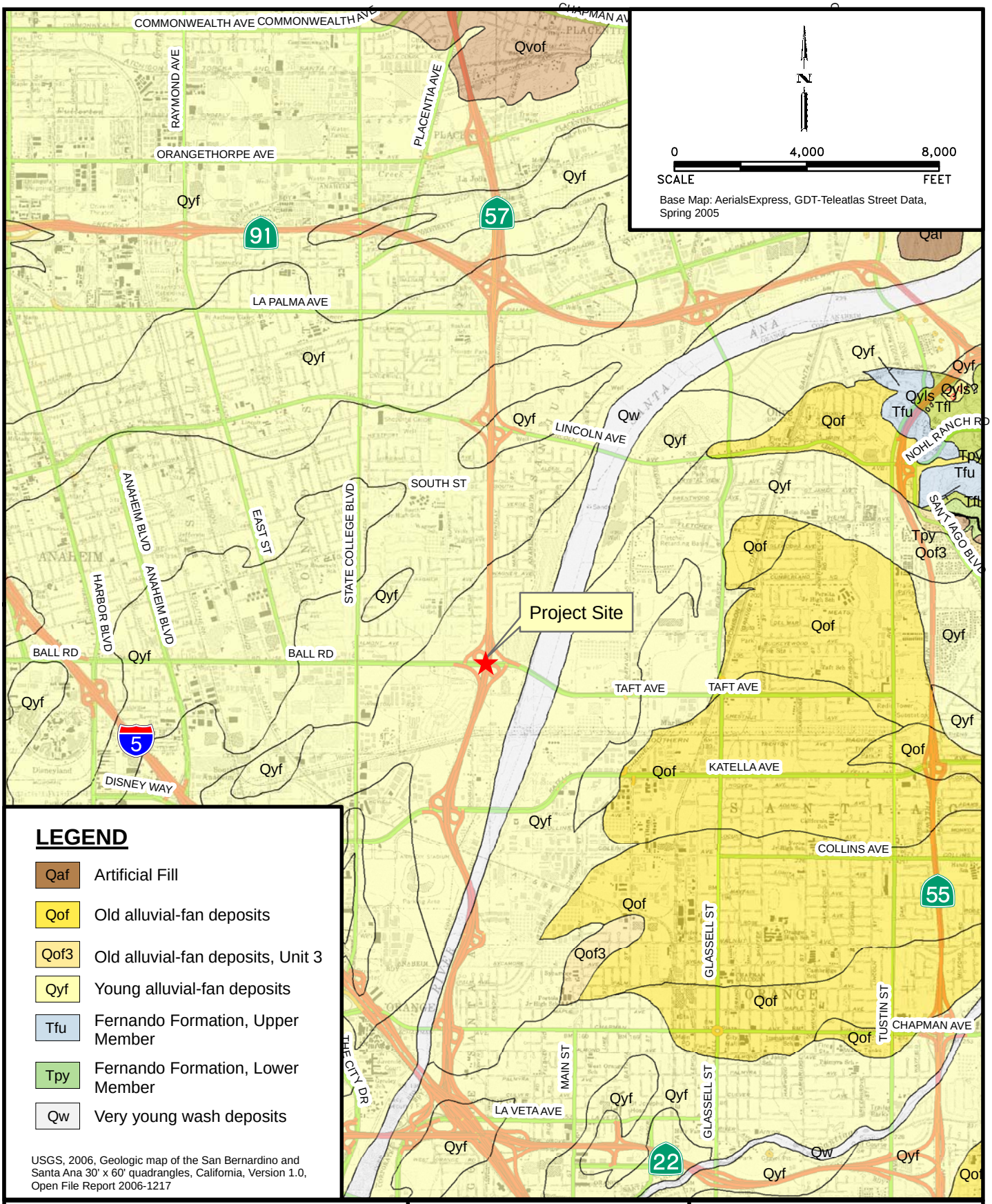
602231-002

Date

May 2009

Figure 1

P:\Drafting\602231\002\GIS\602231002_SiteLocationMap_DouglsRd.mxd



LEGEND

Qaf	Artificial Fill
Qof	Old alluvial-fan deposits
Qof3	Old alluvial-fan deposits, Unit 3
Qyf	Young alluvial-fan deposits
Tfu	Fernando Formation, Upper Member
Tpy	Fernando Formation, Lower Member
Qw	Very young wash deposits

USGS, 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, Version 1.0, Open File Report 2006-1217

Retaining Wall
at Ball Road Overcrossing
Northbound SR-57 Widening
Orange County, California

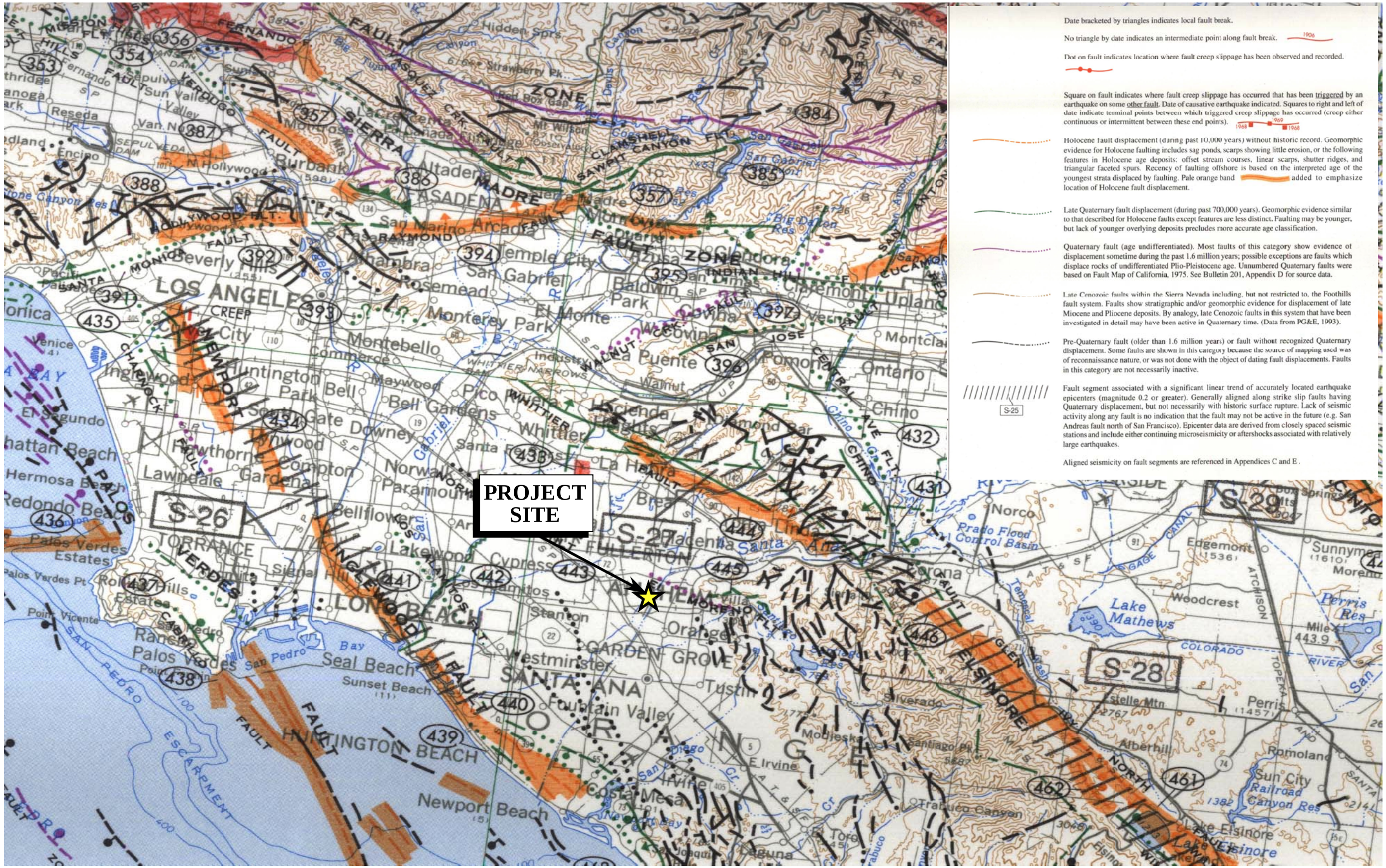
REGIONAL GEOLOGIC MAP

Project No.
602231-002

Date
May 2009

Figure 2

\\GIS\Drafting\602231\002\GIS\Figure3-GeologyMap-LincolnAve.mxd



Base Map: Fault Activity Map of California and Adjacent Areas with Location and Ages of Recent Volcanic Eruptions; CDMG 1994

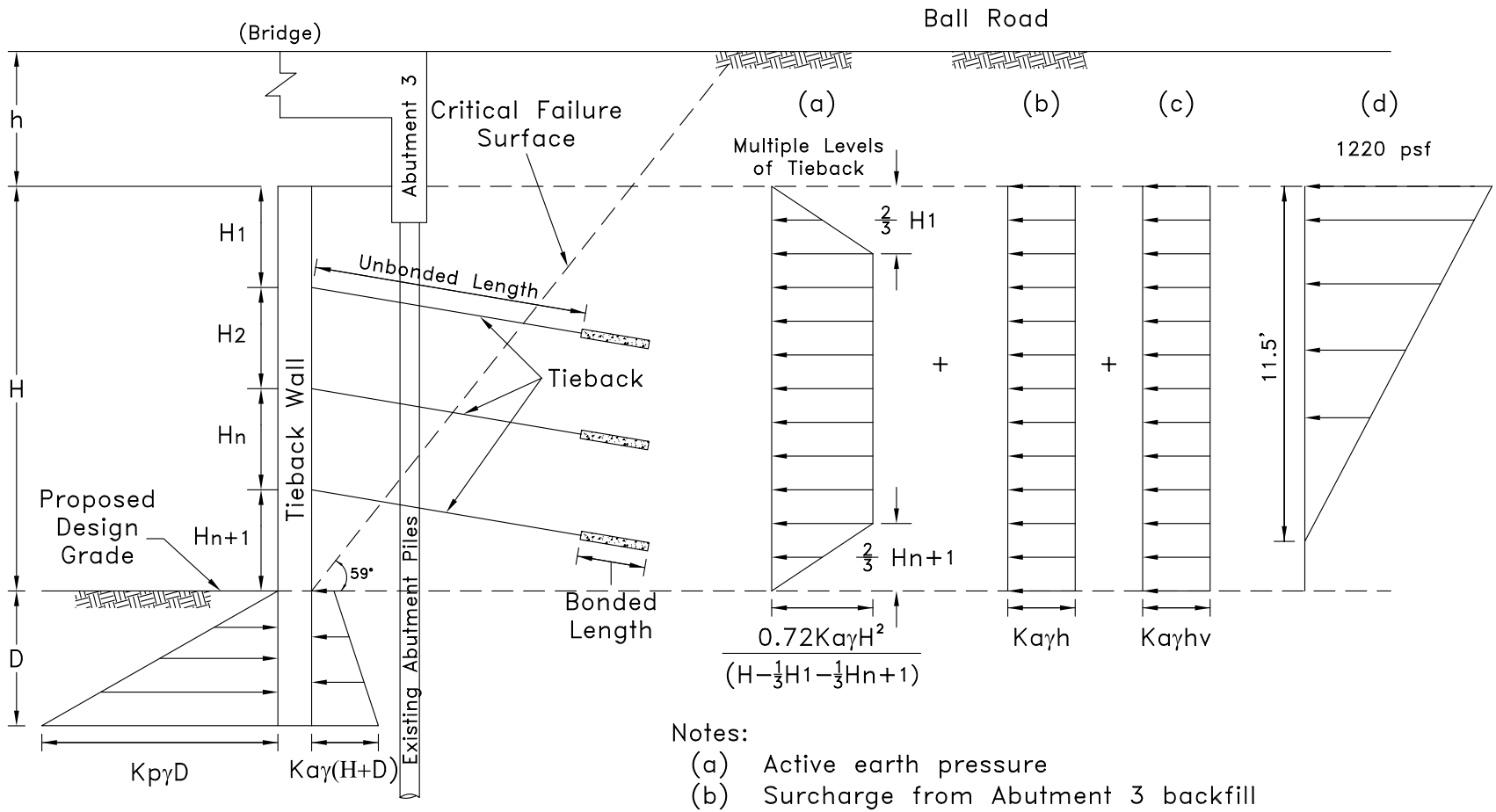
FAULT ACTIVITY MAP

Retaining Wall at Ball Road Overcrossing
Northbound SR 57 Widening
Anaheim, California

Project No.	602231-002
Scale (Approx)	1:750,000
Engr./Geol.	DJC / ELB
Drafted By	BQT
Date	5/09

Leighton

Figure 3



Notes:

(a) Active earth pressure
(b) Surcharge from Abutment 3 backfill
(c) Surcharge from traffic loading
(d) Seismic pressure resulting from lateral load of the existing piles

hv –Equivalent soil height for traffic surcharge (min. 2 feet)
ka –Active earth pressure coefficient
kp –Passive earth pressure coefficient
γ –Soil unit weight

Reference: Caltrans Bridge Design Specification (2004)

Figure 4

LATERAL EARTH PRESSURE ON TIEBACK WALL BALL ROAD OVERCROSSING	Leighton	Proj: 602231-002 Eng./Geol. DJC	Scale: As-Shown Drafted By: VMN	Date: 5/09 CP By: BQT

P:\DRAFTING\602231\002\OF_2009-05-04-BORING-LOGS\BALL-ROAD\FIGURE5.DWG (06-02-09 9:27:19AM) Plotted by: btran

APPENDIX A

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

				Gradation				Atterberg Limits		Maximum Density		Shear Strength: Peak		Shear Strength: Ultimate		Chemical Analyses					
Boring No.	Sample Type	Top of Sample (ft)	Bottom of Sample (ft)	Gravel (%)	Sand (%)	Silt (%)	Clay <5μm (%)	LL:PL:PI	Sand Equivalent	Max Dry Density (pcf)	Optimum Moisture Content (%)	ϕ' (deg)	C' (psf)	ϕ' (deg)	C' (psf)	pH	Sulfate (ppm)	Chloride (ppm)	Resistivity (Ω-cm)	Expansion Index of Soil	R-Value
A-09-007	BULK	10.0	20.0													6.7	647	34	552		
	RING	20.0	21.5									42	900	42	400						
	RING	30.0	31.5	10	55	35															
	SPT	35.0	36.5			86	14														
	RING	40.0	41.5									37	200	30	150						
	SPT	60.0	61.5			95	5														
	SPT	65.0	66.5			97	3														
	SPT	70.0	71.5			83	17														
	SPT	80.0	81.5			61	39														

NOTE: The laboratory tests were performed in general accordance with the following standards:
Sieve Analysis - ASTM D422
Direct Shear Test - ASTM D3080
Corrosivity Tests - DOT CA 532/643 - pH, DOT CA 417 - soluble sulfates, DOT CA 422 - chlorides, DOT CA 643 - minimum resistivity

Leighton Consulting, Inc.

SR-57 Widening
Project No: 602231-002
Sheet 1 of 1

Boring No.	A-09-007	A-09-007	A-09-007					
Sample No.	R-1	R-2	R-4					
Depth (ft.)	5.0	10.0	30.0					
Sample Type	Drive	Drive	Drive					
Soil Identification	Light brown poorly-graded sand (SP)	Dark gray silty clay (CL- ML)	Dark brown silty sand with clay (SC-SM)					
Pocket Penetrometer (tons/ft^2)		2.25						
Weight Soil + Rings / Tube (g)	1127.30	1088.91	1238.28					
Weight of Rings / Tube (g)	266.40	266.40	266.40					
Average Length (in.)	6.00	6.00	6.00					
Average Diameter (in.)	2.416	2.416	2.416					
Wet. Wt. of Soil + Cont. (g)	194.09	183.85	413.52					
Dry Wt. of Soil + Cont. (g)	159.53	175.65	371.83					
Weight of Container (g)	38.66	38.26	39.61					
Container No.								
Wet Density	119.2	113.9	134.6					
Moisture Content (%)	**29**	**6**	**13**					
Dry Density (pcf)	**93**	**107**	**120**					
Degree of Saturation (%)	94.4	28.4	82.7					

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MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/04/09

Boring No.	A-09-007	A-09-007	A-09-007	A-09-007	A-09-007			
Sample No.	S-3	S-7	S-8	S-9	S-11			
Depth (ft.)	35	60	65	70	80			
Sample Type	SPT	SPT	SPT	SPT	SPT			
Soil Identification	Light brown silty sand with clay (SC-SM)	Light brown poorly-graded sand (SP)	Light brown poorly-graded sand (SP)	Light brown silty sand (SM)	Light brown silty sand (SM)			
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00			
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00			
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00			
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00			
Sample Dry Weight Determination								
Weight of Sample + Container (g)	807.53	768.51	725.92	688.30	643.87			
Weight of Container (g)	244.47	248.72	220.78	237.80	250.61			
Weight of Dry Sample (g)	563.06	519.79	505.14	450.50	393.26			
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B			
Dry Weight of Sample + Cont. (g)	729.17	744.92	708.88	609.60	488.91			
Weight of Container (g)	244.47	248.72	220.78	237.80	250.61			
Dry Weight of Sample (g)	484.70	496.20	488.10	371.80	238.30			
% Passing No. 200 Sieve	**13.9**	**4.5**	**3.4**	**17.5**	**39.4**			
% Retained No. 200 Sieve	86.1	95.5	96.6	82.5	60.6			

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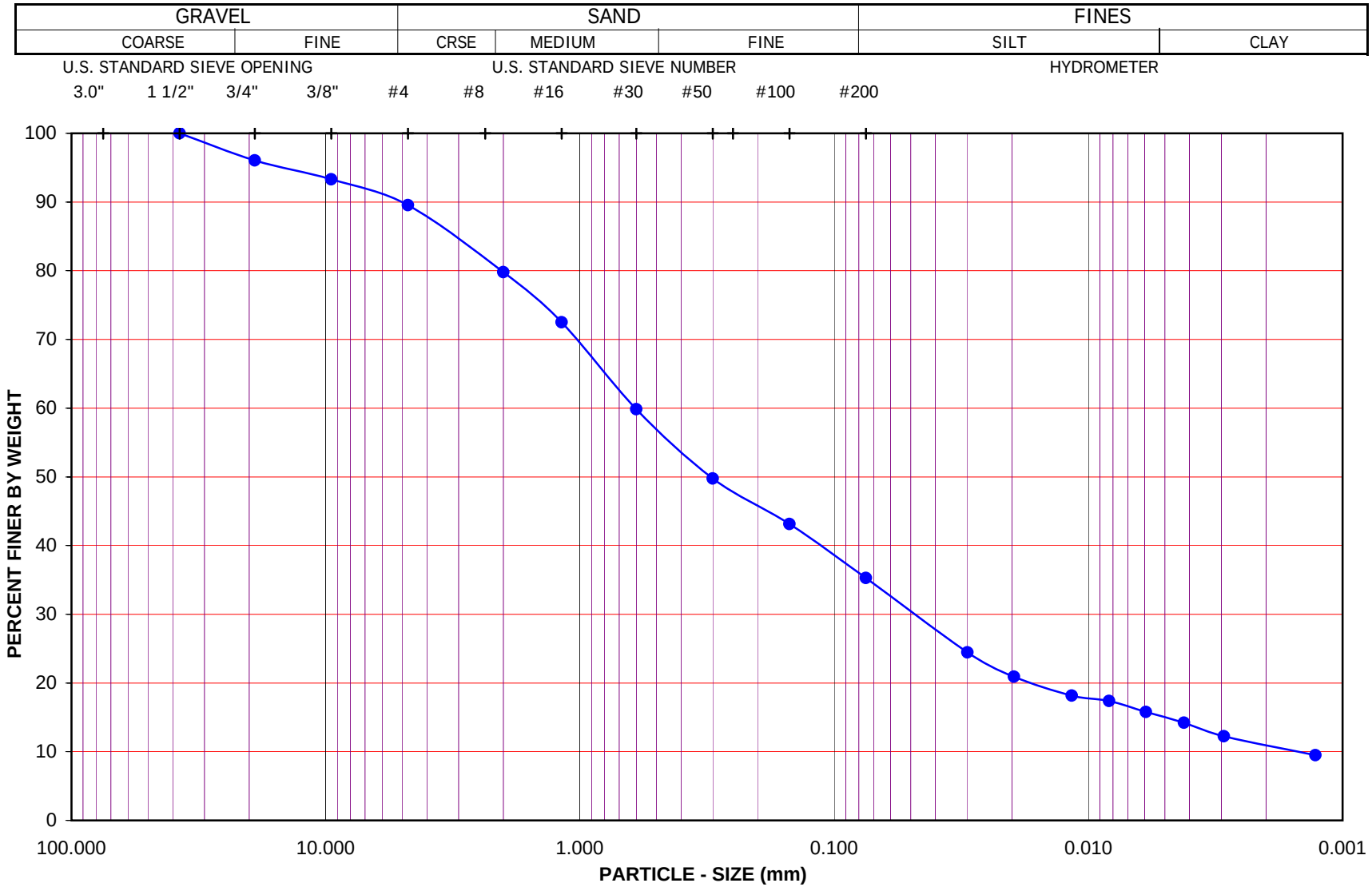
PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/04/09



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-007 Sample No.: R-4

Depth (feet) : 30.0 Soil Type : SC-SM

Soil Identification: Dark brown silty sand with clay (SC-SM)

GR:SA:FI : (%) 10 : 55 : 35

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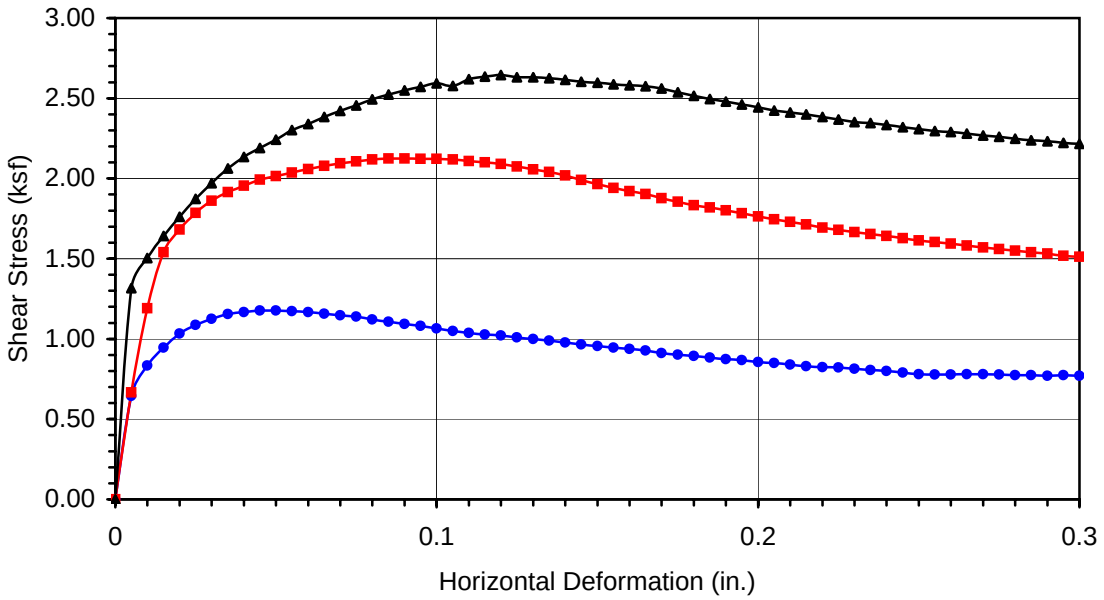
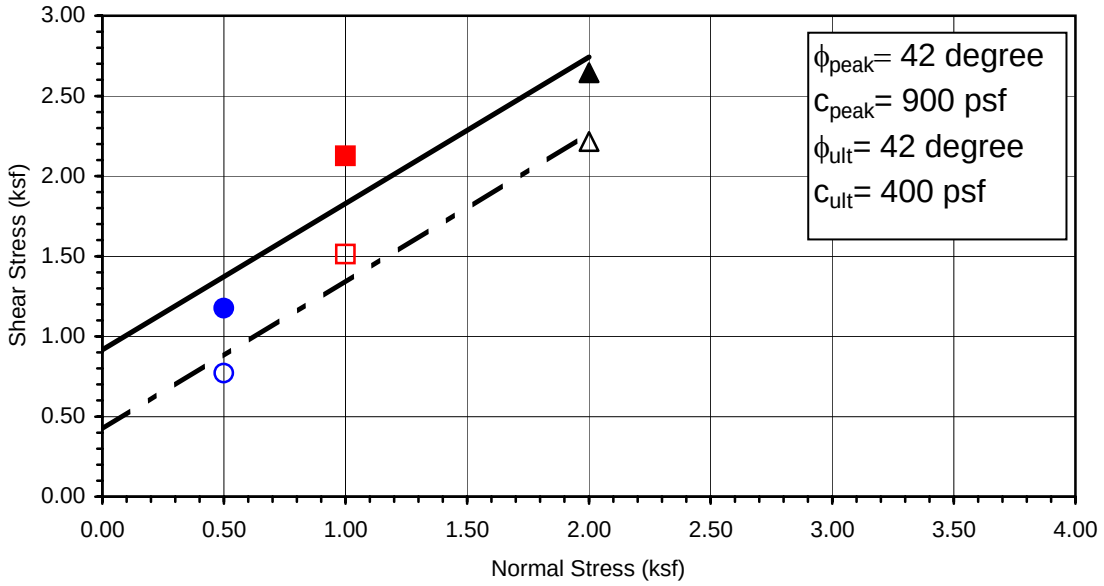
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10





Boring No.	**A-09-007**
Sample No.	**R-3**
Depth (ft)	**20**

Sample Type:

Drive

Soil Identification:
Dark gray silty clay (CL-ML)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 1.176	■ 2.125	▲ 2.644
Shear Stress @ End of Test (ksf)	○ 0.770	□ 1.512	△ 2.216
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.95	22.95	22.95
Dry Density (pcf)	100.6	103.5	104.4
Saturation (%)	91.7	98.5	100.8
Soil Height Before Shearing (in.)	1.0057	0.9996	0.9920
Final Moisture Content (%)	32.2	30.4	29.5

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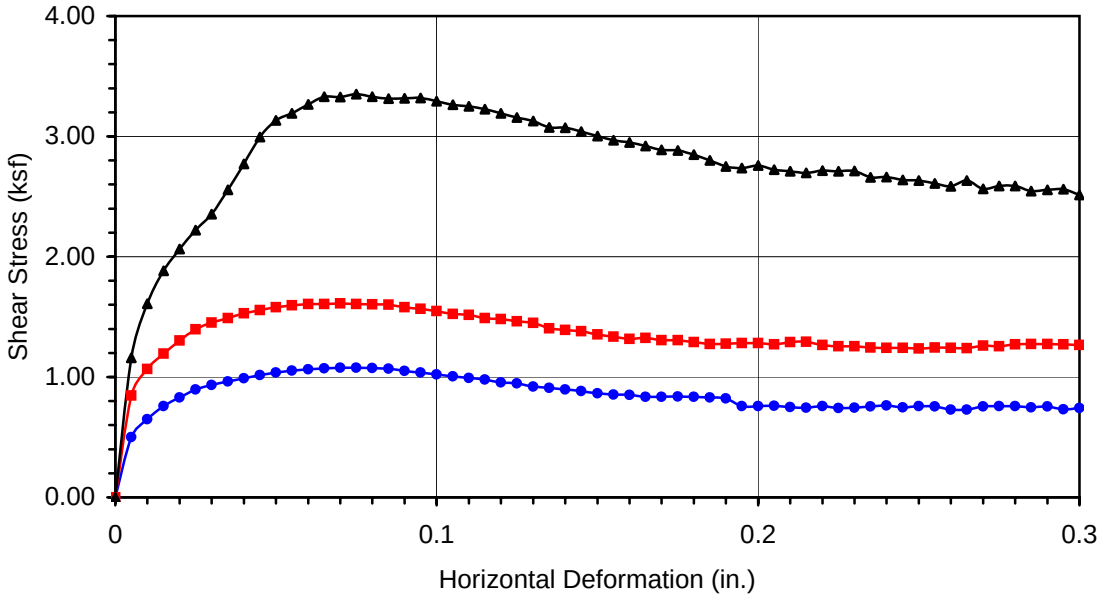
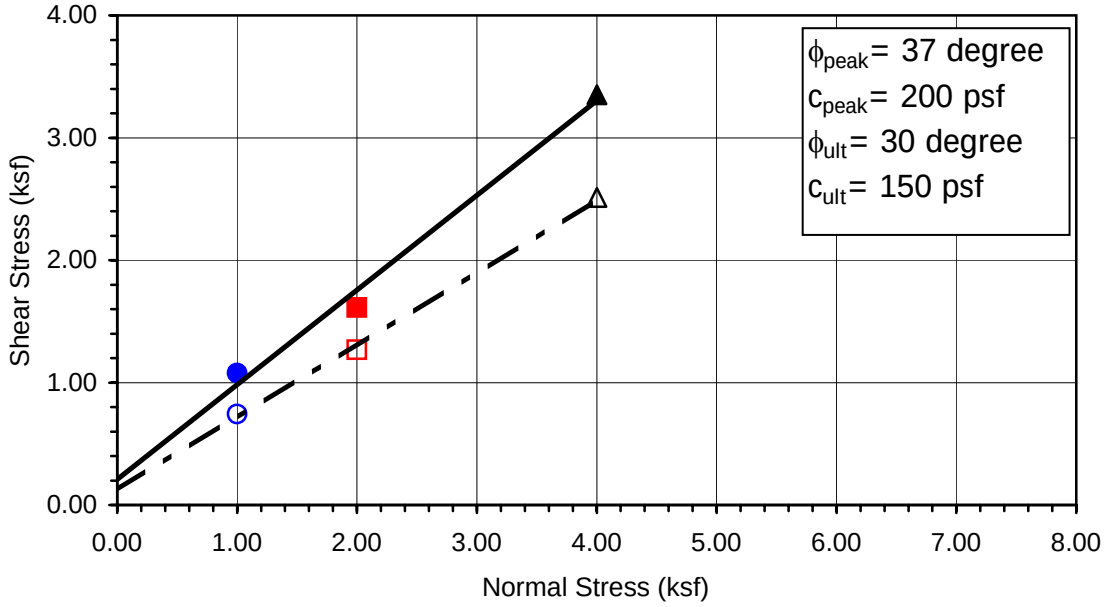
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09





Boring No.	**A-09-007**
Sample No.	**R-5**
Depth (ft)	**40**

Sample Type:

Drive

Soil Identification:
Light yellowish brown poorly graded sand (SP)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.078	■ 1.613	▲ 3.351
Shear Stress @ End of Test (ksf)	○ 0.742	□ 1.267	△ 2.512
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	2.51	2.51	2.51
Dry Density (pcf)	101.0	105.9	107.9
Saturation (%)	10.1	11.4	12.0
Soil Height Before Shearing (in.)	0.9923	0.9888	0.9833
Final Moisture Content (%)	20.8	20.1	18.5

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09

Leighton

SOIL RESISTIVITY TEST

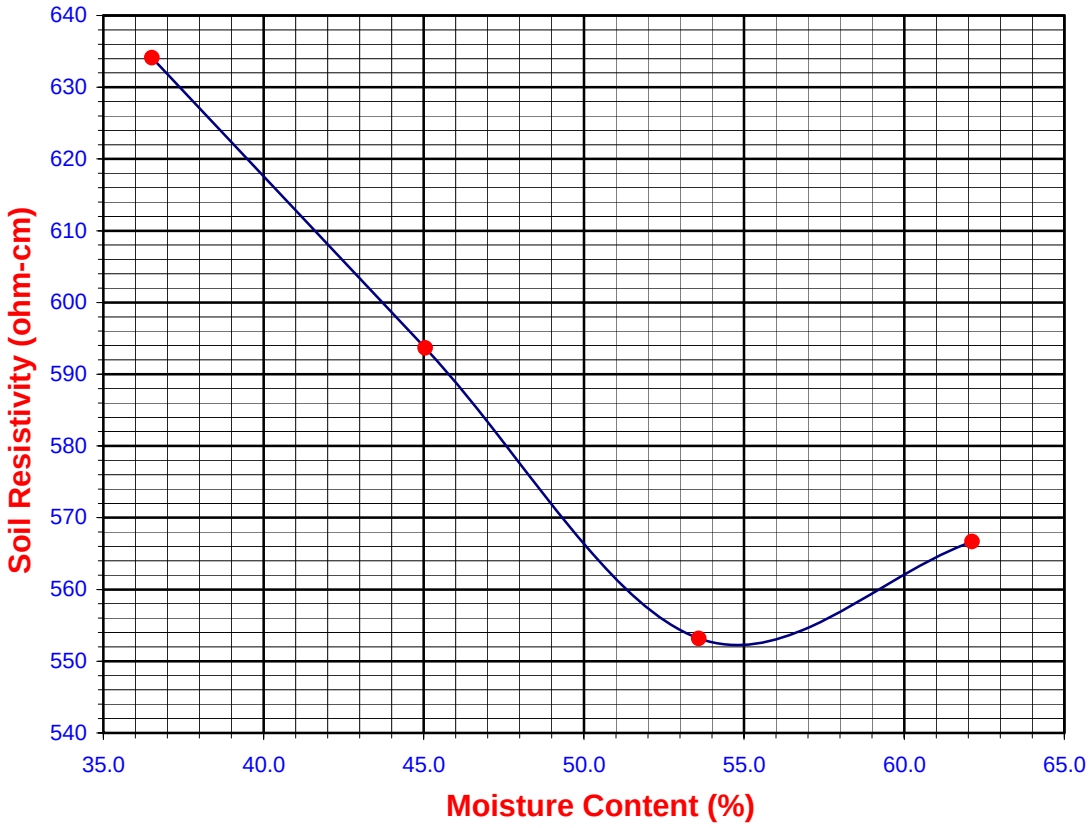
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/16/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/19/09
Boring No.:	A-09-007	Depth (ft.) :	10-20		
Sample No. :	R-2, S-1, R-3				
Soil Identification:	Dark gray (CL-ML)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	300	36.52	94	634
2	400	45.05	88	594
3	500	53.59	82	553
4	600	62.12	84	567
5				

Moisture Content (%) (MCi)	10.92
Wet Wt. of Soil + Cont. (g)	211.60
Dry Wt. of Soil + Cont. (g)	196.70
Wt. of Container (g)	60.30
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

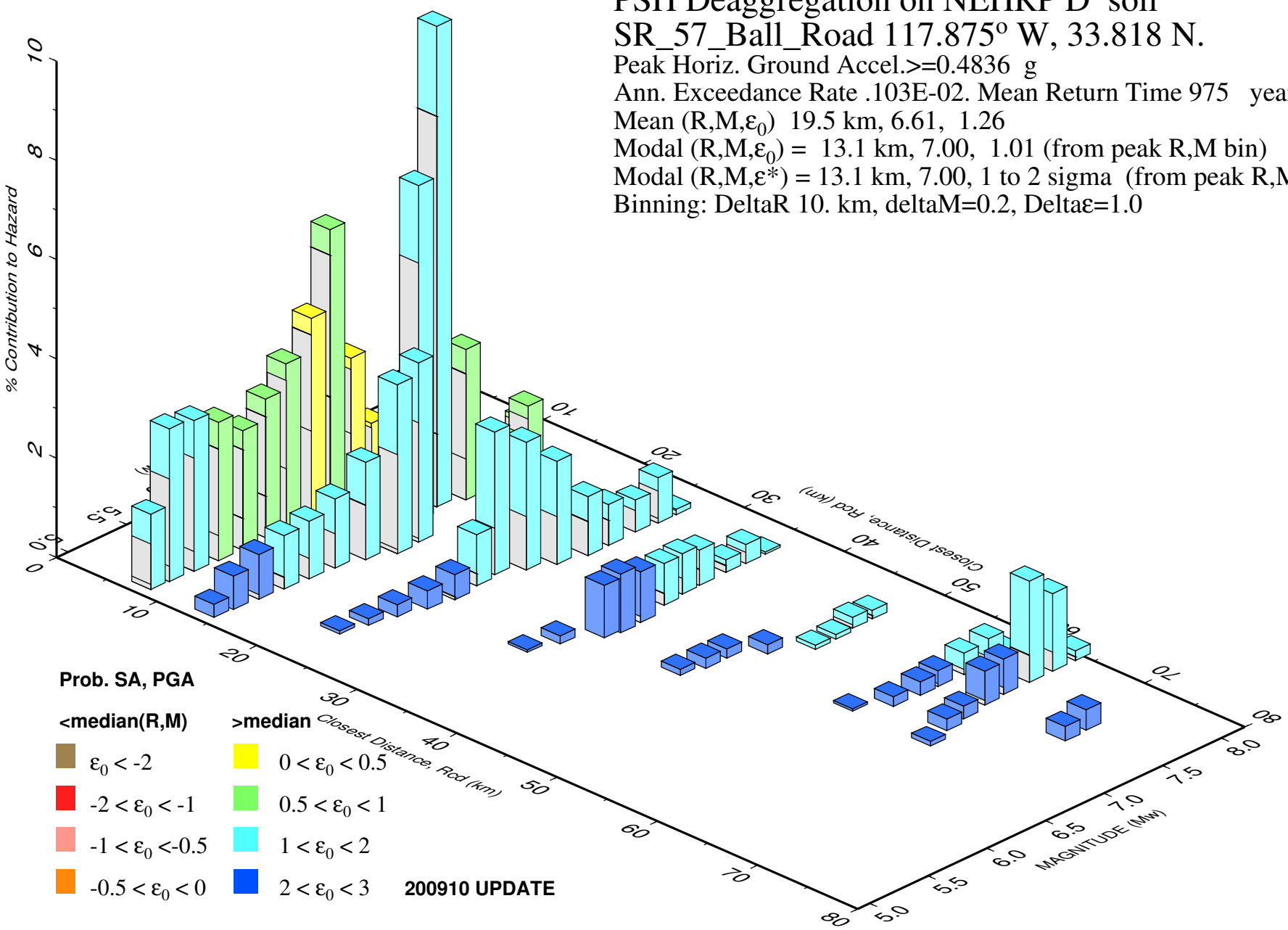
Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
552	**54.8**	**647**	**34**	**6.75**	**19.3**



APPENDIX B

PSH Deaggregation on NEHRP D soil
SR_57_Ball_Road 117.875° W, 33.818 N.

Peak Horiz. Ground Accel.>=0.4836 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 years
Mean (R,M,ε_0) 19.5 km, 6.61, 1.26
Modal (R,M,ε_0) = 13.1 km, 7.00, 1.01 (from peak R,M bin)
Modal (R,M,ε*) = 13.1 km, 7.00, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



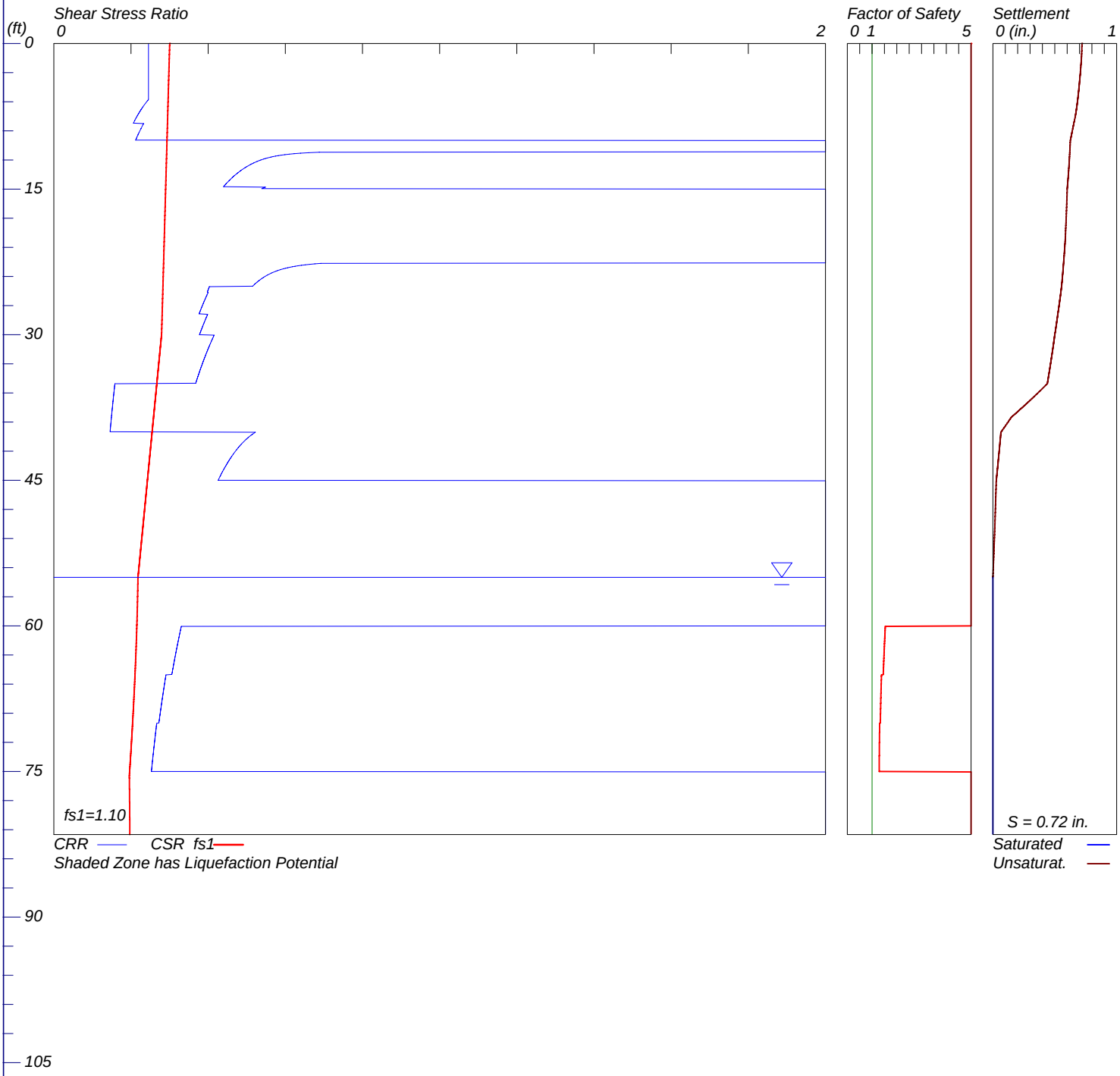
GMT 2010 Jan 19 23:14:09 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

SEISMIC SETTLEMENT ANALYSIS

SR-57 Widening - Tieback Wall at Ball Road OC

Hole No.=A-09-007 Water Depth=55 ft Surface Elev.=211

Magnitude=6.6
Acceleration=0.42g



LiquefyPro CivilTech Software USA www.civiltech.com

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*******************************************************************************
                                    LIQUEFACTION ANALYSIS SUMMARY
                                  Copyright by CivilTech Software
                                     www.civiltechsoftware.com

*******************************************************************************
        Font: Courier New, Regular, Size 8 is recommended for this report.
        Licensed to ,    2/4/2010 12:28:18 PM

        Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase
2\ENG\Liquefaction\B-7.liq
        Title:  SR-57 Widening - Tieback Wall at Ball Road OC
        Subtitle:  602231-002

        Surface Elev.=211
        Hole No.=A-09-007
        Depth of Hole= 81.50 ft
        Water Table during Earthquake= 55.00 ft
        Water Table during In-Situ Testing= 81.50 ft
        Max. Acceleration= 0.48 g
        Earthquake Magnitude= 6.60

 Input Data:
        Surface Elev.=211
        Hole No.=A-09-007
        Depth of Hole=81.50 ft
        Water Table during Earthquake= 55.00 ft
        Water Table during In-Situ Testing= 81.50 ft
        Max. Acceleration=0.48 g
        Earthquake Magnitude=6.60

        1. SPT or BPT Calculation.
        2. Settlement Analysis Method: Tokimatsu, M-correction
        3. Fines Correction for Liquefaction: Idriss/Seed
        4. Fine Correction for Settlement: During Liquefaction*
        5. Settlement Calculation in: All zones*
        6. Hammer Energy Ratio,                                   Ce = 1.333
        7. Borehole Diameter,                                      Cb= 1.15
        8. Sampling Method,                                       Cs= 1.2
        9. User request factor of safety (apply to CSR) ,   User= 1.1
           Plot one CSR curve (fs1=User)
        10. Use Curve Smoothing: No
        * Recommended Options

        In-Situ Test Data:
        Depth    SPT      gamma    Fines
        ft                pcf      %
        ____________________________________
        0.00     7.00     120.00   5.00
        10.00    11.00    120.00   50.00
        15.00    17.00    120.00   50.00
        20.00    14.00    120.00   50.00
        25.00    12.00    120.00   50.00
        30.00    13.00    120.00   35.00
        35.00    7.00     120.00   13.00
        40.00    25.00    120.00   5.00
        45.00    62.00    120.00   5.00
        50.00    45.00    120.00   5.00
        55.00    46.00    120.00   5.00
        60.00    26.00    120.00   4.50
        65.00    25.00    120.00   3.40
        70.00    20.00    120.00   17.50
        75.00    35.00    120.00   17.50
        80.00    26.00    120.00   39.40
        ____________________________________

Output Results:
        Settlement of Saturated Sands=0.00 in.
        Settlement of Unsaturated Sands=1.07 in.
        Total Settlement of Saturated and Unsaturated Sands=1.07 in.
        Differential Settlement=0.536 to 0.707 in.

        Depth    CRRm     CSRfs    F.S.     S_sat.   S_dry    S_all
        ft                                  in.      in.      in.
        ____________________________________________________________
        0.00     0.25     0.34     5.00     0.00     1.07     1.07
        5.00     0.25     0.34     5.00     0.00     1.04     1.04
        10.00    2.77     0.34     5.00     0.00     0.93     0.93
        15.00    2.77     0.33     5.00     0.00     0.89     0.89
        20.00    2.77     0.33     5.00     0.00     0.87     0.87
        25.00    0.52     0.32     5.00     0.00     0.83     0.83
        30.00    0.38     0.32     5.00     0.00     0.76     0.76
        35.00    0.37     0.31     5.00     0.00     0.67     0.67
        40.00    0.15     0.29     5.00     0.00     0.09     0.09
        45.00    0.43     0.28     5.00     0.00     0.03     0.03
        50.00    2.43     0.26     5.00     0.00     0.02     0.02
        55.00    2.37     0.25     5.00     0.00     0.00     0.00
        60.00    2.32     0.25     5.00     0.00     0.00     0.00
        65.00    0.31     0.24     1.28     0.00     0.00     0.00
        70.00    0.27     0.23     1.17     0.00     0.00     0.00
        75.00    0.26     0.22     1.14     0.00     0.00     0.00
        80.00    2.14     0.22     5.00     0.00     0.00     0.00
        ____________________________________________________________
        * F.S.<1, Liquefaction Potential Zone
        (F.S. is limited to 5,    CRR is limited to 2,      CSR is limited to 2)

        Units:   Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf,
                 Settlement = in.
        ____________________________________________________________________________
        1 atm (atmosphere) = 1 tsf (ton/ft2)
        CRRm             Cyclic resistance ratio from soils
        CSRsf            Cyclic stress ratio induced by a given earthquake (with
                          user request factor of safety)
        F.S.             Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
        S_sat            Settlement from saturated sands
        S_dry            Settlement from Unsaturated Sands
        S_all            Total Settlement from Saturated and Unsaturated Sands
        NoLiq            No-Liquefy Soils
```

Lateral Earth Pressure Calculation

ϕ (degree)	28
c (psf)	500
Equivalent ϕ (degree)	32
γ (pcf)	120.0
Factor of Safety	1.0

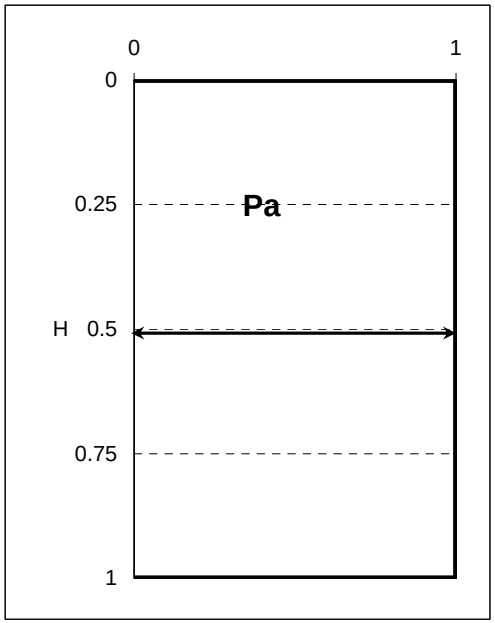
	Level Backfill
Friction resistance	0.42
K_p	3.25
K_0	0.47
K_a	0.31
P_p (pcf)	**390.6**
P_0 (pcf)	**56.4**
P_a (pcf)	**36.9**

Temporary Excavation - Braced Cut

1	2	3	
Sand	Soft & Medium Clay	Stiff Clay	

Soil Type: 1

Soil Pressure (psf): **24.0**



Assumption: Wall friction (δ) assumed to be 0.
Passive Pressure: Rankine Theory
Active Pressure: Rankine Theory for Level Backfill and NAVFAC DM 7.02 Ch3 for Sloping Backfill.
At rest condition: empirical relationship by Jaky 1944

Jaky, J., 1944, The Coefficient of Earth Pressure at Rest," Journal of the Society of Hungarian Architects and Engineers, Vol 7, 355-358

NAVFAC Figure 33, Passive pressure distribution for solider piles, p7.2-112

LATERAL EARTH PRESSURES-STATIC CONDITION
SR-57 RETAINING WALL AT BALL ROAD OVERCROSSING
ANAHEIM, CALIFORNIA

PROJECT NAME : SR-57/Ball Rd Retaining Wall
PROJECT NO: 602231-002
DESIGNED BY: TK
CHECKED BY: DJC
DATE: 10/13/2009

Figure B2

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Tieback Wall at Boll Road Overcrossing 602231-002

PROPOSED DEPTH = 56.0 FT

NUMBER OF LAYERS = 2

WATER TABLE DEPTH = 70.0 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.50

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 3.00

SOIL INFORMATION

LAYER NO 1----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.600E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.500E+03
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.120E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.500E+03
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.120E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.200E+02

LAYER NO 2----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.100E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.320E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.200E+02

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.100E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.320E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.700E+02

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	1.330	FT.
DIAMETER OF BASE	=	1.330	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	11.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	2.001	SQ.IN.
ELASTIC MODULUS, Ec	=	0.380E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
12.0	0.62	0.57	2.81	3.39	1.51	1.17	5.49
13.0	0.67	1.15	2.87	4.01	2.10	1.41	6.00
14.0	0.72	1.72	2.92	4.64	2.70	1.66	6.44
15.0	0.77	2.30	2.97	5.27	3.29	1.91	6.82
16.0	0.82	2.87	3.02	5.90	3.88	2.16	7.16
17.0	0.87	3.45	3.07	6.52	4.47	2.40	7.45
18.0	0.93	4.02	3.13	7.15	5.06	2.65	7.72
19.0	0.98	4.60	7.41	12.01	7.07	4.31	12.28

20.0	1.03	5.17	7.41	12.58	7.64	4.54	12.23
21.0	1.08	8.45	7.41	15.86	10.92	5.85	14.68
22.0	1.13	11.87	7.41	19.28	14.34	7.22	17.03
23.0	1.18	15.43	7.41	22.85	17.91	8.64	19.30
24.0	1.24	19.14	7.41	26.55	21.61	10.13	21.50
25.0	1.29	23.00	7.41	30.41	25.47	11.67	23.63
26.0	1.34	26.99	7.41	34.40	29.46	13.27	25.71
27.0	1.39	31.13	7.41	38.54	33.60	14.92	27.74
28.0	1.44	35.41	7.41	42.82	37.88	16.64	29.72
29.0	1.49	39.84	7.41	47.25	42.31	18.41	31.66
30.0	1.54	44.41	7.41	51.82	46.88	20.23	33.57
31.0	1.60	49.12	7.41	56.54	51.59	22.12	35.44
32.0	1.65	53.98	7.41	61.39	56.45	24.06	37.28
33.0	1.70	58.98	7.41	66.39	61.45	26.06	39.10
34.0	1.75	64.13	7.41	71.54	66.60	28.12	40.89
35.0	1.80	69.42	7.41	76.83	71.89	30.24	42.65
36.0	1.85	74.85	7.41	82.26	77.32	32.41	44.40
37.0	1.90	80.42	7.41	87.84	82.89	34.64	46.13
38.0	1.96	86.14	7.41	93.55	88.61	36.93	47.84
39.0	2.01	92.01	7.41	99.42	94.48	39.27	49.54
40.0	2.06	98.01	7.41	105.42	100.48	41.68	51.21
41.0	2.11	104.16	7.41	111.57	106.63	44.14	52.88
42.0	2.16	110.46	7.41	117.87	112.93	46.65	54.53
43.0	2.21	116.89	7.41	124.31	119.36	49.23	56.17
44.0	2.26	123.48	7.41	130.89	125.95	51.86	57.80
45.0	2.32	130.20	7.41	137.61	132.67	54.55	59.42
46.0	2.37	137.07	7.41	144.48	139.54	57.30	61.03
47.0	2.42	144.08	7.41	151.49	146.55	60.10	62.63
48.0	2.47	151.24	7.41	158.65	153.71	62.97	64.23
49.0	2.52	158.54	7.41	165.95	161.01	65.88	65.81
50.0	2.57	165.98	7.41	173.39	168.45	68.86	67.39
51.0	2.62	173.57	7.41	180.98	176.04	71.90	68.96
52.0	2.68	181.30	7.41	188.71	183.77	74.99	70.52
53.0	2.73	189.17	7.41	196.58	191.64	78.14	72.07
54.0	2.78	197.19	7.41	204.60	199.66	81.35	73.62
55.0	2.83	205.35	7.41	212.76	207.82	84.61	75.17
56.0	2.88	213.65	7.41	221.06	216.12	87.93	76.71

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9942E+00	0.1088E-02	0.1625E-02	0.1000E-03
0.1010E+02	0.1098E-01	0.1625E-01	0.1000E-02
0.2528E+02	0.2777E-01	0.4063E-01	0.2500E-02
0.4768E+02	0.5442E-01	0.8127E-01	0.5000E-02
0.6705E+02	0.7897E-01	0.1219E+00	0.7500E-02
0.8315E+02	0.1009E+00	0.1625E+00	0.1000E-01
0.1400E+03	0.1899E+00	0.4063E+00	0.2500E-01
0.1764E+03	0.2658E+00	0.8127E+00	0.5000E-01
0.1923E+03	0.3140E+00	0.1219E+01	0.7500E-01
0.2002E+03	0.3511E+00	0.1616E+01	0.1000E+00
0.2057E+03	0.5107E+00	0.3671E+01	0.2500E+00
0.2072E+03	0.7635E+00	0.5558E+01	0.5000E+00
0.2085E+03	0.1016E+01	0.7222E+01	0.7500E+00
0.2093E+03	0.1267E+01	0.8367E+01	0.1000E+01
0.2109E+03	0.1867E+01	0.1082E+02	0.1596E+01

602231-002/ SR 57 N Widening/ Ball Road Tieback Wall/ 3 Rows H=15 feet

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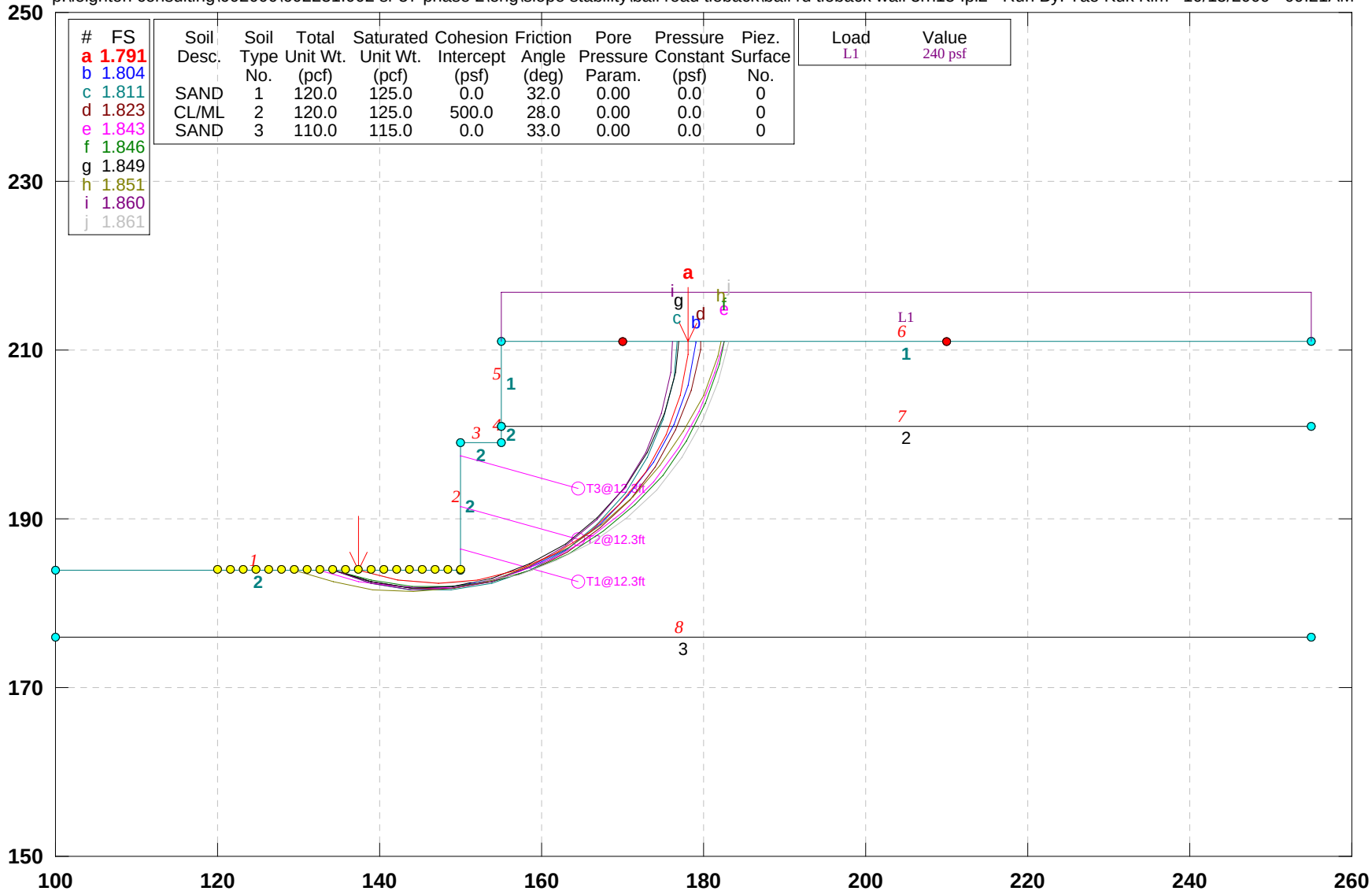

GSTABL7 v.2 FSmin=1.791

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/ Ball Road Tieback Wall/3 Rows/Pseudo Static/H=15ft

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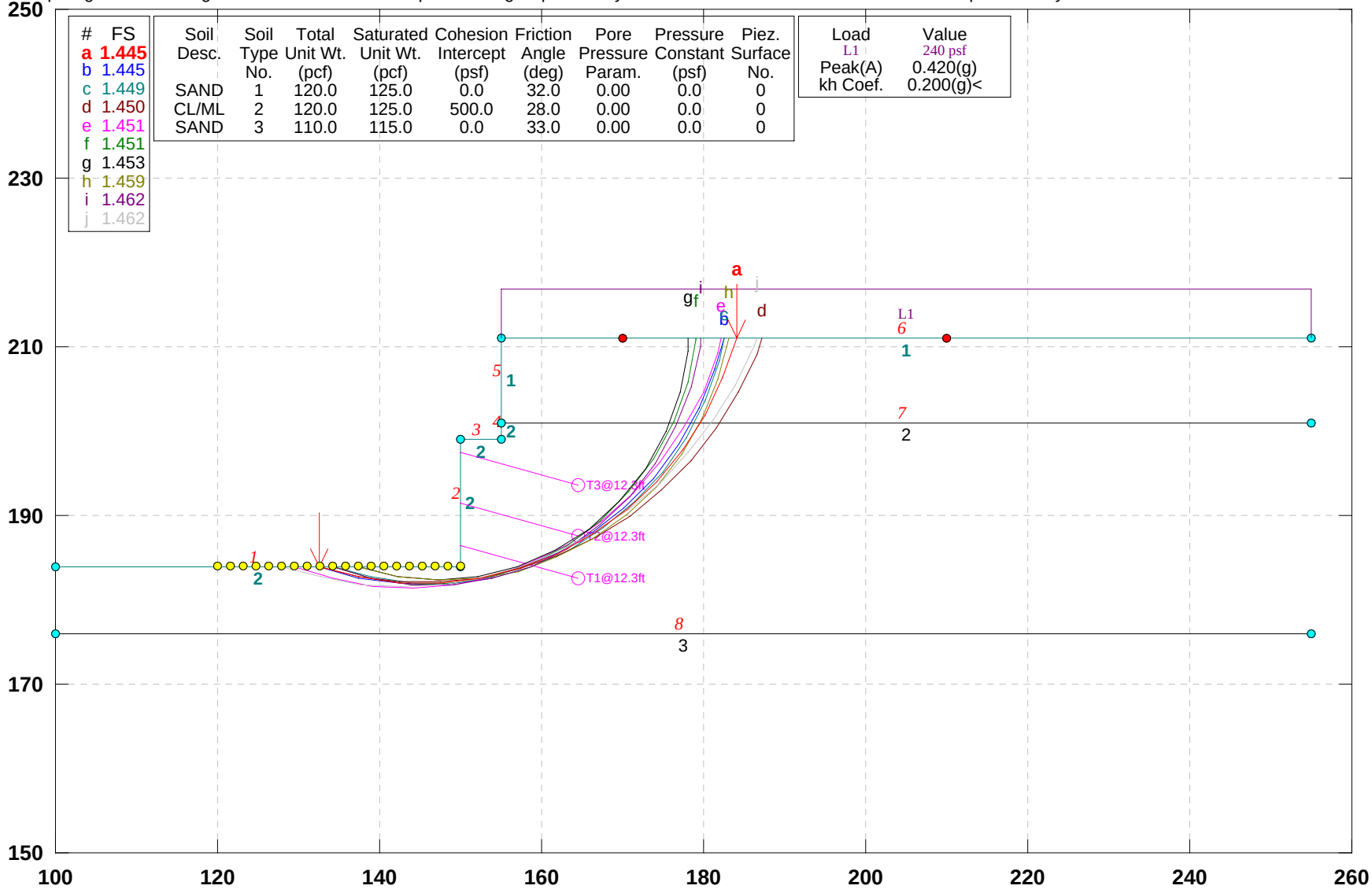
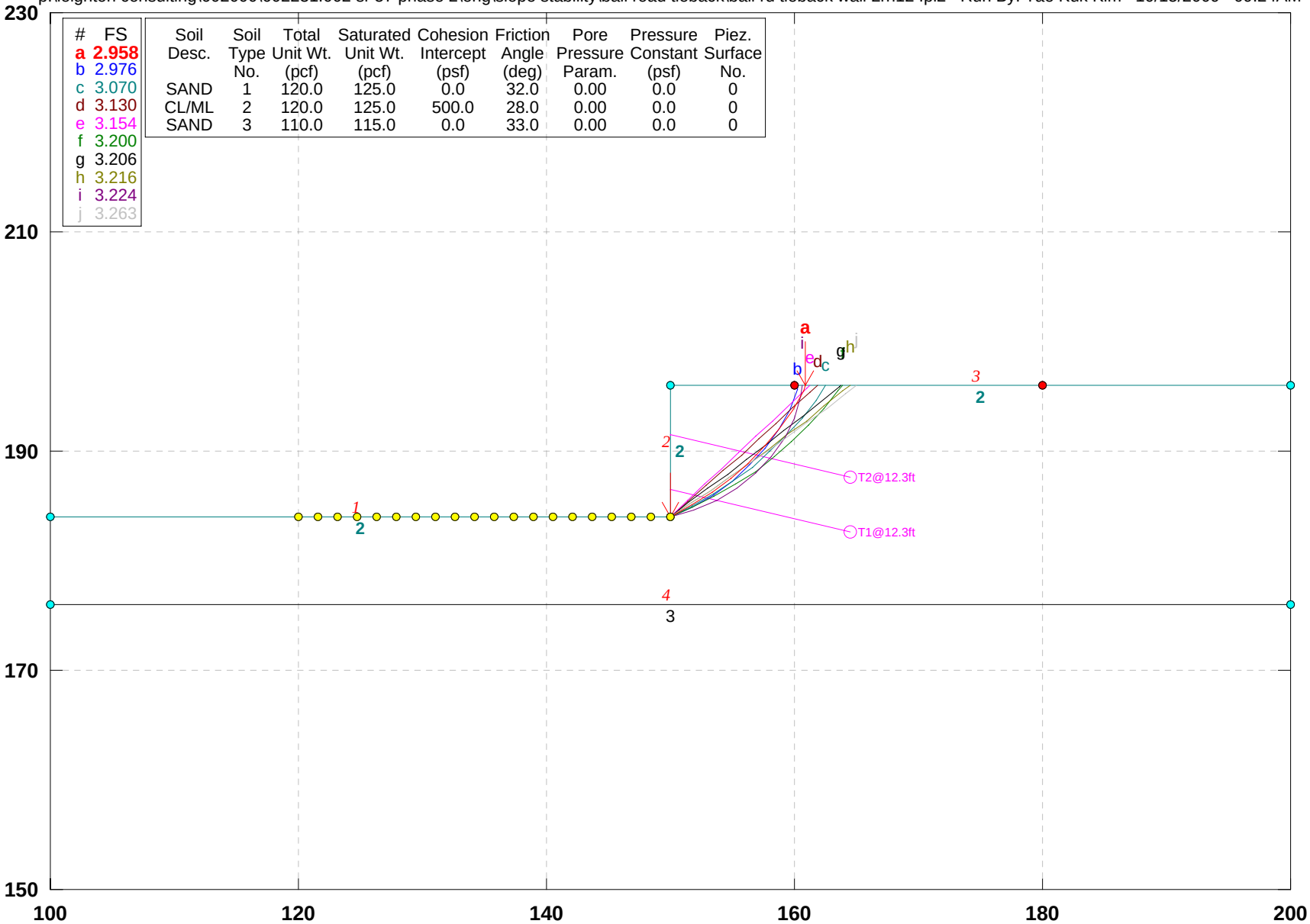


GSTABL7 v.2 FSmin=1.445

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/ Ball Road Tieback Wall/ 2 Rows H=12 feet

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\ball road tieback\ball rd tieback wall 2rh12 .pl2 Run By: Tae Kuk Kim 10/15/2009 09:24AM



GSTABL7 v.2 FSmin=2.958

Safety Factors Are Calculated By The Modified Bishop Method

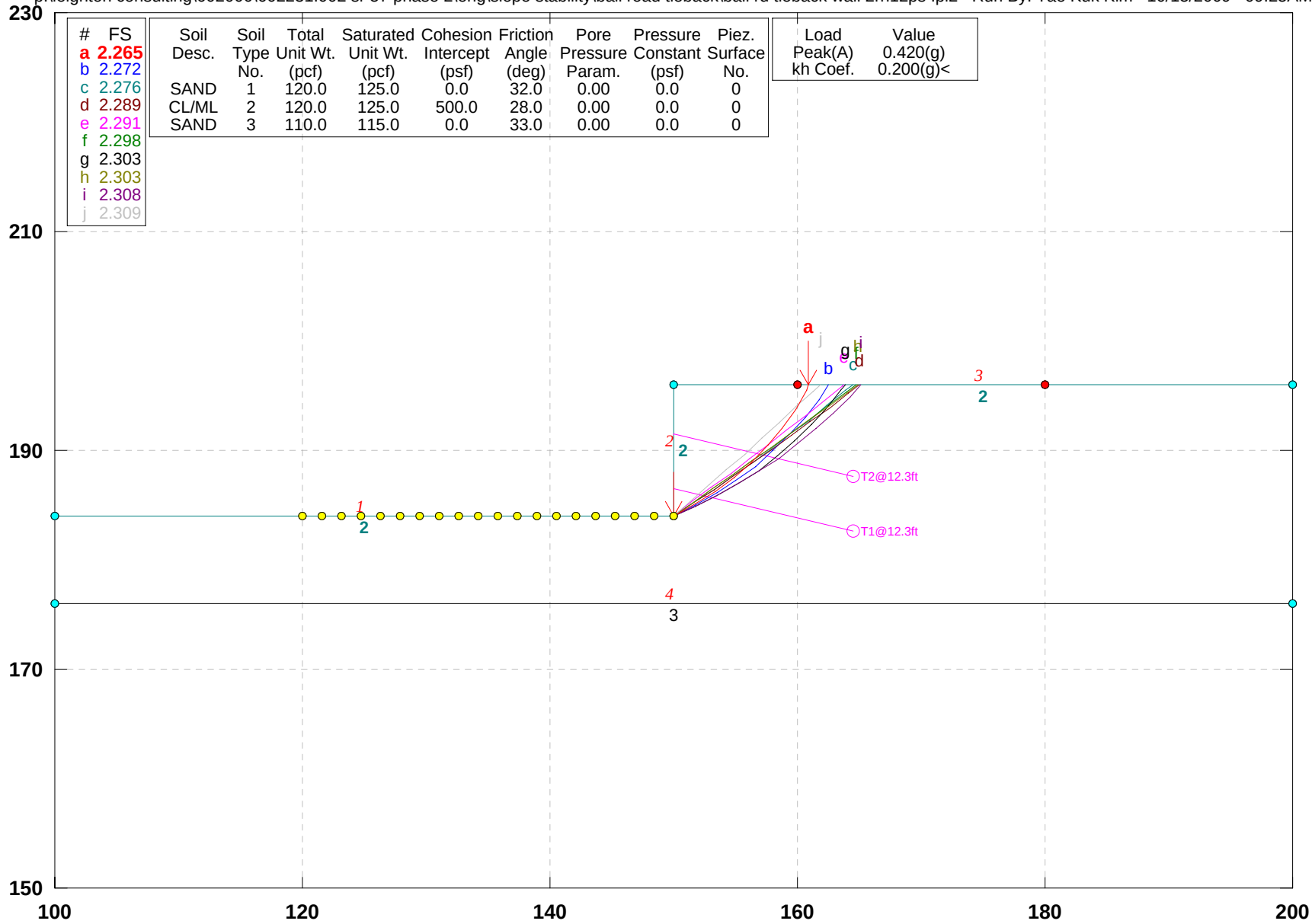
602231-002/ SR 57 N Widening/ Ball Road Tieback Wall/ 2Rows/Pseudo Static/H=12ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\ball road tieback\ball rd tieback wall 2rh12ps .pl2 Run By: Tae Kuk Kim 10/15/2009 09:25AM

#	FS
a	2.265
b	2.272
c	2.276
d	2.289
e	2.291
f	2.298
g	2.303
h	2.303
i	2.308
j	2.309

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
SAND	1	120.0	125.0	0.0	32.0	0.00	0.0	0
CL/ML	2	120.0	125.0	500.0	28.0	0.00	0.0	0
SAND	3	110.0	115.0	0.0	33.0	0.00	0.0	0

Load	Value
Peak(A)	0.420(g)
kh Coef.	0.200(g)<



GSTABL7 v.2 FSmin=2.265

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/ Ball Road Type 1 Retaining Wall/ H=8 feet

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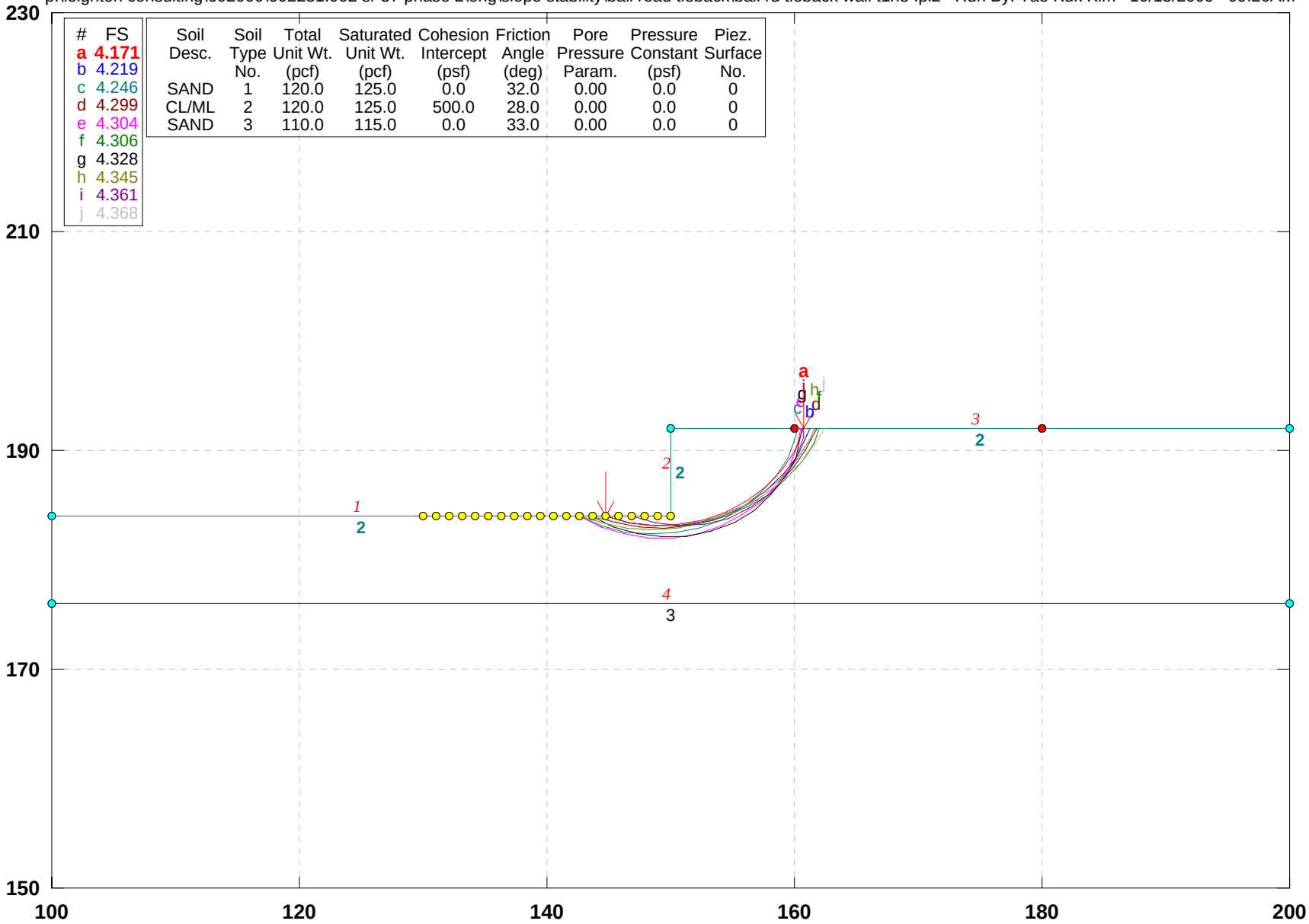

GSTABL7 v.2 FSmin=4.171

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/ Ball Road Type 1 RW/Pseudo Static/ H=8 feet

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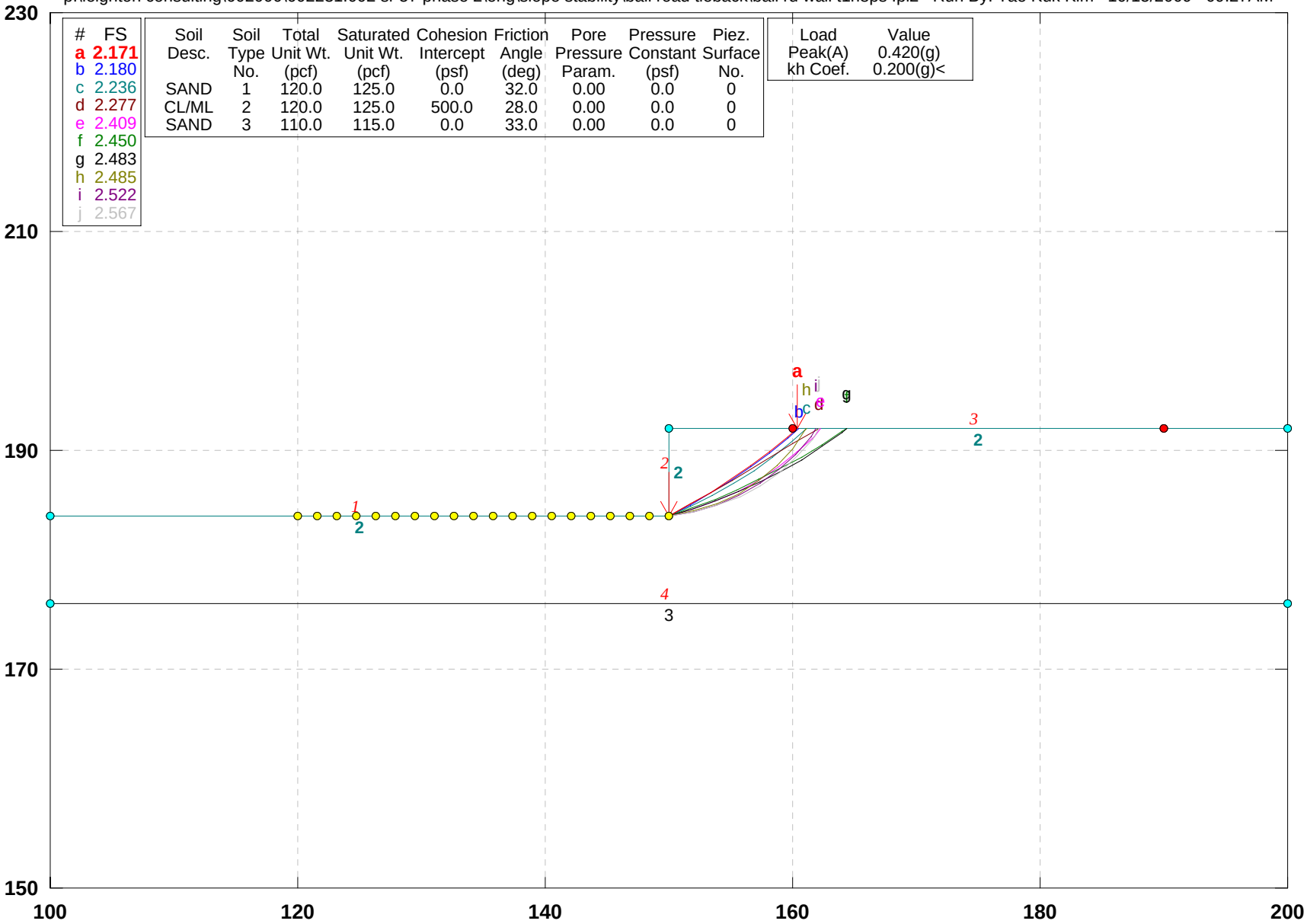

GSTABL7 v.2 FSmin=2.171

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR-57 N Widening / Ball RoadTieback Wall Critical Failure H=15 ft

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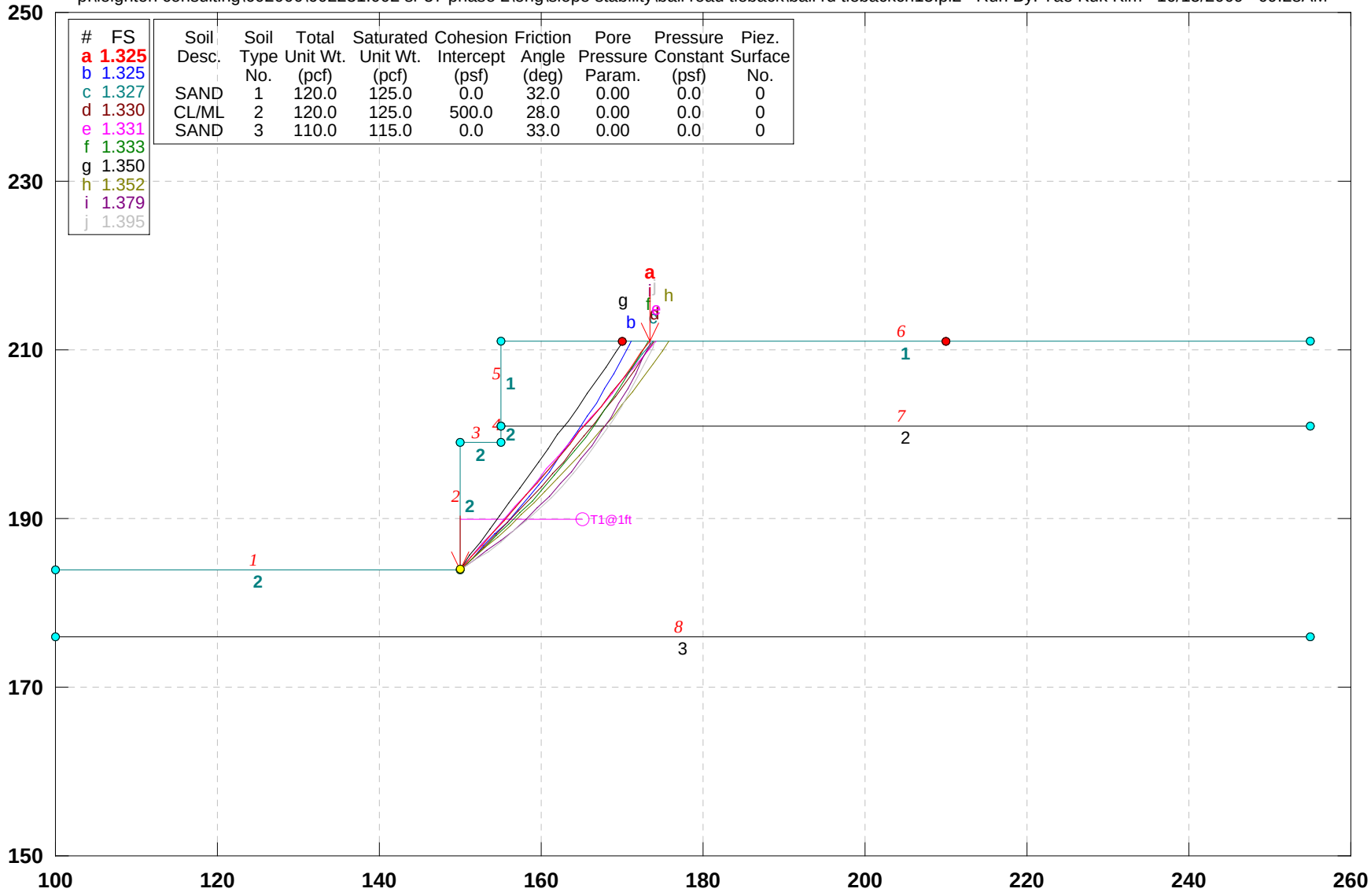

GSTABL7 v.2 FSmin=1.325

Safety Factors Are Calculated By The Modified Bishop Method

APPENDIX C

State of California | Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. JON HAMAGUCHI
Office of Special Funded Projects

Attn: MR. SIDNEY DADRAS

Date: July 14, 2009
File: 12-ORA-57-PM 13.42
12-0F0401

Tieback Wall at Abut. 3
Ball Road Overcrossing
Bridge No. 55-0524

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Subject: Review of the Draft Foundation Report

On July 9, 2009, we received a draft Foundation Report for the Tieback wall at Abutment 3 of the Ball Road OC # 55-0524. Construction of this wall is part of the Northbound widening of the SR-57 between Katella and Lincoln Avenues. The following comments are based on review of the subject report dated June 2, 2009, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

Table 1

- Soil parameters for clay and silt are unreasonable (high friction and low cohesion).

3.4.2 Corrosion Potential

- The reason for considering soils at Abutment 3 to be corrosive, which is not supported by laboratory test results.

Table 3

- The reason for not providing the allowable capacity, if it is not known replace it with design load as indicated in the foot note.

- Item (5) in the foot note is missing (or perhaps miss numbered).

4.3 Missing Section

- Section 4.3 is missing, paragraphs 2, 3 & 4 under Section 4.2 could be placed in Section 4.3 and more sections may be added.

5.2 Temporary Excavations

- Excavation slope can not be laid back, it is too close to abutment piles.

5.3 Earthwork

- Please explain where the 90% compacted fill will be placed, if it is placed under the road way, it should be compacted to 95%.

Additional Comments

- The global stability analysis should be performed for determination of unbonded length of the tieback anchors considering number of rows and height of the retained soil.

- A table with stationing limits, number of tieback rows, row numbers, approximate wall height and related unbonded length should be provided.

- Wall settlement should be calculated and possible effects on existing bridge abutment foundation discussed.

- Drainage type and location for behind and toe of the tieback wall should be discussed.

Design Plans

- Tieback wall layout with location and size of geocomposite drains, toe drains, tieback line numbers and wall facing, etc. should be provided.

- Tieback wall detail with tieback schedule, tendon details, etc. should also be provided.

- List of utilities must be noted on Foundation Plan sheet. The reason for referring to siltstone with (0) cohesion in soil parameters.

- In Foundation Plan, soil density "r" should be changed to "γ".

Log of Test Borings (LOTB)

- Figure 2 with sheet Nos. in parenthesis should be deleted from LOTB and Soil Legend sheets and referred to as LOTB sheets in report text.

- Single post mile (i.e. 13.42) instead of post mile range should be provided in Bottom title blocks of LOTB and Soil Legend sheets.

- EA number should be changed to 0F0401 in LOTB, Soil Legend and report text.

- Boring number should comply with Caltrans Soil and Rock Logging Manual (Section 2.3). Boring number in the report text and laboratory test results should also be changed accordingly.

- Soil Legend sheets (sheet 1 of 4 & 2 of 4) should be placed after LOTB sheet as sheets 2 of 4 and 3 of 4.

- If available, pocket penetrometer (PP) or pocket torvane (TV) values should be shown at the end of each cohesive soil layer. Description and consistency should be based on those values rather than blow counts.

- Correction factor for conversion of 2.4" sampler blow count to 1.4" Standard Penetration Test sampler blow count for granular and cohesive soils should be noted on LOTB sheet.

- Apparent density of granular soil and consistency of cohesive soils should be based on corrected blow counts of both samplers (2.4" & 1.4") for hammer efficiency, in addition to converted blow counts of 2.4" to 1.4" sampler blow counts. However, the actual blow counts (raw field blow counts) as currently shown on LOTB should not be changed.

- The soil group names "SILTY CLAY (CL)" should be modified to SILTY LEAN CLAY (CL) and "SAND (SP)" to POORLY GRADED SAND (SP).

- Dotted lines marking elevation intervals should not carry through the boring graphic column which could be mistaken as a break in the layer.

- Legend notes and other borings (except B-7) plotted on Plan View should be deleted.

- In Plan View: provisions of notes a, b, d, e, g, h, & i in Section 5.2.3.3 of Caltrans Soil and Rock Manual should be followed.

- In Profile View: provisions of notes b, j & k in Section 5.2.3.4 of Caltrans Soil and Rock Manual should be followed.

- Contents of notes a & b in Section 5.2.3.5 of Caltrans Soil and Rock Manual should be included in LOTB sheet.

- It is required to include a conversion factor in the report for converting As-Built LOTB elevations (Datum NGVD 29) to current elevations (Datum NAVD 88).

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by:

Date: 7/14/2009

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
No. 2669
Exp. 6-30-2010
GEOTECHNICAL
STATE OF CALIFORNIA

c: OGDS1 - LA. File
OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED JULY 14, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Ball Road Tieback Wall, SR 57 NB Widening, dated June 2, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Table 1	Faramarz Gerami	Soil parameters for clay and silt are unreasonable (high friction and low cohesion).	Per our discussion, we will revise the soil parameters of clay and silt in our report to 28 degree and 500 pcf.
2	3.4.2	Faramarz Gerami	The reason for considering soils at Abutment 3 to be corrosive, which is not supported by laboratory test results.	We understand that the soil minimum resistivity is only an indicator. Based on the sulfate and chloride results, the onsite soil behind Abutment 3 is considered non-corrosive. We will revise our report accordingly.
3	Table 3	Faramarz Gerami	The reason for not providing the allowable capacity, if it is not known replace it with design load as indicated in the foot note.	We will use the design load as the allowable pile capacity for the existing piles.
4	Table 3	Faramarz Gerami	Item (5) in the footnote is missing (or perhaps miss numbered).	We will revise the report accordingly.
5	4.3	Faramarz Gerami	Section 4.3 is missing, paragraphs 2, 3 & 4 under Section 4.2 could be placed in Section 4.3 and more sections may be added.	Section 4.4 should be Section 4.3. We will revise our report.
6	5.2	Faramarz Gerami	Excavation slope cannot be laid back, it is too close to abutment piles.	We concur. We will revise our report to incorporate this.
7	5.3	Faramarz Gerami	Please explain where the 90% compacted fill will be placed, if it is placed under the roadway, it should be compacted to 95%.	We concur.
8	Additional Comment	Faramarz Gerami	The global stability analysis should be performed for determination of unbonded length of the tieback anchors considering number of rows and height of the retained soil.	We will perform global stability analysis to determine the unbonded length of the tiebacks.
9	Additional Comment	Faramarz Gerami	A table with stationing limits, number of tieback rows, row numbers, approximate wall height and related unbonded length should be provided.	The location, number of rows, wall height and other details are shown in the layout plan prepared by HDR.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED JULY 14, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Ball Road Tieback Wall, SR 57 NB Widening, dated June 2, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
10	Additional Comment	Faramarz Gerami	Wall settlement should be calculated and possible effects on existing bridge abutment foundation discussed.	No vertical settlement is expected for the new tieback wall. We will evaluate the lateral wall movement of the tieback wall and its impact to the existing abutment foundation.
11	Additional Comment	Faramarz Gerami	Drainage type and location for behind and toe of the tieback wall should be discussed.	We will include a discussion on drainage type and location.
12	Design Plan	Faramarz Gerami	Tieback wall layout with location and size of geocomposite drains, toe drains, tieback line numbers and wall facing, etc. should be provided.	HDR will provide this information on the design plan.
13	Design Plan	Faramarz Gerami	Tieback wall detail with tieback schedule, tendon details, etc. should also be provided.	HDR will provide this information on the design plan.
14	Design Plan	Faramarz Gerami	List of utilities must be noted on Foundation Plan sheet. The reason for referring to siltstone with (0) cohesion in soil parameters.	HDR will provide this information on the design plan.
15	Design Plan	Faramarz Gerami	In Foundation Plan, soil density "r" should be changed to "γ".	HDR will provide this information on the design plan.
16	Log of Test Borings (LOTB)	Faramarz Gerami	Figure 2 with sheet Nos. in parenthesis should be deleted from LOTB and Soil Legend sheets and referred to as LOTB sheets in report text.	We will revise our LOTB accordingly.
17	Log of Test Borings (LOTB)	Faramarz Gerami	Single post mile (i.e. 13.42) instead of post mile range should be provided in Bottom title blocks of LOTB and Soil Legend sheets.	We will revise our LOTB accordingly.
18	Log of Test Borings (LOTB)	Faramarz Gerami	EA number should be changed to OF0401 in LOTB, Soil Legend and report text.	We will revise our report and LOTB accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED JULY 14, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Ball Road Tieback Wall, SR 57 NB Widening, dated June 2, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
19	Log of Test Borings (LOTB)	Faramarz Gerami	Boring number should comply with Caltrans Soil and Rock Logging Manual (Section 2.3). Boring number in the report text and laboratory test results should also be changed accordingly.	We will revise our report accordingly.
20	Log of Test Borings (LOTB)	Faramarz Gerami	Soil Legend sheets (sheet 1 of 4 & 2 of 4) should be placed after LOTB sheet as sheets 2 of 4 and 3of 4.	We will revise our LOTB accordingly.
21	Log of Test Borings (LOTB)	Faramarz Gerami	If available, pocket penetrometer (PP) or pocket torvane (TV) values should be shown at the end of each cohesive soil layer. Description and consistency should be based on those values rather than blow counts.	We will add PP value, where available.
22	Log of Test Borings (LOTB)	Faramarz Gerami	Correction factor for conversion of 2.4" sampler blow count to 1.4" Standard Penetration Test sampler blow count for granular and cohesive soils should be noted on LOTB sheet.	We will revise LOTB accordingly.
23	Log of Test Borings (LOTB)	Faramarz Gerami	Apparent density of granular soil and consistency of cohesive soils should be based on corrected blow counts of both samplers (2.4" & 1.4") for hammer efficiency, in addition to converted blow counts of 2.4" to 1.4" sampler blow counts. However, the actual blow counts (raw field blow counts) as currently shown on LOTB should not be changed.	We will revise LOTB accordingly.
24	Log of Test Borings (LOTB)	Faramarz Gerami	The soil group names "SILTY 'CLAY (CL)" should be modified to SILTY LEAN CLAY (CL) and "SAND (SP)" to POORLY GRADED SAND (SP).	We will revise LOTB accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED JULY 14, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Ball Road Tieback Wall, SR 57 NB Widening, dated June 2, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
25	Log of Test Borings (LOTB)	Faramarz Gerami	Dotted lines marking elevation intervals should not carry through the boring graphic column which could be mistaken as a break in the layer.	We will revise LOTB accordingly.
26	Log of Test Borings (LOTB)	Faramarz Gerami	Legend notes and other borings (except B-7) plotted on Plan View should be deleted.	We will revise LOTB accordingly.
27	Log of Test Borings (LOTB)	Faramarz Gerami	In Plan View: provisions of notes a, b, d, e, g, h, & i in Section 5.2.3.3 of Caltrans Soil and Rock Manual should be followed.	We will revise LOTB accordingly.
28	Log of Test Borings (LOTB)	Faramarz Gerami	In Profile View: provisions of notes b, j & k in Section 5.2.3.4 of Caltrans Soil and Rock Manual should be followed.	We will revise LOTB accordingly.
29	Log of Test Borings (LOTB)	Faramarz Gerami	Contents of notes a & b in Section 5.2.3.5 of Caltrans Soil and Rock Manual should be included in LOTB sheet.	We will revise LOTB accordingly.
30	Log of Test Borings (LOTB)	Faramarz Gerami	It is required to include a conversion factor in the report for converting As-Built LOTB elevations (Datum NGVD 29) to current elevations (Datum NAVD 88).	We will revise LOTB accordingly.

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. JON HAMAGUCHI
Office of Special Funded Projects

Date: December 16, 2009
File: 12-ORA-57-PM 13.42
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
Ball Road Overcrossing
Bridge No. 55-0524

Subject: 2nd Review of the Draft Foundation Report

On October 28, 2009, we received a draft Foundation Report for the Tieback wall at Abutment 3 of the Ball Road OC Bridge No. 55-0524. Construction of this wall is part of the Northbound widening of the SR-57 between Katella and Lincoln Avenues. The following comments are based on review of the subject report dated October 13, 2009, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

Faulting and Seismicity

- A section for Response Spectra should be added. Also Deterministic and Probabilistic Response Spectrum for each fault should be provided.
- 2008 USGS Deaggregated Hazard (Beta) Curve should be used as design curve if there is a difference of more than 10% between USGS and ARS online probabilistic data.
- QC/QA sheets should be included for all faults listed in calculated spectra.

Log of Test Borings (LOTB)

- The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets.
- The laboratory test symbols should be attached to the boring stick.
- The project name in title block of as built LOTB should be the same as current LOTB (sheet 1of 4) and Soil Legend (sheets 2 of 4 and 3 of 4). The project name should read "Ball Road OC – Retaining Wall".
- Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NAVD88.

- Place "medium dense" at elevation 204 after symbol (SP) and before light brown color.
- There is not such a term as "clayey silt ". It is suggested to use elastic silt, silty clay or another acceptable cohesive soil group name.
- Delete the word "wet" at elevation 204 unless it is defining a perched water.
- The symbol for "silty sand with clay" at elevation 180 should be (SC-SM).
- Consistencies at elevations 199, 194, 190 and 184 should be "very stiff".
- The lab test symbol for pocket penetrometer at elevation 200 should not be shown (it was deleted in Soil and Rock Manual – Errata sheets).

Design Plans

- Typical section of Type 1 wall is not shown in General Plan or other plan sheets.
- The reason for extending shotcrete limits to Type 1 wall as shown in General Plan.
- Soil parameters in the report's Foundation Plan are different than those in Foundation Plan submitted separately. Cohesive soil parameters for the top two rows and granular soil parameters for the third row should be provided.
- Show the label orientation on the cross sections in Retaining Wall Section Plan (i.e. vertical E-E label on Section E-E).

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 12/16/2009

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

No. 2809
Exp. 6-30-2010
GEOTECHNICAL
STATE OF CALIFORNIA

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GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of Ball Rd OC Bridge No. 55-0524, dated October 13, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Faulting & Seismicity	Faramarz Gerami	A section for Response Spectra should be added. Also Deterministic and Probabilistic Response Spectrum for each fault should be provided. 2008 USGS Deaggregated Hazard (Beta) Curve should be used as design curve if there is a difference of more than 10% between USGS and ARS online probabilistic data. QC/QA sheets should be included for all faults listed in calculated spectra.	ARS curve is not required for the tieback wall design.
2	Log of Test Borings (LOTB)	Faramarz Gerami	The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets. The laboratory test symbols should be attached to the boring stick. The project name in title block of as built LOTB should be the same as current LOTB (sheet 1 of 4) and Soil Legend (sheets 2 of 4 and 3 of 4). The project name should read "Ball Road OC - Retaining Wall". Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NA VD88. Place "medium dense" at elevation 204 after symbol (SP) and before light brown color. There is not such a term as "clayey silt ". It is suggested to use elastic silt, silty clay or another acceptable cohesive soil group name.	We will remove the boxes. We will revise our LOTBs accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of Ball Rd OC Bridge No. 55-0524, dated October 13, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			Delete the word "wet" at elevation 204 unless it is defining perched water. The symbol for "silty sand with clay" at elevation 180 should be (SC-SM). Consistencies at elevations 199, 194, 190 and 184 should be "very stiff'. The lab test symbol for pocket penetrometer at elevation 200 should not be shown (it was deleted in Soil and Rock Manual- Errata sheets).	
3	Design Plans	Faramarz Gerami	Typical section of Type 1 wall is not shown in General Plan or other plan sheets. The reason for extending shotcrete limits to Type 1 wall as shown in General Plan. Soil parameters in the report's Foundation Plan are different than those in Foundation Plan submitted separately. Cohesive soil parameters for the top two rows and granular soil parameters for the third row should be provided. Show the label orientation on the cross sections in Retaining Wall Section Plan (i.e. vertical E-E label on Section E-E).	We understand that HDR will revise the plans accordingly. We will provide the appropriate soil parameters for the third (lower) row of the tieback.

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
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To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: March 15, 2010
File: 12-ORA-57-PM 13.42
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
Ball Road Overcrossing
Bridge No. 55-0524

Subject: 3rd Review of the Foundation Report

On February 22, 2010, we received a Foundation Report for the Tieback wall at Abutment 3 of the Ball Road OC Bridge No. 55-0524. Construction of this wall is part of the Northbound widening of the SR-57 between Katella and Lincoln Avenues. The following comments are based on review of the subject report revised February 15, 2010, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

4.1 Table 4 – As Built Foundation Data

- As Built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified.

- Please explain the reason Nominal Resistance is exceeding 2 x Allowable Capacity.

Log of Test Borings (LOTB)

- Bottom of footing elevations (Tieback or Type 1) should not be shown on LOTB.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 3/15/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
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REGISTERED PROFESSIONAL ENGINEER
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SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MARCH 15, 2010
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

3rd Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of Ball Rd OC Bridge No. 55-0524, dated February 15, 2010.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	4.1 Table 4 – As Built Foundation Data	Faramarz Gerami	As built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified. Please explain the reason Nominal Resistance is exceeding 2X Allowable Capacity.	We have revised Page 12 of our report accordingly. We have revised Page 12 of our report to indicate nominal resistance as 2 times the allowable pile capacity.
2	Log of Test Borings (LOTB)	Faramarz Gerami	Bottom of footing elevations (Tieback or Type 1) should not be shown on LOTB.	We have revised our LOTB accordingly.

State of California **Business, Transportation and Housing Agency**

M e m o r a n d u m

Flex your power!
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To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: June 7, 2010
File: 12-ORA-57-PM 13.42
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
Ball Road Overcrossing
Bridge No. 55-0524

Subject: 4th Review of the Foundation Report-Addendum

On May 26, 2010, we received an addendum to Foundation Report for the proposed Tieback wall No. 55E0111 at Abutment 3 of the Ball Road OC Bridge No. 55-0524. The subject addendum report including responses dated May 20, 2010, is prepared by Leighton Consulting, Inc.

We have no further comments after reviewing the referenced submittal and responses to our previous review comments dated March 15, 2010. Any questions should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 6/7/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
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REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA

c: OGDS1 - LA. Electronic File
OGDS1 - Sac. Electronic File
GS – Sac. Electronic File

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

TRANSMITTAL

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: June 11, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail		Draft Report	X	Your Use
X	Courier/Overnight	X	Final Report		As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Foundation Report for Proposed Widening of Douglass Overhead (Bridge No. 55-0337) and Protection Wall, Northbound State Route 57, Orange County, California

LEIGHTON CONSULTING, INC.

By: Djan Chandra

Distribution (6) Addressee

17781 Cowan ■ Irvine, CA 92614-6009
949.253.9836 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

FOUNDATION REPORT FOR PROPOSED DOUGLASS OVERHEAD (BRIDGE NO. 55-0337) WIDENING AND PROTECTION WALL, NORTHBOUND STATE ROUTE 57, ORANGE COUNTY, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 57
PROJECT POST MILES: 12.2/15.2, EA # 0F0401

Prepared For:

HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

August 5, 2010

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

August 5, 2010

Project No. 602231-002

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Attention: Mr. Scott Bacsikin

Subject: Foundation Report for Proposed Douglass Overhead (Bridge No. 55-0337) Widening and Protection Wall, Northbound State Route 57, Orange County, California

In response to your request, Leighton Consulting, Inc. has performed a geotechnical exploration for the proposed widening of Douglass Overhead (Bridge No. 55-0337) at northbound State Route 57 (SR-57) in Orange County, California. The bridge widening is part of the proposed widening of northbound SR-57 from approximately 0.3 mile south of Katella Avenue to approximately 0.3 miles north of Lincoln Avenue. This project is sponsored by OCTA and Leighton Consulting has been retained as the geotechnical consultant by HDR Engineering, Inc. The purpose of our study was to evaluate the subsurface conditions at the project site and to provide geotechnical recommendations for design and construction of the foundations of the proposed overhead widening.

Based on the available borings, SR-57 at this location is underlain by approximately 35 feet of man-made fill consisting mainly of stiff to very stiff silty clay and medium dense clayey sand. The fill is further underlain by alluvium consisting predominantly of medium dense to dense, poorly graded sand to a depth of approximately 75 feet below the freeway level (40 feet below Douglass Road grade). The soils below 75 feet to the maximum depth explored (111½ feet) generally consist of silty/clayey sand, sandy silt and silty clay. Groundwater was encountered during our field exploration at a depth of 72 feet below the freeway level (elevation of 131 feet) and 40½ feet below the street level (elevation of 130.5 feet).

17781 Cowan ■ Irvine, CA 92614-6009
949.253.9836 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

This report summarizes the results of our geotechnical exploration and presents geotechnical recommendations for design and construction of the proposed structure. The *General Plan* and *Foundation Plan* of the proposed bridge widening are included at the end of the text of the attached report. A draft version of this report was issued on October 19, 2009 and February 15, 2010 for review by Caltrans and the design team. An addendum report providing response to Caltrans final review comments was issued on May 20, 2010 and approved by Caltrans. Caltrans review comments and our response are included in Appendix C of this report.

As part of the project, a protection wall is proposed near Bent 2 of the overcrossing. A draft version of the Foundation Report for the protection wall was issued on February 15, 2010. An addendum report providing response to Caltrans final review comments was issued on May 20, 2010 and approved by Caltrans. As requested by Caltrans, the Foundation Reports for the protection wall and the bridge widening are hereby combined.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/lr

Distribution: (4) Addressee

Leighton

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1.0 INTRODUCTION

1.1 Project Overview

The California Department of Transportation (Caltrans), District 12, in cooperation with the Orange County Transportation Authority (OCTA), proposes to widen northbound State Route 57 (SR-57) between approximately 0.3 miles south of Katella Avenue (Post Mile 12.2) and approximately 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project segment of SR-57 is approximately 3 miles long, passing through the City of Anaheim in Orange County, California. The purpose of the proposed project is to improve both existing and future mobility, reduce congestion and improve mainline merge and diverge movements.

This segment of SR-57 is relatively flat with elevations ranging from 186 feet at Katella Avenue to 200 feet at Lincoln Avenue. Elevations used throughout this report are referenced to mean sea level (msl). The southern portion of this segment is higher than the surrounding areas while the northern portion is lower. SR-57 was constructed in 1974 and currently has four general purpose lanes and a high-occupancy vehicle (HOV) lane in each direction. Six grade separations exist within this segment; namely at Katella Avenue, Douglass Road, Ball Road, Wagner Avenue, South Street and Lincoln Avenue. The project consists of widening of approximately 3 miles of northbound SR-57 by approximately 35 feet to provide standard lane widths, an additional general purpose lane (fifth lane) and a standard 10-foot wide inside shoulder.

1.2 Project Description

As part of the northbound SR-57 widening project, the existing bridge at Douglass Road will be widened. An existing railroad track is located approximately 15 feet north of Bent 2 of the bridge. A protection wall is proposed between Bent 2 and the railroad track to protect the bent from potential impact due to derailed trains. The approximate location of the project site is shown in Figure 1, *Site Location Map*.

Based on the as-built plan (Caltrans, 1974), the existing Douglass Overhead (Bridge No. 55-0337) was constructed in 1974 and is supported on two abutments and one bent. The as-built elevations of the bridge range from 205.2 to 204.8 feet above mean sea level from south to north. The as-built plan was based on the old datum (NGVD29) and approximately 1.84 feet should be added to the as-built elevations to convert them to the current elevations (Datum NAVD88). The elevation of Douglass Road is approximately

171 feet. The existing bridge, approximately 235 feet long and currently 158 feet wide, will be widened easterly by approximately 20 feet. The widened portion of the bridge will be supported on a pile foundation system similar in type and layout to the existing foundation system. The protection wall will be located along the north of Bent 2 and will be supported on a Cast-In-Drilled-Hole (CIDH) pile foundation system. The *General Plan* and *Foundation Plan* of the proposed bridge widening and protection wall prepared by HDR are included at the end of the text of this report.

1.3 Purpose and Scope

The purpose of this report is to review existing geotechnical data and perform subsurface exploration, laboratory testing and geotechnical analysis to provide geotechnical design recommendations for the proposed project.

Our scope of work for this project included the following tasks:

- *Literature Review*: We reviewed various documents pertinent to the project site including the as-built Log of Test Borings (LOTBs) prepared by Caltrans for the existing Bridge No. 55-0337. The as-built LOTBs are presented in Sheet 4 of 4 of the attached LOTBs. A list of references used in preparation of this report is presented in Section 6.0.

- *Site Reconnaissance:* We performed a site reconnaissance to visually evaluate the accessibility of the site for drilling equipment and locate and mark the proposed boring locations.

- *Subsurface Exploration*: We performed a subsurface exploration that included drilling, logging and sampling of two 8-inch diameter hollow-stem auger borings to a maximum depth of 111½ feet below existing grade of SR-57 freeway. We also advanced one Cone Penetration Test (CPT) to a depth of 80 feet below the existing grade of Douglass Road. Logs of the borings and CPT are included in Sheet 1 of 4 of the attached LOTBs.

- *Laboratory Testing*: Laboratory testing was performed on selected soil samples collected from our field exploration to evaluate the engineering properties of the soils. The laboratory test results are included in Appendix A.

- *Seismic Analysis*: Based upon the encountered subsurface conditions and regional seismicity of the area, we performed ground motion analysis for the project site for use in structural analysis and design.

- *Geotechnical Design and Analysis*: Geotechnical analysis was performed on the collected data to develop recommendations for design and construction. Results of the analysis are included in Appendix B.

- *Report Preparation*: Relevant geotechnical data were compiled in this report along with our findings and recommendations for the proposed project.

2.0 GEOTECHNICAL FIELD AND LABORATORY INVESTIGATIONS

2.1 Subsurface Exploration

Our field exploration consisted of advancing two 8-inch diameter hollow-stem borings to a maximum depth of 111½ feet below the existing grade of SR-57 freeway and one CPT to a depth of 80 feet below Douglass Road grade. Boring A-09-004 was located within the embankment behind the existing Abutment 1 of Douglass Overhead. Boring A-09-005 and CPT-09-006 were located near the proposed bent location. The approximate location of these borings and CPT are shown in the LOTBs.

Standard Penetration Test (SPT) was performed within the hollow-stem borings using a 140-pound automatic hammer falling freely for 30 inches. The samplers were driven for a total penetration of 18 inches and the blow counts were recorded for the last 12 inches of penetration. Relatively undisturbed samples were collected from the borings using the Modified California Ring sampler. The field sampling procedures were conducted in accordance with ASTM Standard Specifications D 1586 and D 3550 for SPT and split-barrel sampling of soil. In addition to driven samples, representative bulk soil samples were also collected from the borings.

The test borings were logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. All samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the borings were backfilled with soil cutting mixed with cement, tamped and capped with rapid set concrete and/or cold mix asphalt. The CPT was performed in accordance with ASTM D 5778. Geotechnical logs of the borings and CPT are included in the LOTBs.

2.2 Geotechnical Laboratory Testing

Laboratory tests were performed on representative soil samples to determine the geotechnical engineering properties of subsurface materials. The following laboratory tests were performed:

- In-situ moisture content and density;
- Atterberg Limits;
- Sand Equivalent;

- Grain-size distribution;
- Percent passing No. 200 sieve;
- Direct shear;
- Expansion Index;
- R-Value; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests, except corrosivity tests, were performed in general accordance with ASTM procedures. The corrosivity tests were performed in accordance with Caltrans procedures. Results of the laboratory tests are presented in Appendix A.

3.0 GEOTECHNICAL FINDINGS

3.1 Geologic Setting

The subject site is located in the Tustin Plain within the southeastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. In general, the Tustin Plain consists of approximately 1,400 feet of unconsolidated to semi-consolidated Quaternary-age alluvial sediments. Underlying the Quaternary alluvial deposits are Tertiary-age bedrock units consisting of sandstone, siltstone, shale and conglomerate on the order of 31,000 feet in thickness.

The site lies near the lower reaches of the Santa Ana River. The surface distribution of Holocene sediments, as recorded in early editions of regional soil survey maps (Eckmann et al., 1916), suggests that the Santa Ana River has recently wandered back and forth across the Orange County coastal plain from Alamitos Bay to Newport Bay. Historical accounts and documents further support the process of widespread sheet flooding being the dominant depositional process associated with the Santa Ana River prior to the construction of Prado Dam in 1941 (California Department of Water Resources, 1957). Currently, the Santa Ana River is located approximately 1,000 feet from the Douglass Overhead. Geology map of the area is presented in Figure 2.

3.2 Subsurface Earth Materials

The subsurface soils encountered in our borings and CPT consist of up to 35 feet of man-made fill underlain by alluvial deposits. The fill is likely associated with the construction of Douglass Road and embankment fills for SR-57 and consists of stiff to very stiff silty clay and medium dense clayey sand and poorly graded sand. The alluvium consists mainly of medium dense to dense, poorly graded sand to a depth of 75 feet below the freeway level (40 feet below the street level). The soils below 75 feet to 95 feet generally consist of medium dense silty and clayey sand and medium stiff to stiff sandy silt and silty clay. The soils below 95 feet to the maximum depth explored (111½ feet) consist of medium stiff to stiff silty clay and sandy silt and medium dense to vey dense silty sand.

We have performed direct shear tests on representative samples collected from our borings. The cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils were found to range from 35 to 60 psf and 28 to 33 degrees, respectively. The test results are presented in Appendix A. Based on these

test results, SPT blowcounts, and soil types, the shear strength parameters and unit weights selected for design are presented in Table 1.

Table 1 – Generalized Soil Profile and Design Parameters

Depth below SR-57 Freeway Grade (feet)	Elevation (feet)	Generalized Soil Type	Total Unit Weight (pcf)	Friction Angle[(1)] (degrees)	Undrained Cohesion, Cu[(1)] (psf)
0 to 35	203 to 168	**Fill**: Silty Clay/ Clayey Sand/ Sand	120	-	1,300
35 to 75	168 to 128	**Alluvium**: Sand	110	33	-
75 to 95	128 to 108	Silty/Clayey Sand/ Sandy Silt	110	32	-
95 to 112	108 to 91	Silty Clay/ Sandy Silt	110	-	1,500

[(1)]Ultimate shear strength parameters based on SPT blow counts (NAFVAC, 1986) and laboratory test results.

3.3 Groundwater

Groundwater was encountered during our field exploration at depths of 72 feet below the freeway level (elevation of 131 feet) in Boring A-09-004 and 40½ feet below the street level (elevation of 130.5 feet) in Boring A-09-005. Groundwater was also encountered in Borings B-1 and B-3 by Caltrans in 1962 at depths ranging from 33 to 34.5 feet below the existing grade (elevation of 134.2 to 135.7 feet msl). The historically high groundwater table is on the order of 30 feet below Douglass Road street grade (CDMG, 1997), corresponding to elevation of 141. The freeway is approximately 34 feet higher than Douglass Road. The groundwater data from the borings are summarized in Table 2. Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff.

Table 2 – Groundwater Tables

Boring No.	SR-57 Station-ing	Offset	Time of Drilling	Total Depth (feet)	Bottom Elevation of Boring[1] (feet)	Groundwater Table	
						Depth below Existing Grade (feet)	Elevations[1] (feet)
A-09-004[2]	289+90	70' RT	2009	111.5	91.5	72.0	131.0
A-09-005[2]	291+60	100' RT	2009	81.5	89.5	40.5	130.5
B-1[3]	291+70	25' LT	1962	82.0	86.7	34.5	134.2
B-3[3]	291+97	26' RT	1962	75.0	93.7	33.0	135.7

[1]Elevations used by Caltrans were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).
[2]Borings by Leighton Consulting
[3]Borings by Caltrans

3.4 Engineering Properties of Subsurface Materials

Engineering properties of the subsurface materials were modeled based on results of geotechnical field and laboratory tests performed during our exploration. Results of these laboratory tests that are applicable to the proposed project are presented in Appendix A. These test results are briefly discussed below:

3.4.1 Shear Strength

Based on direct shear test results, the cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils ranges from 35 to 60 psf and 28 to 33 degrees, respectively. The shear strength parameters used for design are presented in Table 1.

3.4.2 Corrosion Potential

Representative samples of the subsurface soils were subjected to analytical testing to evaluate the potential for corrosion to concrete and ferrous metals. The test results are included in Appendix A and indicate the tested soils exhibited chloride concentration of 40 to 82 parts per million (ppm), sulfate concentration of 33 to 383 ppm, minimum resistivity of 574 to 13,500 ohm-cm, and pH level of 5.7 to 7.7. Caltrans specifications define a corrosive soil as a material in which any of the

conditions exist: a chloride content greater than 500 ppm; soluble sulfate content greater than 2,000 ppm; or a pH of 5.5 or less. Although the pH level of the soils is closed to the borderline of corrosive environment, based on the guidelines established by Caltrans, the subsurface soils at the site are not considered corrosive.

3.4.3 Expansion Potential

Laboratory test performed on near-surface samples indicated that the clayey soils encountered near the existing freeway grade level possess low expansion potential when tested in accordance with ASTM D 4829 (see Appendix A).

3.5 Faulting and Seismicity

Our review of available in-house literature indicates that there are no known active or potentially active faults that have been mapped at the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in southern California. According to the California Geological Survey fault database, the closest active faults that could affect the site are the San Joaquin Hills Blind Thrust, Puente Hills Blind Thrust, and Whittier faults located approximately 12.3 kilometers (km), 13.8 km and 13.9 km, respectively, from the site. Other known regional active faults that could affect the site include the Newport-Inglewood (L.A. Basin), Elsinore (Glen Ivy), and Newport-Inglewood (Offshore) faults. The locations of these faults with respect to the site are shown in Figure 3.

We have performed seismic analysis for the site following Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). Distance of faults to the site was estimated using Caltrans ARS online program and peak ground acceleration for each fault was estimated using Caltrans excel worksheet. The estimated peak ground accelerations caused by various faults near the site are summarized in the following table.

Table 3 – Peak Bedrock Accelerations

Fault	Maximum Magnitude	Distance (km)	Peak Bedrock Acceleration
Peralta Hills	6.2	3.7	0.39g
Compton-Los Alamitos Blind Thrust	6.8	11.8	0.38g
Puente Hills Blind Thrust	7.3	12.3	0.34g
Elsinore fault zone (Whittier Section)	7.6	13.1	0.29g
Elsinore fault zone (Chino Section)	7.6	17.8	0.33g

As shown in the table above, the Peralta Hills fault is the nearest fault to the site at a distance of approximately 3.7 km. A maximum earthquake magnitude of 6.2 has been estimated for this fault, resulting in a peak horizontal ground acceleration of 0.39g at the site. This fault, however, is not included in the latest California Geological Survey fault database.

We have also performed probabilistic seismic analysis using Caltrans ARS online program and USGS deaggregation hazard online program. The peak ground acceleration was calculated to be 0.48g with a deaggregated moment magnitude (Mw) of 6.6. We have used this ground acceleration and earthquake magnitude in our liquefaction analysis.

3.6 Seismic Hazards

3.6.1 Fault Rupture

Based on available literature and reports, no known active faults are known to traverse the project site, and the site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. As such, the principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in the region as discussed in Section 3.5.

3.6.2 Liquefaction

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of

liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading.

The site is located within an area designated as potentially liquefiable on the *California Seismic Hazard Zone Map* (CDMG, 1998). We have performed liquefaction analysis of the soil profiles encountered at Borings A-09-004 and A-09-005 and the profile obtained from the interpretation of the field data collected from CPT-09-006. Based on our borings and CPT, the subsurface soils below the historically high groundwater table of 30 feet below the street grade consist predominantly of loose to dense sand and silt and medium stiff to stiff clay to the maximum depth explored.

The liquefaction analysis was performed using procedures outlined by Youd et al. (2001) and in accordance with the guidelines in the Special Publication 117. The historically high groundwater level of 30 feet below the existing grade of Douglass Road and a peak ground acceleration of 0.48g with a moment magnitude (Mw) of 6.6 were used in the analysis.

The effect of liquefaction is expected to be settlement due to the post-liquefaction consolidation of the soils that experience liquefaction in response to the seismic event. We have used the procedure described by Tokimatsu and Seed (1987) to calculate the liquefaction-induced settlement. The results of our analysis, summarized in Table 4, indicate the presence of sandy soil layers between 30 and 48 feet below the existing street grade (elevations 123 and 137 feet) and 50 and 60 feet (elevations of 108 and 121 feet) that are potentially susceptible to liquefaction.

A CPT sounding yields several hundred continuous data points throughout the soil column, producing a more realistic model of the actual soil profile. SPT sampling from borings generally yields data points at 5-foot intervals; consequently, each data point must be used to estimate the soil characteristics over a representative 5-foot thick layer. If the SPT data point indicates a potentially liquefiable condition, it is assumed that the liquefiable condition exists over the entire representative layer, often an overly conservative assumption. Based on the results of the liquefaction analysis for CPT-09-006, the potentially liquefiable layers are relatively thin (less than a foot). With historically high groundwater, the settlement of these strata was estimated to be less than one inch. Due to the relatively thin layers, liquefaction is not expected to have an adverse impact on the proposed structure.

Table 4 – Results of Liquefaction Analysis

Boring/ CPT No.	Depth of Liquefiable Layer (feet)	Elevation of Liquefiable Layer (feet)	Liquefaction-Induced Settlement (inches)
A-09-004	90 to 95	108 to 113	1.2
A-09-005	50 to 55	116 to 121	0.7
CPT-09-006	30 to 48	123 to 137	0.2
	51 to 54	117 to 120	0.0

3.6.3 Seismically Induced Settlement

Seismically induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). This settlement occurs primarily within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event. The seismically induced settlement at Douglass Road grade was estimated to be on the order of ½ to 1½ inches. The magnitude of the estimated settlement is considered relatively minor, especially considering that the potentially liquefiable layers are relatively deep and thin.

3.6.4 Seisches and Tsunami

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Based on the absence of enclosed bodies of water near the site and the inland location of the site, seiches and tsunami risks at the site are considered negligible.

4.0 GEOTECHNICAL AND FOUNDATION DESIGN RECOMMENDATIONS

Based upon our evaluation of the soils and geologic information, we conclude that the proposed project is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in the design and construction of the project. The recommendations in this report are considered minimum and may be superseded by more stringent requirements of the structural engineer and/or the governing agencies. Leighton should be notified, in a timely manner, of changes in the project plans that might impact recommendations in this report.

4.1 Response Spectra

Caltrans design ARS curve was developed following Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). The ARS curve was first generated using Caltrans ARS online program and then checked against Caltrans deterministic and probabilistic excel worksheets. For the probabilistic approach, the difference between the ARS curve by the online program and the excel worksheet was found to be less than 10 percent. The next step was to input the spectral accelerations from USGS deaggregation hazard online program into the probabilistic excel worksheet to account for basin effects and near-source factors. The difference between the probabilistic ARS curve by Caltrans online program and the one by USGS online program adjusted for basin effects and near-source factors was greater than 10 percent. Therefore, per Caltrans guidelines, the latter ARS curve is recommended as the design curve. The ARS curves and the digitized values for the site are provided in Figure 4.

4.2 As-Built Foundation Data

Based on the as-built plan for the Douglass Overhead (Caltrans, 1974), we have summarized the as-built foundation types and characteristics in Table 5. The nominal resistance shown in the table was calculated using the computer program *APILE* (Reese et al., 2004) considering the skin friction only. The computer printouts are included in Appendix B. Elevations in Table 5 were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).

Table 5 – As-Built Bridge Foundation Data (Caltrans, 1974)

Structure[1]	Pile Size and Type	Pile Cutoff Elevation (feet)	Pile Tip Elevation (feet)	Nominal Resistance[2] (kips)	Allowable Capacity[3] (kips)
Abutment 1[4]	10-inch Square Precast Concrete Pile	188	139.8	180[6]	90
Bent 2[5]	10-inch Square Precast Concrete Pile	162	140.2	180	90
Abutment 3[4]	HP 10 x 42 Steel Pile	188	129.8	180[6]	90

[1]Elevations of freeway and Douglass Road grade are approximately 205 feet and 171 feet, respectively.
[2]A minimum factor of safety of 2.0 should be applied to calculate the allowable capacity.
[3]Design load of 45 tons (90 kips) per the as-built plan (Class 45 precast concrete pile)
[4]Abutments 1 and 3 are supported on two rows of 56 piles total and 40 piles total, respectively, with minimum pile spacing of 3.6 times the pile width.
[5]Bent 2 is supported on two rows of 104 piles total with minimum pile spacing of 3.6 times the pile width.
[6]The upper 19 feet of pile capacity within the existing fill was ignored.

As requested by the structural engineer, we have calculated the lateral capacities of the existing piles using the computer program *LPILE* (Reese and Wang, 2000). The lateral capacities were calculated for both fixed-head and free-head conditions considering lateral displacements of ¼, ½ and 1 inch at the pile head. The results of the analysis are summarized in Tables 6 and 7 for a 10-inch square pile at Abutment 1 and Bent 2 and the computer printouts of the analysis are included in Appendix B. Lateral capacities of the existing HP 10x42 steel pile can be considered similar to the new HP 10x42 piles and the capacities presented in Tables 12 and 13 may be used.

Lateral pile capacities shown in Tables 6 and 7 for the existing concrete piles and Tables 12 and 13 for the HP steel piles are for the leading row (furthest row from the applied load). Per Section 10 of *California Amendments to AASHTO LRFD Bridge Design Specifications* (Caltrans, 2008b), p-multipliers were applied to calculate the lateral capacities of piles where the center-to-center pile spacing is less than 8 times the width of

the piles. Therefore, the lateral pile capacities for other rows of piles for both abutments and bent should be obtained by applying the group reduction factor shown in Table 8.

Table 6 – Lateral Capacities of 10-inch Square Precast Concrete Piles
Abutment 1 – Leading Row (Row 1)

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	8	17	4.3
½	11	28	4.8
1	15	45	5.3

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	16	45	3.6
½	22	72	4.0
1	31	115	4.5

Table 7 – Lateral Capacities of 10-inch Square Precast Concrete Piles
Bent 2 - Leading Row (Row 1)

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	29	33	2.5
½	49	63	2.7
1	70	112	2.9

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	60	101	2.3
½	101	186	2.5
1	141	305	2.8

Table 8 – Group Reduction Factors for Lateral Capacities of Existing Piles

	Group Reduction Factor[1]	
	Row 2	Row 3 and Beyond
Shear	0.83	0.68
Maximum Moment	0.88	0.78
Depth to Maximum Moment	1.10	1.17
Depth to Zero Moment	1.09	1.17

[1]Based on minimum center-to-center spacing of 3.6 times the pile width

4.3 Foundation Type

The subsurface conditions in conjunction with the magnitude of structural load associated with the proposed bridge widening indicate a shallow foundation system is not feasible. Consequently, and for continuity of structural support, the proposed widening of the overhead structure will require a deep foundation system. We understand that the same foundation type as the existing bridge will be used for the proposed widening; i.e., 12-inch square precast concrete piles for Abutment 1 and Bent 2 and HP 10x42 steel piles for Abutment 3. We understand that steel piles are selected for Abutment 3 partly due to the presence of an adjacent overhead power line that limits the overhead space for the pile installation. For the proposed protection wall, considering the magnitude of structural load and overhead clearance, we understand that CIDH pile foundation is the preferred foundation system. The recommendations presented in this report are based upon these pile types. Recommendations for other alternates can be provided upon request.

4.4 Douglass Overhead Widening

4.4.1 Axial Pile Capacities

Soil strength data collected from the exploratory soil borings performed as part of this geotechnical exploration were used to estimate pile design tip elevations for the axial load demands provided by the structural engineer. Design of the precast concrete driven piles and HP 10x42 steel piles has been performed using the

software package *APILE* (Reese et al., 2004) and *Driven* (FHWA, 2001) on the basis of skin friction only. The results of the analysis are included in Appendix B. Based on the provided information, we understand that the minimum center-to-center spacing of the piles will be 3 times the pile width for both abutments and bent.

General information and design loads from the structural engineer are presented in the tables in Appendix B. Table 9 summarizes the structural loads provided by the structural engineer and the corresponding recommended pile tip elevations. The design tip elevations for compression and specified tip elevations were lowered per Caltrans' review comments. It should be noted that the driven pile capacities shown are based on soil strengths alone. The actual structural capacities may be limited to lesser values by the strength of pile materials and connections. The piles and related connections should be evaluated for structural capacity as part of the structural design.

Table 9 – Pile Data Table for Overhead Widening

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (feet)	Specified Tip Elevation (feet)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abutment 1	12-inch square precast concrete pile (Class 90)	170	-	141 [(a)] 144 [(c)] 169 [(d)]	141	170
Bent 2	12-inch square precast concrete pile (Class 90)	180	-	122 [(a)] 132 [(c)] 143 [(d)]	122	180
Abutment 3	HP 10 x 42 Steel Pile (Class 90)	140	-	134 [(a)] 139 [(c)] 169 [(d)]	134	140
Design tip elevations are controlled by: (a) Compression, (c) Settlement, and (d) Lateral Load The specified tip elevation shall not be raised above the design tip elevations for lateral and tolerable settlement.						

Settlements of piles generally result from settlement of the supporting soils and elastic compression of piles. The settlement due to the axial load is expected to be less than ½ inch.

4.4.2 Lateral Pile Capacities

The lateral capacities of piles were calculated using the computer program *LPILE* (Reese and Wang, 2000) for both fixed-head and free-head conditions considering lateral displacements of ¼, ½ and 1 inch at the pile head. The results of the analysis are summarized in Tables 10 through 13 and the computer printouts of the analysis are included in Appendix B.

Table 10 – Lateral Capacities of 12-inch Square Precast Concrete Piles Abutment 1 – Leading Row (Row 1)

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	10	26	5.1
½	14	41	5.9
1	19	65	6.2

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	20	68	4.3
½	28	107	4.8
1	39	170	5.4

Table 11 – Lateral Capacities of 12-inch Square Precast Concrete Piles
Bent 2 – Leading Row (Row 1)

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	32	46	3.2
½	54	86	3.2
1	81	156	3.8

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	66	139	2.9
½	115	257	3.0
1	166	435	3.3

Table 12 – Lateral Capacities of HP 10x42 Steel Pile in Strong Direction*
Abutment 3 – Leading Row (Row 1)

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	9	26	5.1
½	13	41	5.6
1	19	65	6.1

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	20	67	4.2
½	28	106	4.7
1	39	168	5.3

*using moment of inertia Ix

Table 13 – Lateral Capacities of HP 10x42 Steel Pile in Weak Direction*
Abutment 3 – Leading Row (Row 1)

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	6	14	4.1
½	9	22	4.6
1	12	35	5.1

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	13	35	3.4
½	18	56	3.8
1	26	89	4.3

*using moment of inertia Iy

Lateral pile capacities shown in Tables 10 through 13 are for the leading row (furthest row from the applied load). Following the guidelines in Section 10 of *California Amendments to AASHTO LRFD Bridge Design Specifications* (Caltrans, 2008b), the lateral pile capacities for other rows of piles for both abutments and bent should be obtained by applying the group reduction factor shown in Table 14.

Table 14 – Group Reduction Factors for Pile Lateral Capacities

	Group Reduction Factor[(1)]	
	Row 2	Row 3 and Beyond
Shear	0.78	0.60
Maximum Moment	0.85	0.73
Depth to Maximum Moment	1.13	1.19
Depth to Zero Moment	1.10	1.17

[(1)] Based on minimum center-to-center spacing of 3 times the pile width

For Bent 2, per the structural engineer's request, soil spring constants were calculated based on the results of the *LPILE* analysis. The analysis was based

upon the pile tip elevations presented in Table 9. Results of the analysis are summarized in Table 15.

Table 15 – Spring Constants of Bent 2 Pile Group

Spring Constants	Lateral Displacement (inches)					
	Free Head Condition			Fixed Head Condition		
	¼	½	1	¼	½	1
K_δ (K_{11}, Longitudinal Direction, lbs/inch)	2.28E+06	1.92E+06	1.44E+06	4.70E+06	4.09E+06	2.95E+06
K_δ (K_{22}, Transverse Direction, lbs/inch)	1.41E+06	1.19E+06	8.95E+05	2.92E+06	2.54E+06	1.83E+06
k_v (K_{33}, lbs/inch)	1.57E+06					
k_θ (K_{44}, Longitudinal Direction, lbs-inches/radian)	4.35E+12					
k_θ (K_{55}, Transverse Direction, lbs-inches/radian)	1.02E+10					

K_δ: Translational Stiffness, K_v: Axial Stiffness, and K_θ: Rotational Stiffness

4.5 Protection Wall

4.5.1 Axial Pile Capacities

Soil strength data collected from the exploratory soil boring performed as part of this geotechnical exploration were used to estimate pile design tip elevations for the axial load demands provided by the structural engineer. Design of the CIDH piles has been performed on the basis of shaft friction using the procedures outlined by O'Neill and Reese (1999) using the software package *SHAFT*. The results of the analysis are included in Appendix B. Based on the provided information, we understand that the minimum center-to-center spacing of the piles will be 3 times the pile diameter.

Table 16 summarizes the structural loads provided by the structural engineer and the corresponding recommended pile tip elevations based upon our evaluation of pile capacity. It should be noted that the CIDH pile capacities shown are based on soil strengths alone. The actual structural capacities may be limited to lesser values by the strength of pile materials and connections. The piles and related connections should be evaluated for structural capacity as part of the structural design.

Table 16 – Pile Data Table for Protection Wall

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (feet)	Specified Tip Elevation (feet)
		Compression	Tension		
Protection Wall	24-inch Diameter CIDH Pile	35	-	159 (a) 159 (c) 139 (d)	139.0
Design tip elevations are controlled by: (a) Compression, (c) Settlement, and (d) Lateral Load The specified tip elevation shall not be raised above the design tip elevations for compression, lateral and tolerable settlement.					

Settlements of piles generally result from settlement of the supporting soils and elastic compression of piles. The settlement due to the axial load is expected to be less than ½ inch.

4.5.2 Lateral Pile Capacities

The lateral capacities of a 24-inch diameter CIDH pile were calculated using the computer program *LPILE* (Reese and Wang, 2000). A shear force of 80 kips and moment of 640 kips-feet, as provided by the structural engineer, were applied at the top of the CIDH pile. The analyses were based upon the pile length indicated in Table 16 and a reduced or effective Moment of Inertia ($I_{effective}$) per the structural engineer.

The results of the analysis are summarized in Table 17 and the computer printouts of the analysis are included in Appendix B. Following the guidelines in Section 10 of *California Amendments to AASHTO LRFD Bridge Design Specifications* (Caltrans, 2008b), the lateral pile capacities shown in Table 17 were calculated considering p-multiplier of 0.9 (perpendicular loading case with the pile spacing of 3 times of pile diameter).

Table 17 – Lateral Capacities of 24-inch Diameter CIDH Pile

Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
2	80	840	4.1

4.6 Lateral Resistance of Pile Cap

Passive earth pressure developed against the pile caps can be used to resist a portion of the lateral loads transferred from the substructure to the soil during a seismic event. The earth pressure resisting the pile cap can be assumed to have a trapezoidal distribution that increases linearly from the top of the pile cap to the bottom of the pile cap. An equivalent passive fluid pressure of 400 pound per square foot (psf) per foot and 150 psf/foot may be used to calculate the passive pressure for level and sloping ground in front of the pile cap, respectively.

Development of full passive earth pressure in clayey soil requires a lateral pile cap displacement equal to 3 percent of the pile cap thickness. Development of full passive earth pressure in sandy soil requires a lateral pile cap displacement equal to 0.2 percent of the pile cap thickness (NAVFAC, 1986). Soil surrounding and above pile caps should be placed and compacted in accordance with Section 19-3 of the Caltrans *Standard Specifications* (Caltrans, 2006a) and in accordance with Section 5.4 of this report. Pile caps should be backfilled with the low expansion material (Expansion Index (EI) < 50 and Sand Equivalent (SE) > 20).

4.7 Lateral Earth Pressure and Load Resistance

Earth retaining structures including abutment walls and wing walls may be designed using a lateral "equivalent-fluid" earth pressure of 39 pcf for an active condition. This value does not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design. The design value indicated above is based upon drained conditions. Proper drainage should be provided behind the walls in accordance with Caltrans *Standard Plan B-03* (Caltrans 2006d) to prevent buildup of hydrostatic pressure behind the walls. A soil unit weight of 125 pcf may be assumed for calculating the actual weight of the soil. In addition to the above

lateral pressures from retained earth, lateral pressures from other superimposed loads, such as those from adjacent structures or vehicles, should be added per the Section 6 of Caltrans *Trenching and Shoring Manual*.

For seismic loading, an inverted triangular pressure distribution of 18 pcf (equivalent fluid pressure) may be used in addition to the static earth pressures. These seismic earth pressures may be assumed to act at 0.6H from the bottom of the wall and are applicable for both cantilever and braced conditions. Forces resulting from wall inertia effects are expected to be relatively minor for non-gravity walls and may be ignored in estimating the seismic lateral earth pressure. A maximum passive pressure of 5.0 ksf may be used for seismic design of abutment walls per Caltrans *Seismic Design Criteria* (2006b).

4.8 Allowable Bearing Capacity

We understand that a cantilever wing wall is proposed perpendicular to Abutments 1 and 3. An allowable soil bearing pressure of 2,500 psf may be used for design of the wing wall footings having a minimum width of 12 inches and a minimum embedment of 24 inches below the lowest adjacent ground surface. The bottom edge of the wing wall footings should have a minimum horizontal distance of 5 feet from the slope face.

4.9 Approach Fill

Based on the existing topography at the site, widening of northbound SR-57 will require imported fill. The imported materials within the upper 4 feet of finished grade should have a minimum R-value of 40 and should be non-corrosive. Class 3 aggregate subbase can be used for the imported material for upper 4 feet of finished grade.

The abutments should be backfilled in accordance with Sections 19-3.06 and 19-3.065 of Caltrans *Standard Specifications*. The zone shown in Figure 5.4 of *Caltrans Guidelines for Structures Foundation Reports* (Caltrans, 2006c) should consist of material free of organic material and construction debris, with EI less than 50 and SE greater than 20.

The slopes of the existing embankments should be benched into a minimum of 6 feet horizontally as the new fill is brought up in layers. Excavated material should be recompacted along with the new embankment material. All materials and placement should conform to Sections 19-6 and 19-7 of Caltrans *Standard Specifications*.

Based on our borings, the subsurface soils consisted of sandy materials. Due to the nature of sandy soils, immediate settlement is expected to occur during or within a short period after placement of the embankment/approach fill. The immediate settlement of the subsurface soil below the street grade was estimated using the Schmertmann's method. The settlement was estimated to be on the order of ½ inches.

4.10 Structure Approach Slab

Structure approach slab provides a smooth transition between freeway pavement and bridge structure. Design of the structure approach slab should be in accordance with *Memo to Designer 5-3* (Caltrans, 1992). Structure approach slab should extend the full width of the widening including shoulder and per *Highway Design Manual* (Caltrans, 2008b), it is recommended that dowel bars be placed at the transverse joint between the structure approach slab and new rigid pavement to ensure load transfer at the joint.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Driven Pile Construction Consideration

Vibrations associated with pile driving may potentially cause distress to adjacent improvements. Noise during pile driving may also cause disturbance to people occupying the adjacent buildings. The pile driving contractors should be informed about the potential concerns so that they can use equipment and/or implement measures that will minimize noise and vibration during the pile driving. The conditions of existing adjacent improvements should be documented by surveying, video tapes, photographs, and other means before, during and after the pile driving. The noise and vibration associated with pile driving should be addressed before the commencement of the pile driving program. The installation of pile should be in accordance with the Section 49 of *Caltrans Standard Specifications.* Section 49-1.06 of Caltrans *Standard Specifications* should be followed for the abutment piles extending through more than five feet of fill. Pile drivability analysis should be performed prior to the pile installation to aid in selection of the hammer type and develop pile driving acceptance criteria.

Based on observation during our site visits, an existing overhead power line and existing railroad tracks are located north and south of Abutment 3, respectively. The contractor should evaluate site accessibility of the pile driving equipment prior to construction.

5.2 CIDH Pile Construction Consideration

CIDH piles will be constructed using the conventional soil augering equipment and technique to advance the drilled hole and remove soil cuttings. The drilling operations are recommended to be observed and evaluated by a representative of the geotechnical engineer to allow further evaluation of the actual subsurface conditions. Based on the available borings, caving may occur during drilling due to the granular nature of the soil. Since the existing Bent 2 piles are in close proximity of the proposed CIDH piles, temporary casing or drilling slurry should be employed to facilitate construction of the CIDH piles. The installation/removal of temporary casing or the use of slurry for borehole stability should be in accordance with the Caltrans *Standard Specifications* to reduce the potential for adversely affecting the frictional resistance of the soils and, thereby, reducing the load capacity of the piles. If wet method is used for the CIDH pile installation, Gamma-Gamma tests should be performed to verify the integrity of the piles and the tests should be performed in accordance with Caltrans specifications.

The construction of the piles should also include considerations with regard to temporary stability of the boreholes and sequence of construction. To maintain a relatively clean hole and to achieve high quality CIDH pile construction, it is recommended that the entire construction operation including drilling of the CIDH pile, lowering of the reinforcing cage, and the concrete placement, be carried out consecutively in the same day. Boreholes that are successfully advanced by the dry method are recommended to be left open in an unsupported condition for the minimum length of time as permitted by construction, but not longer than one day. Consequently, the reinforcing steel is recommended to be set and the concrete placed within one day of drilling to reduce the potential for caving. We further recommend that the use of a drop chute or a tremie pipe with pump concrete be considered to avoid concrete segregation during CIDH pile construction.

The sequence of pile construction is of importance with respect to the spacing of the pile groups. The drilling sequence should be such that for every pile drilled, at least one pile is skipped. The piles adjacent to the freshly poured pile may only be drilled a minimum 24 hours after placement of concrete or as directed by the structural engineer considering concrete curing and concrete strength.

5.3 Groundwater Control

Based on the current and previous field explorations, groundwater levels are expected to be approximately 40 feet below the existing street grade. However, localized perched groundwater may exist at shallower depths on a seasonal basis. Relatively shallow groundwater inflow may be controlled by a system of collection ditches and sump pumps.

5.4 Temporary Excavations

Excavations for pile caps or other appurtenant structures that are 5 feet or deeper should be laid back or shored in accordance with OSHA requirements before personnel are allowed to enter. For temporary excavations greater than 5 feet in depth that cannot be adequately sloped for stability, some form of temporary external support will be required. In consideration of the type of construction, the most practical method is expected to be excavation bracing. The lateral earth pressure for this type of shoring is estimated as 25H pcf where H is the depth of excavation and the resulting lateral pressure distribution is rectangular pressure. This above lateral pressure is only appropriate for level backfill and a drained condition behind the shoring. Shoring should also be designed to resist lateral surcharge from adjacent vehicular traffic, construction equipment, and existing structures.

5.5 Earthwork

Onsite soils to be used as compacted structural fill should be free of organic material and/or construction debris. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches for structural fill placement, moisture-conditioned as necessary to within three percent above optimum, and compacted to a minimum of 90 percent of the maximum density as determined by Caltrans Test Method 216. Embankment fill within 150 feet of bridge abutment should be compacted to a minimum of 95 percent relative compaction. Crushed aggregate base should be compacted to a minimum of 95 percent relative compaction. Subgrade within a depth of 30 inches below the finished grade should also be compacted to at least 95 percent relative compaction. Earthwork should be in accordance with Section 19 of Caltrans *Standard Specifications.*

5.6 Slope Paving

Based on the provided plan, full slope paving is proposed at each abutment area. Slope paving can be constructed of either shotcrete or Portland cement concrete. The slope should be no steeper than 1:1½ (vertical:horizontal). The subgrade receiving slope paving should be evenly graded and compacted at or near the optimum moisture to provide firm and non-yielding support and to prevent absorption of water from the concrete or mortar, but should not contain free surface water. Slope paving should be in accordance with Section 72-6 of Caltrans *Standard Specifications.*

5.7 Additional Geotechnical Services

The proposed construction involves various activities that would require geotechnical observation and testing. These include:

- Placement of compacted fill;
- Pile cap excavation;
- Driven pile installation;
- CIDH pile installation; and
- Footing excavation, if any.

These and other soils related activities should be observed and tested by a qualified representative of the geotechnical engineer.

Geotechnical recommendations presented in this report are based on the conditions encountered at the test boring locations and information gained from review of as-built plans as well as our understanding of the current project plan. Our recommendations should be revised, as necessary, based on the actual soil condition and any modification of the current plans, and incorporated into the final design plans and specifications. Conclusions and recommendations presented in this report should be reviewed and verified by the geotechnical engineer during site construction and revised accordingly, if exposed geotechnical conditions vary from our current understanding and interpretations.

6.0 REFERENCES

The following references were used in preparation of this report:

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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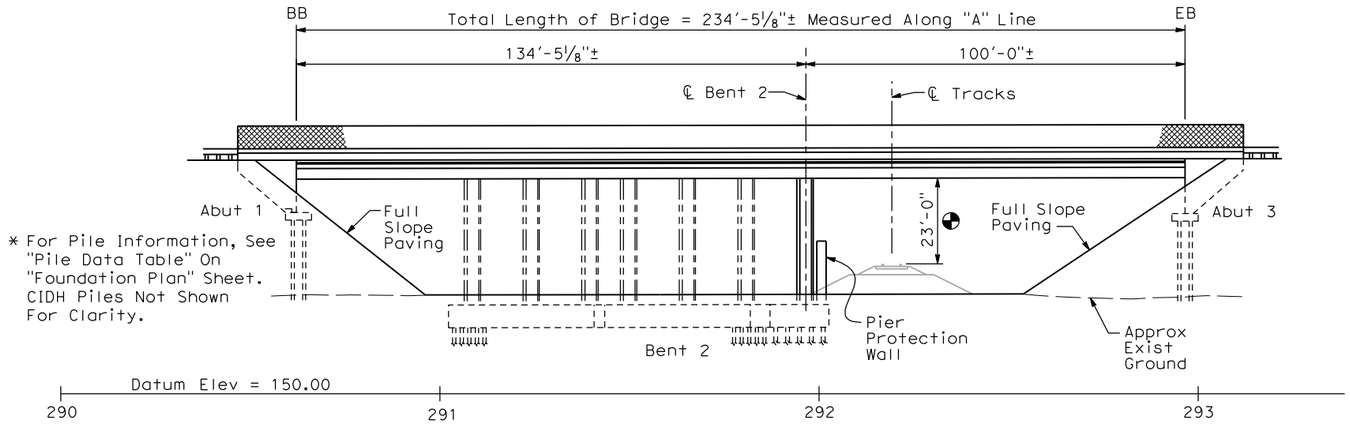
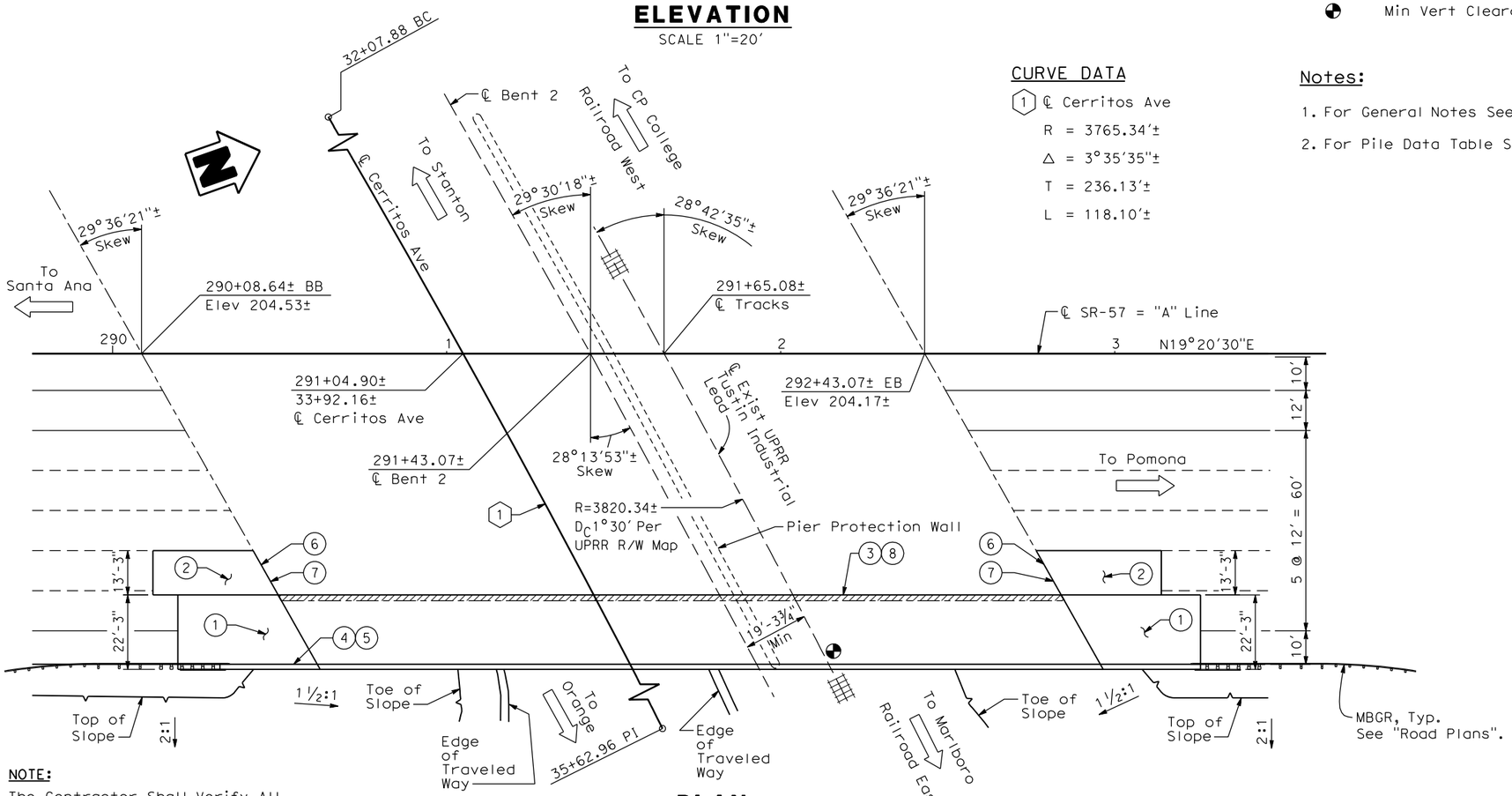


ELEVATION

SCALE 1"=20'



PLAN

SCALE 1"=20'

LEGEND

1. Structure Approach Slab Type N(30D)
2. Structure Approach Slab Type R(30D)
3. Remove Exist Type 9 Barrier And Salvage Metal Railing
4. Paint "DOUGLASS OVERHEAD"
5. Paint "BRIDGE No. 55-0337" And Year Constructed
6. Joint Seal Replacement (Exist)
7. Paving Notch Extension
8. Existing Fiber Optic Line To Be Relocated

Indicates Bridge Removal (Portion)
Indicates New Construction
Indicates Foundation or Hidden Lines
Indicates Existing Structure
Min Vert Clearance 23'-0" (Structure)

CURVE DATA

(1) ℄ Cerritos Ave
R = 3765.34'±
Δ = 3°35'35"±
T = 236.13'±
L = 118.10'±

Notes:

1. For General Notes See "Index To Plans" Sheet.
2. For Pile Data Table See "Foundation Plan" Sheet.

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

DESIGN OVERSIGHT	DESIGN	BY J. Ramirez	CHECKED W. Chu	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE
SIGN OFF DATE	DETAILS	BY E. Gray	CHECKED W. Chu	LAYOUT: BY J. Ramirez	CHECKED W. Chu
	QUANTITIES	BY J. Ramirez	CHECKED Z. Daniel	SPECIFICATIONS: BY E. Johnson	PLANS AND SPECS COMPARED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55-0337
POST MILES 13.0

DOUGLASS OH (WIDEN)
GENERAL PLAN NO. 1

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 1 OF 27

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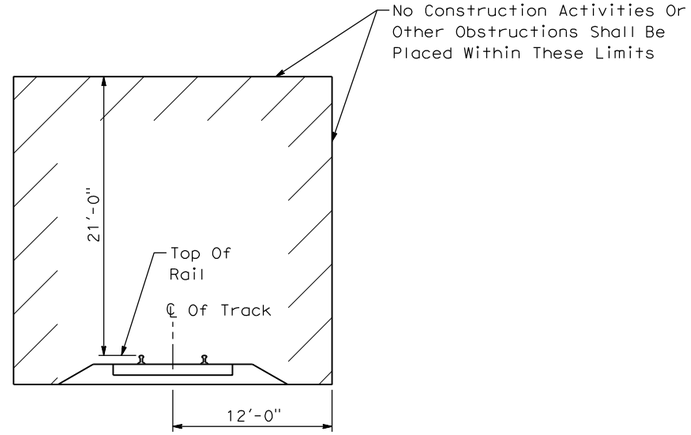


MINIMUM CONSTRUCTION CLEARANCE ENVELOPE

NTS

LEGEND

(3) Remove Exist Type 9 Barrier And Salvage Metal Railing

(4) Paint "DOUGLASS OVERHEAD"

(5) Paint "BRIDGE No. 55-0337" And Year Constructed

(8) Exist Fiber Optic Line To Be Relocated

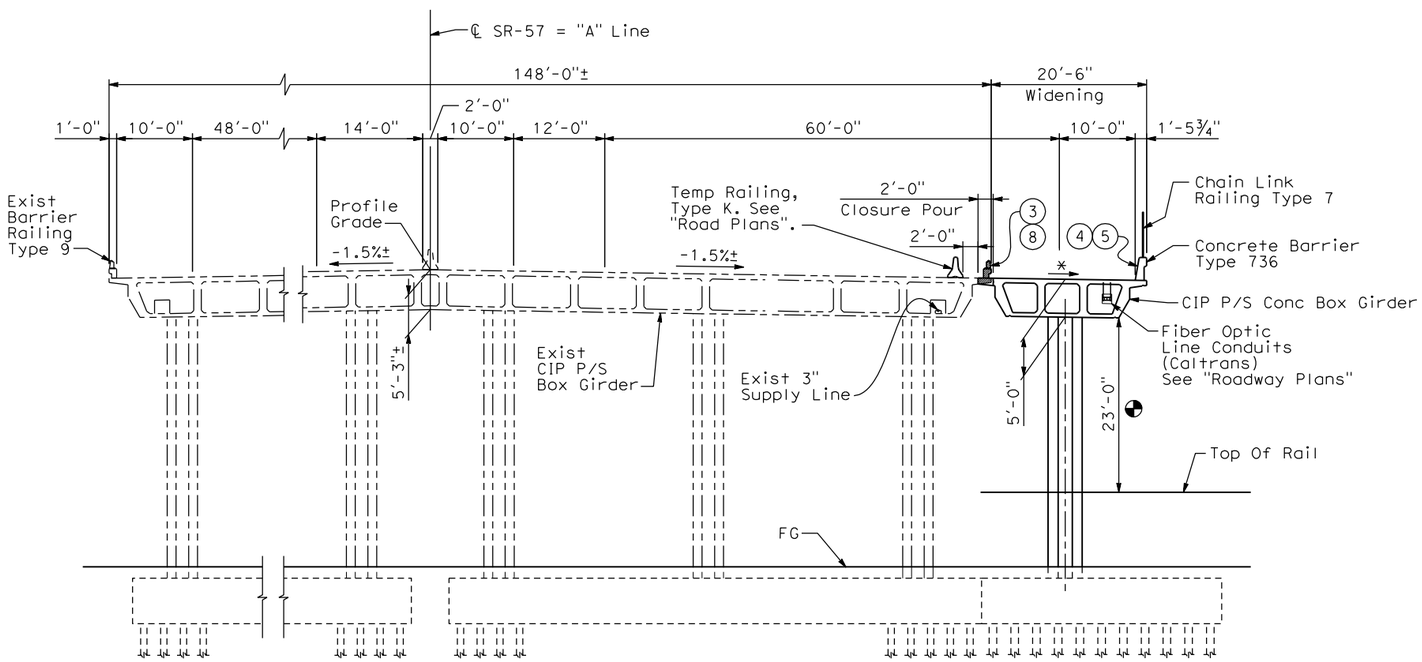
Indicates Bridge Removal (Portion)

Indicates New Construction

Indicates Foundation or Hidden Lines

Indicates Existing Structure

Min Vert Clearance 23'-0" (Structure)



TYPICAL SECTION

SCALE 1"=10'

* Match Existing

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

BENCHMARKS AND DATUM

BASIS OF BEARINGS

The Bearings Shown Hereon Are Based Upon The Bearing Between OCS Horizontal Control Station GPS No. 0560 And Station 0111 Being North 4°59'28" East, Per Records On File In The Office Of The County Surveyor.

DATUM STATEMENT

Coordinates Shown Are Based On The California Coordinate System (CCS83), Zone VI, 1983 NAD, (1991.35 Epoch OCS GPS Adjustment). All Coordinates Shown Are Grid, Unless Otherwise Noted. The Average Combination Factor Of The Two Stations Listed Above Is 0.99999204.

BENCHMARK

Elevations Shown Hereon Are Based On OCS Vertical Control Data Sheet Designation 1K-29-80 As Elevation 202.237' NAVD 88 (OCS 2006 Adjustment), Per Records On File In The Office Of The County Surveyor.

Designation: 1B-99-99

Elevation: 158.271 (NAVD 88; Year Leveled-2006)

Description:
Described By OCS 2002 - Found 3¾" OCS Aluminum Benchmark Disk Stamped "1B-99-99", Set In The Southeast Corner Of A 4' By 22' Concrete Catch Basin. Monument Is Located In The Northwesterly Corner Of The Intersection Of Katella Avenue And Howell Street, 48' Northerly Of The Centerline Of Katella Avenue And 125' Westerly Of The Centerline Of Howell Street. Monument Is Set Level With The Sidewalk.

DESIGN OVERSIGHT	DESIGN	BY J. Ramirez	CHECKED W. Chu	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE
SIGN OFF DATE	DETAILS	BY E. Gray	CHECKED W. Chu	LAYOUT: BY J. Ramirez	CHECKED W. Chu
	QUANTITIES	BY J. Ramirez	CHECKED Z. Daniel	SPECIFICATIONS: BY E. Johnson	PLANS AND SPECS COMPARED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55-0337
POST MILES 13.0

DOUGLASS OH (WIDEN)
GENERAL PLAN NO. 2

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
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REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 2 OF 27

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

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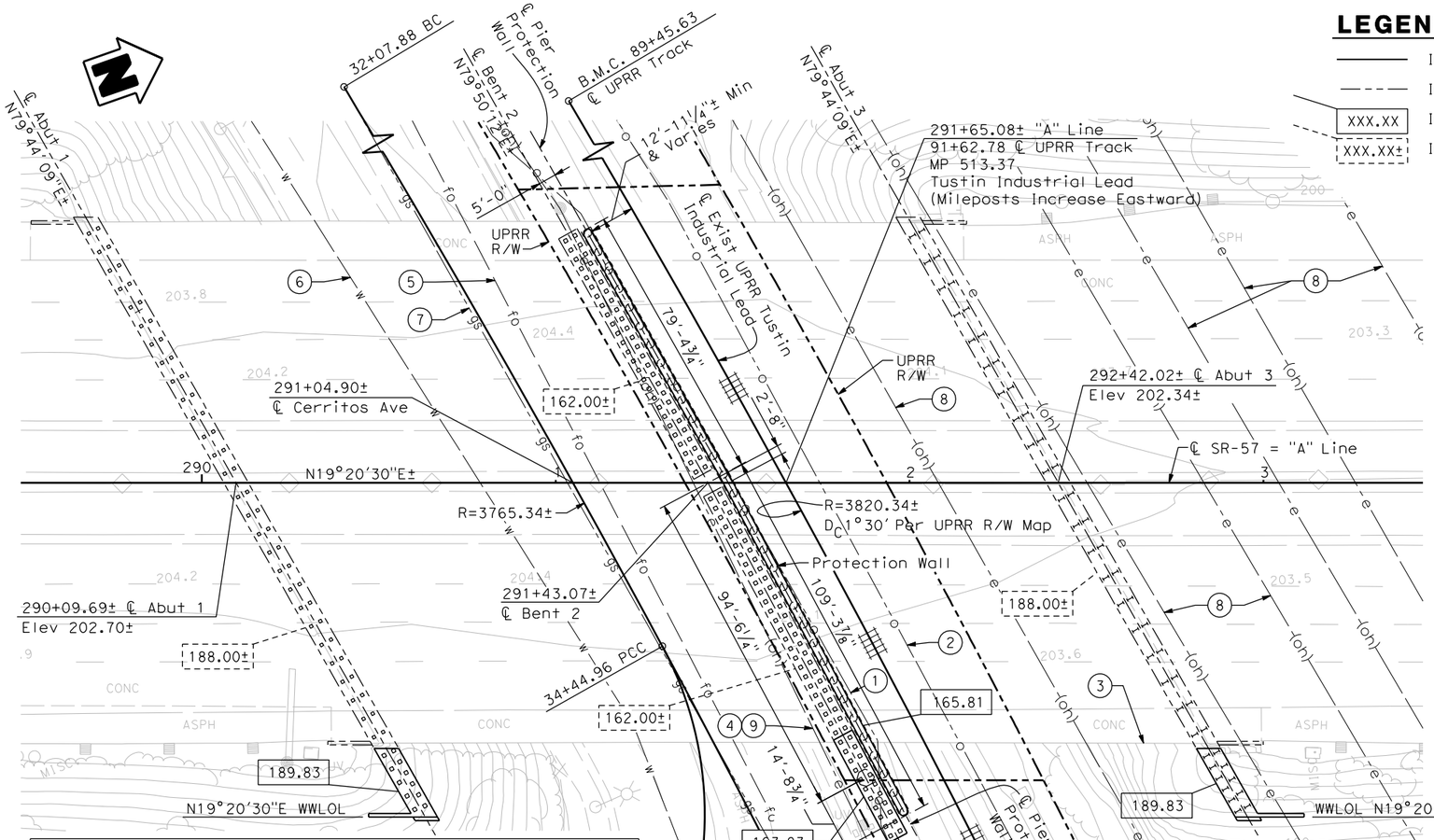
LEGEND

- Indicates New Construction
- Indicates Existing
- XXX.XX Indicates Bottom Of Footing Elevation
- XXX.XX± Indicates Bottom Of Exist Footing Elevation



PLAN

SCALE 1"=20'

PILE DATA TABLE (DRIVEN PILES)

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abut 1	Conc Pile, Class 90 Alt X	170	-	141.0(a) 144.0(c) 169.0(d)	141.0	170
Bent 2	Conc Pile, Class 90 Alt X	180	-	122.0(a) 132.0(c) 143.0(d)	122.0	180
Abut 3	HP 10x42 Steel Pile	140	-	134.0(a) 139.0(c) 169.0(d)	134.0	140

Notes:
1. Design Tip Elevations Are Controlled By:
   (a) Compression; (c) Settlement; (d) Lateral Load.
2. The Specified Tip Elevation Shall Not Be Raised Above The Design Tip Elevations For Lateral And Tolerable Settlement.

PILE DATA TABLE (CIDH PILES)

Location	Pile Type	Cut-off Elevation (ft)	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)
			Compression	Tension		
Protection Wall	24" Dia CIDH	166.06	35	-	159.0(a) 159.0(c) 139.0(d)	139.0

Notes:
1. Design Tip Elevations Are Controlled By:
   (a) Compression; (c) Settlement; (d) Lateral Load.
2. The Specified Tip Elevation Shall Not Be Raised Above The Design Tip Elevations For Compression, Lateral, And Tolerable Settlement.

EXISTING UTILITY LINES TABLE

(BASED ON AS-BUILT DATA)

NO.	UTILITY	OWNER	ACTION
1	10" Oil (Idle)	Kinder Morgan	To Be Abandoned
2	16" HP Oil	Kinder Morgan	Protect In Place
3	2-4" FO Cond	Caltrans	To Be Relocated
4	12 KV OH	City Of Anaheim	Protect In Place
5	FO	Adelphia	Protect In Place
6	10" Water	City Of Anaheim	Protect In Place
7	4" Gas	So Cal Gas	Protect In Place
8	High Tension OH	So Cal Edison	Protect In Place
9	CATV OH	Adelphia	Protect In Place

NOTE:
The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

ABBREVIATIONS

HP = High Pressure
FO = Fiber Optic
KV = Kilovolts

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

DESIGN OVERSIGHT	SCALE: 1"=20'	VERT.DATUM	HORZ.DATUM	DESIGN BY J. Ramirez	CHECKED W. Chu
	PHOTOGRAMMETRY AS OF:	ALIGNMENT TIES		DETAILS BY E. Gray	CHECKED W. Chu
SIGN OFF DATE	SURVEYED BY E. Martinez	DRAFTED BY		QUANTITIES BY J. Ramirez	CHECKED Z. Daniel
	FIELD CHECKED BY D. Williams	CHECKED BY			

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55-0337
POST MILE 13.0

DOUGLASS OH (WIDEN)
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 4 OF 27

FILE => ...\d0108857\55-0337r-e-fp101.dgn

USERNAME => egray DATE PLOTTED => 08\02\10 TIME PLOTTED => 9:31:08 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

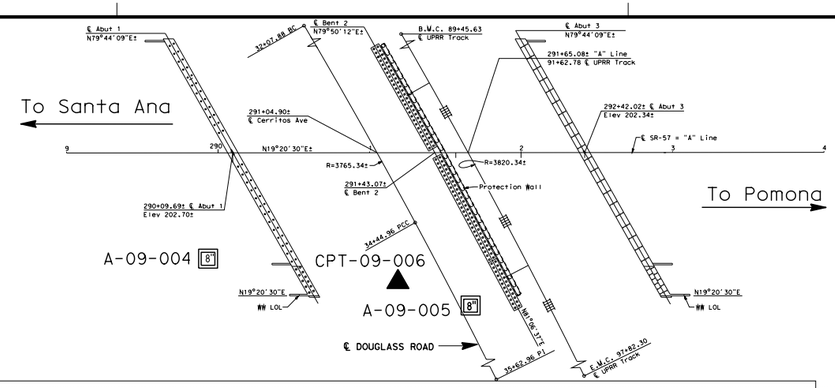
LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

BENCH MARK

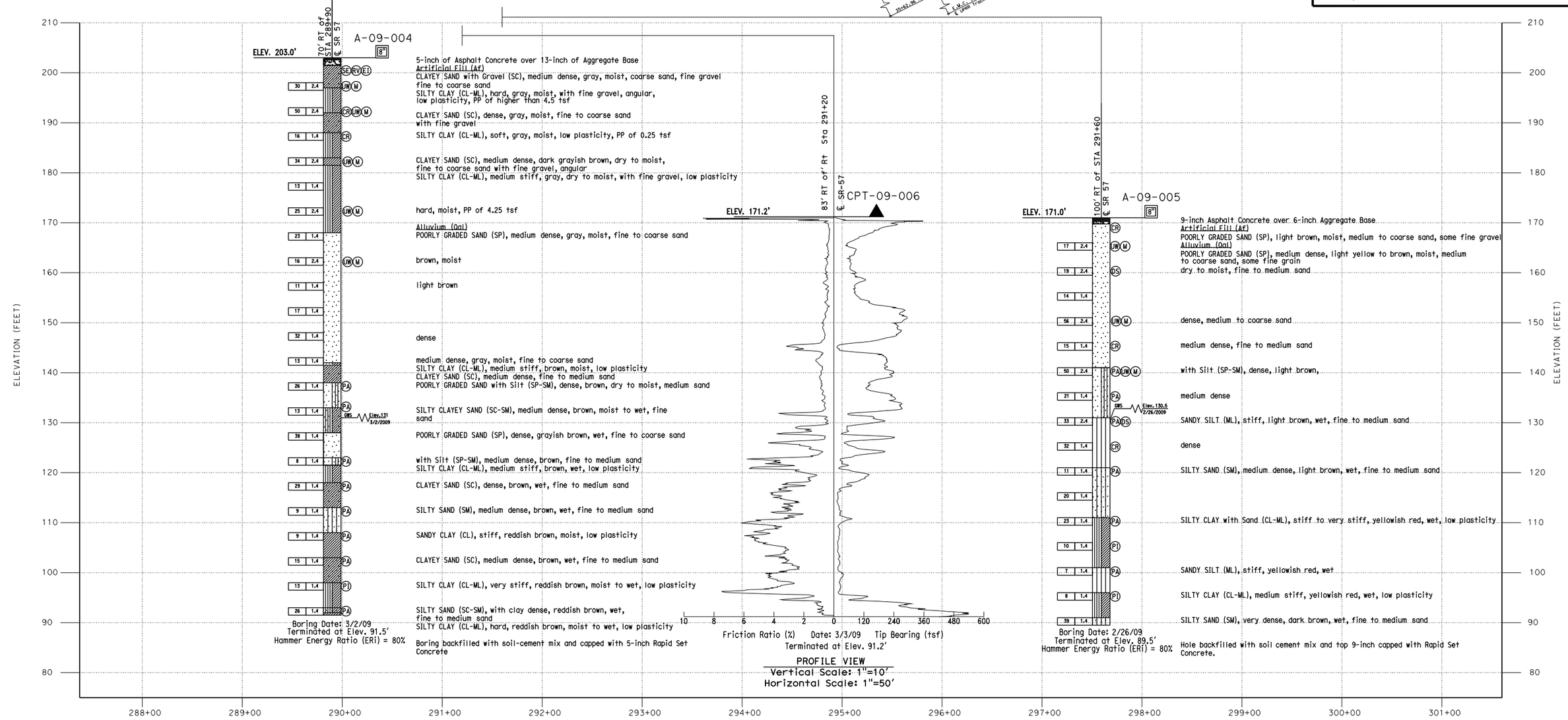
ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.



PLAN VIEW
Scale: 1"=50'



DESIGN OVERSIGHT	DRAWN BY Buu Tran	Amit Bakane FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55-0337
SIGN OFF DATE	CHECKED BY Taekuk Kim	DATE: 2/26/09, 3/2/09 AND 3/3/09			POST MILES 12.98

DOUGLASS OH (WIDEN)
LOG OF TEST BORINGS 1 OF 4

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES: 10/09 2/10 5/10 6/10

SHEET 24 OF 27

FILE => 55-0337r-z-ltb01.dgn

DATE PLOTTED => 03-AUG-2010 TIME PLOTTED => 10:15

USERNAME => btran

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

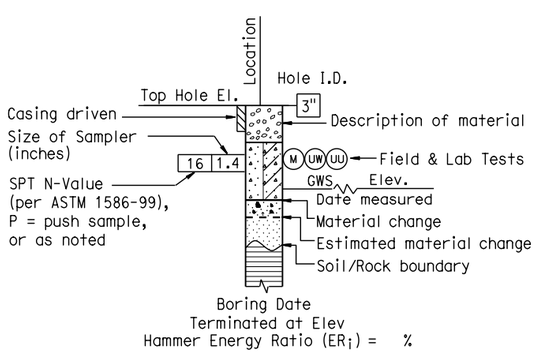
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
[ ]	O	Other

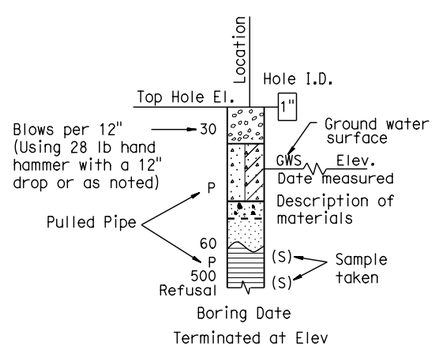
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

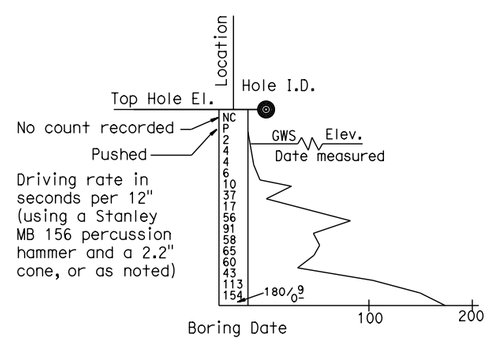
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



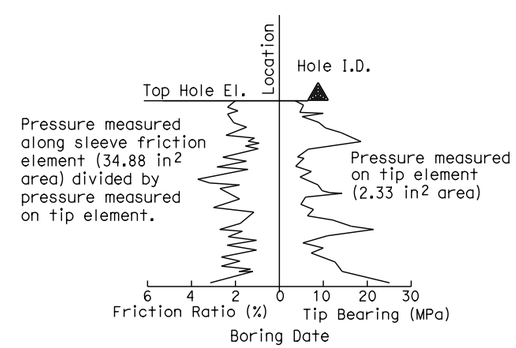
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT SIGN OFF DATE	DRAWN BY Buu Tran CHECKED BY Taekuk Kim	Amit Bakane FIELD INVESTIGATION BY: DATE: 2/26/09, 3/2/09 AND 3/3/09	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55-0337 POST MILES 12.98

DOUGLASS OH (WIDEN)
LOG OF TEST BORINGS 2 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 10/09 2/10 5/10 6/10

REVISION DATES

SHEET 25 OF 27

FILE => FIGURE-2-Dougla_2of4.dgn

USERNAME => btran DATE PLOTTED => 06-JUL-2010 TIME PLOTTED => 15:47

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY Buu Tran

CHECKED BY Taekuk Kim

Amit Bakane
FIELD INVESTIGATION BY:
DATE: 2/26/09, 3/2/09 AND 3/3/09

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Djan Chandra
PROJECT ENGINEER

BRIDGE NO. 55-0337
POST MILES 12.98

DOUGLASS OH (WIDEN)
LOG OF TEST BORINGS 3 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10 6/10

REVISION DATES

SHEET 26 OF 27

FILE => FIGURE-2-Dougla_3of4.dgn

USERNAME => btran DATE PLOTTED => 06-JUL-2010 TIME PLOTTED => 15:49

FED. ROAD DIV. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
7	CAL.				

DIST.	COUNTY	ROUTE	SECTION	SHEET NO.	TOTAL SHEETS
VII	Ora	57	15.5/16.6	300	443

C.E. Barker
DISTRICT ENGINEER (OFFICIAL) DISTRICT CIVIL ENGINEER NO. 1966
DATE APPROVED December 18, 1972

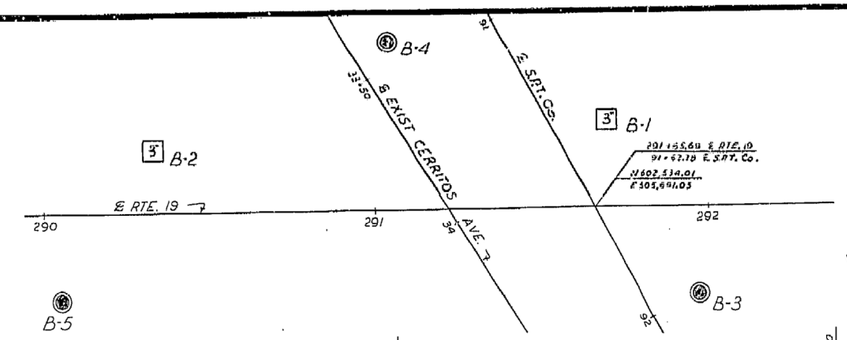
REGISTERED PROFESSIONAL ENGINEER JOHN CHANDLER No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

BENCH MARK #12-19A-56

C.S.T. & W. in E. side of 24" Euc tree, 3' above grnd. 27.5' S. of ℄ of Cerritos Ave. on ℄ Wasser Rd. prod., 71' N. & 27' E. of N.E. cor. of one-story frame house.

ELEV. 171.47

To convert to current datum NAVD88, approximately 1.84 feet should be added to the as-built elevations.



PLAN
Scale: 1"=20'

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED ENGINEER-GEOTECHNICAL

DOUGLASS OH (WIDEN)

LOG OF TEST BORINGS 4 OF 4

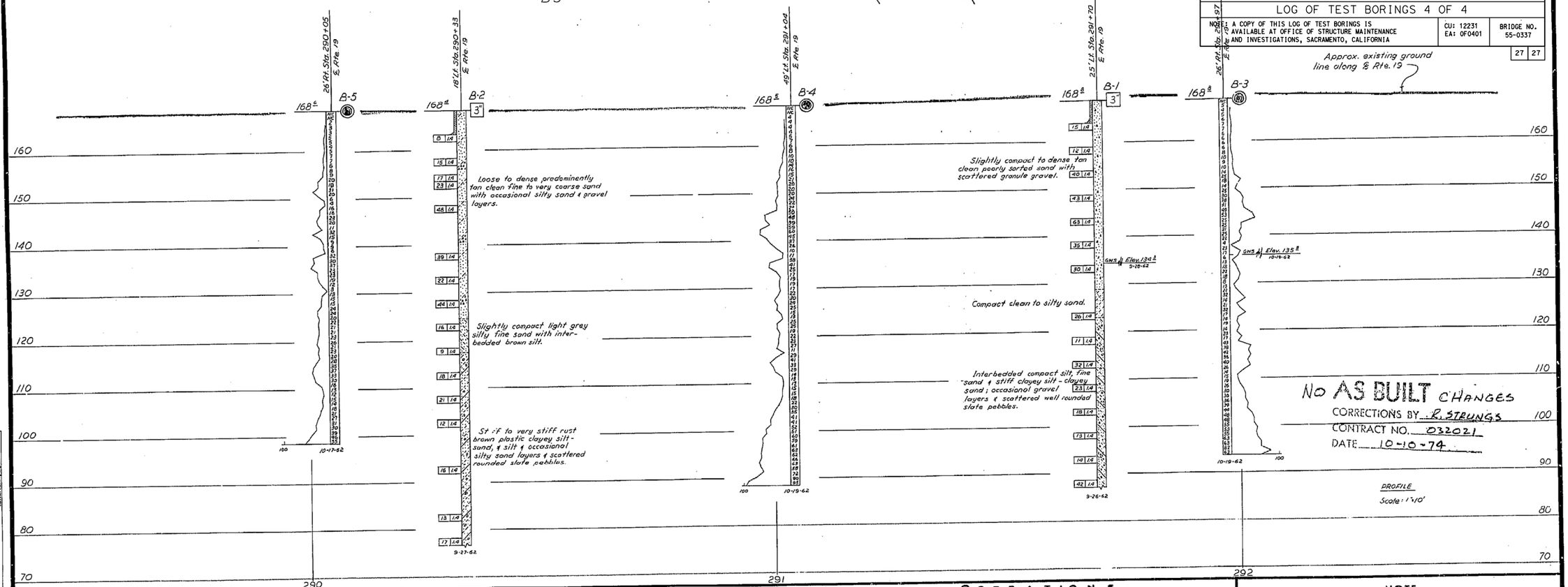
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 12231
EA: 0F0401

BRIDGE NO. 55-0337

27 | 27

BRIDGE DEPARTMENT



No AS BUILT CHANGES
CORRECTIONS BY R. STRUNGS
CONTRACT NO. 032021
DATE 10-10-74

PROFILE
Scale: 1"=10'

DRAWN By: K. Tochino 11-19-62
CHECKED By: J. Ensign 11-19-62
Approval Recommended by: Bridge Foundation Engineer
Bridge Foundation Engineer

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

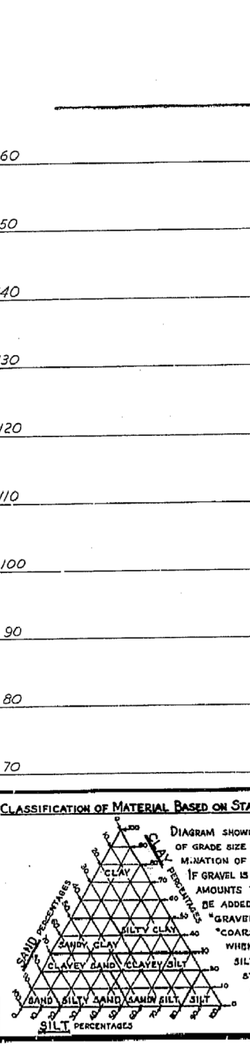


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

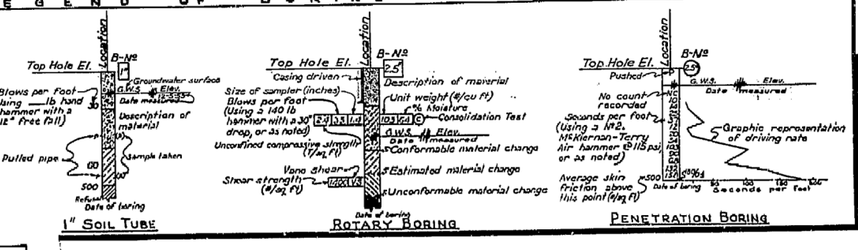
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ, "GRAVELLY SAND." THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND/OR ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PENETROMETER
- 2¼" CONE PENETROMETER
- SAMPLER BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT



NOTE

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

SHEET 15 OF 15

DOUGLASS OVERHEAD

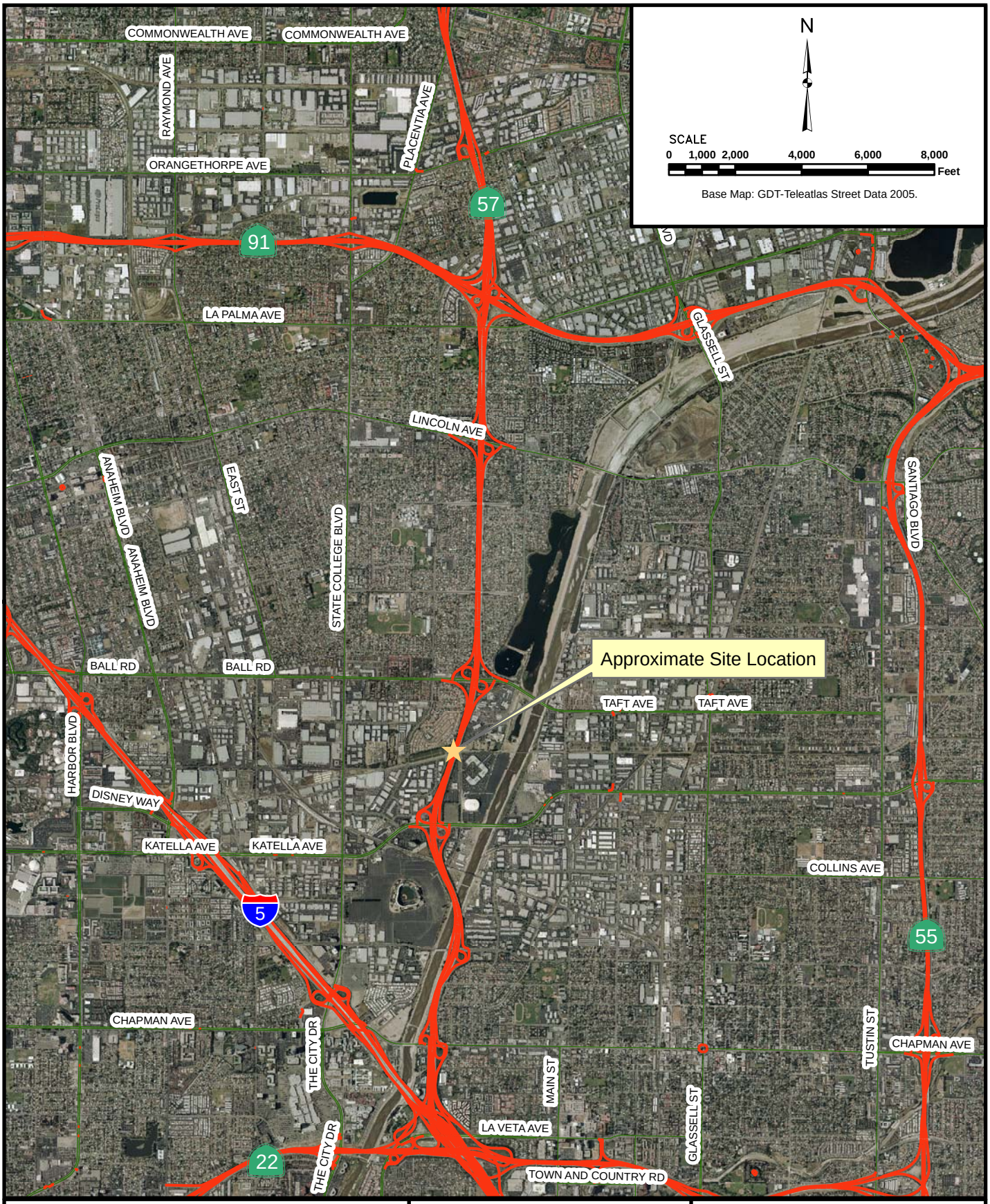
LOG OF TEST BORINGS

SCALE As Noted | BRIDGE 55-337 | FILE | DRAWING

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000 6373

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 1/29/75 SIGNATURE



Douglass Road Undercrossing Widening
Northbound SR-57 Widening
Orange County, California

SITE LOCATION MAP

Project No.

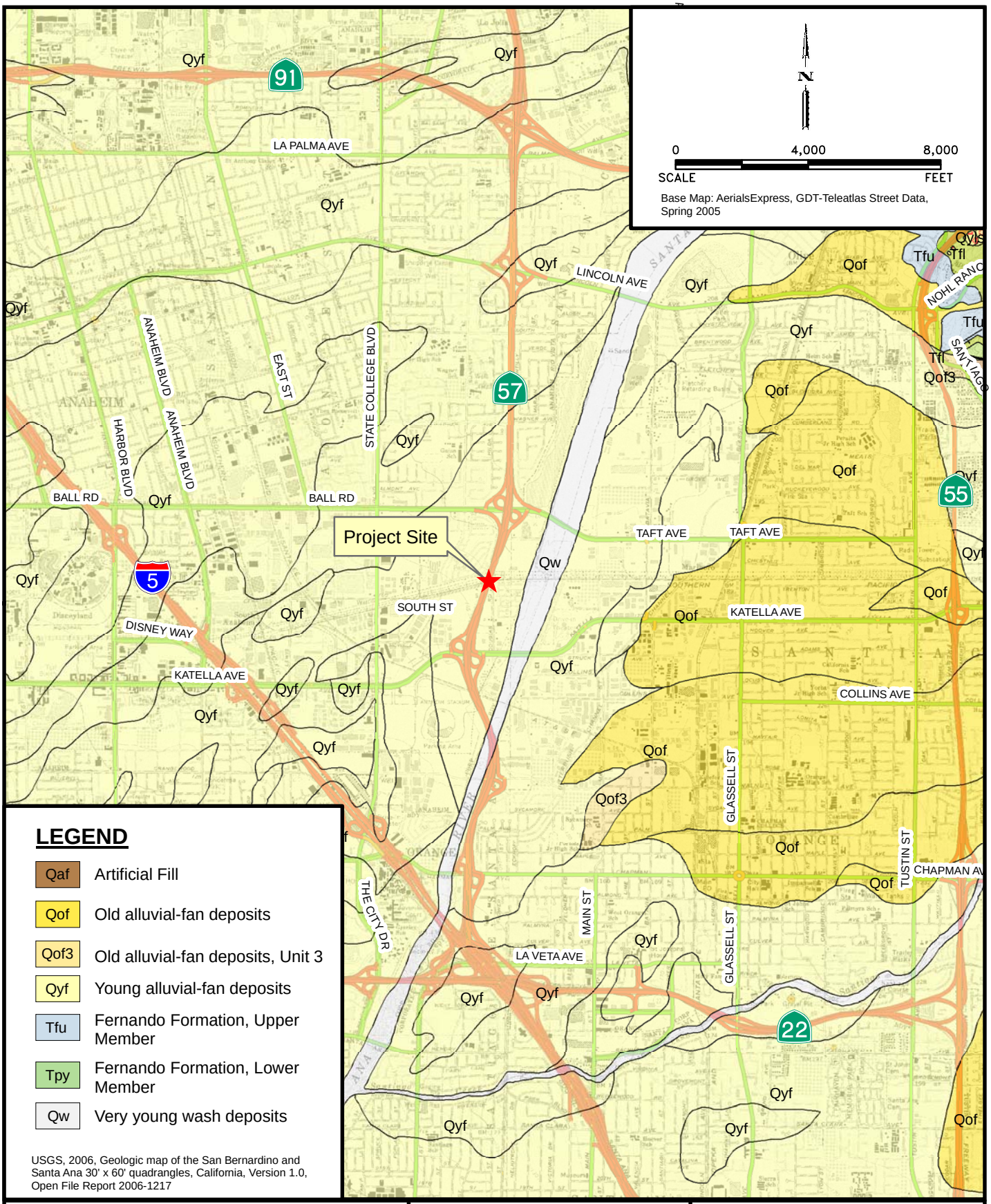
602231-002

Date

May 2009

Figure 1

P:\Drafting\602231\002\GIS\602231002_SiteLocationMap_DouglsRd.mxd



LEGEND

Qaf	Artificial Fill
Qof	Old alluvial-fan deposits
Qof3	Old alluvial-fan deposits, Unit 3
Qyf	Young alluvial-fan deposits
Tfu	Fernando Formation, Upper Member
Tpy	Fernando Formation, Lower Member
Qw	Very young wash deposits

USGS, 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, Version 1.0, Open File Report 2006-1217

Douglass Road Undercrossing Widening
Northbound SR-57 Widening
Orange County, California

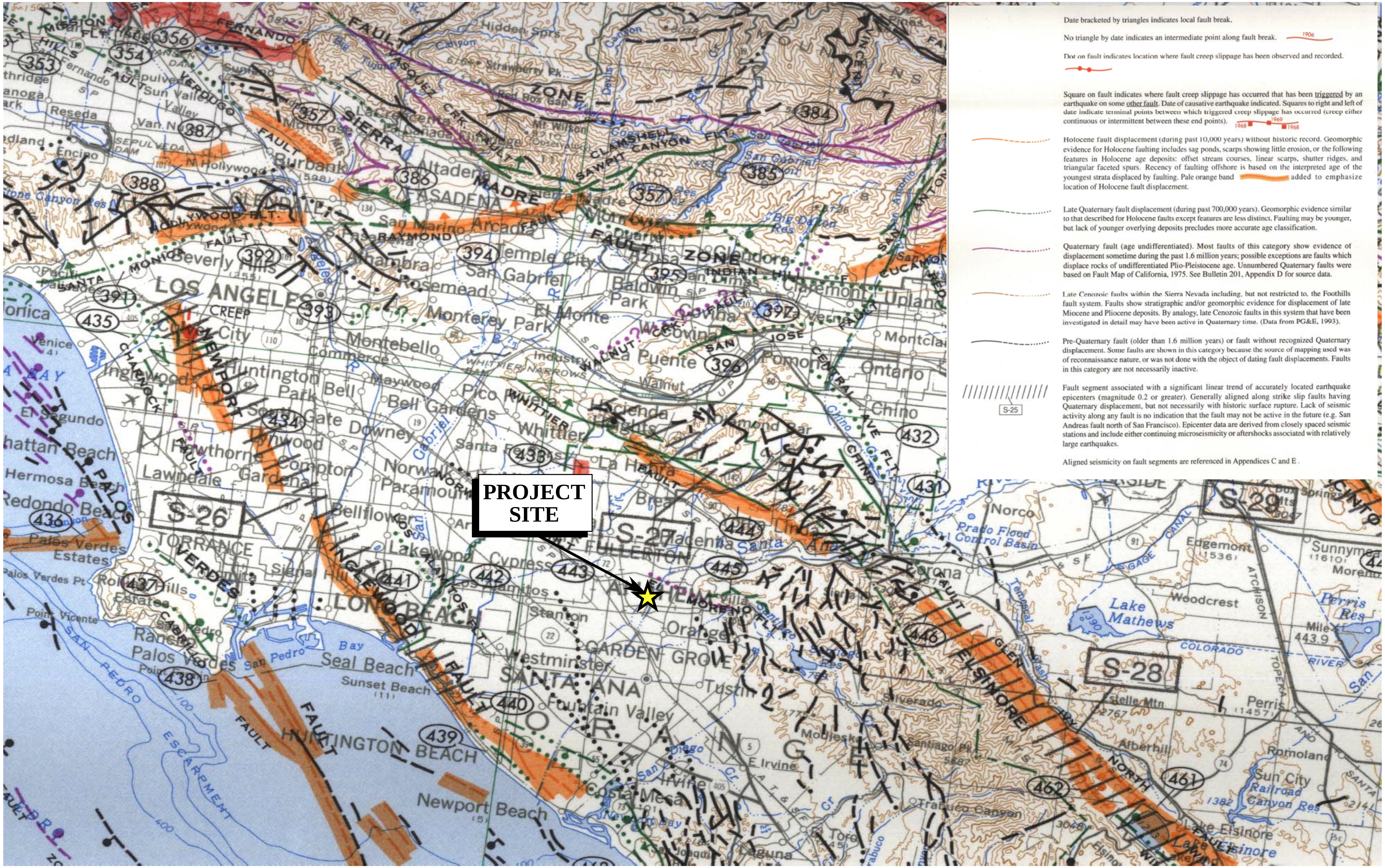
REGIONAL GEOLOGIC MAP

Project No.
602231-002

Date
June 2009

Figure 2

\\GIS\Drafting\602231\002\GIS\Figure3-GeologyMap-DouglasRd.mxd



Base Map: Fault Activity Map of California and Adjacent Areas with Location and Ages of Recent Volcanic Eruptions; CDMG 1994

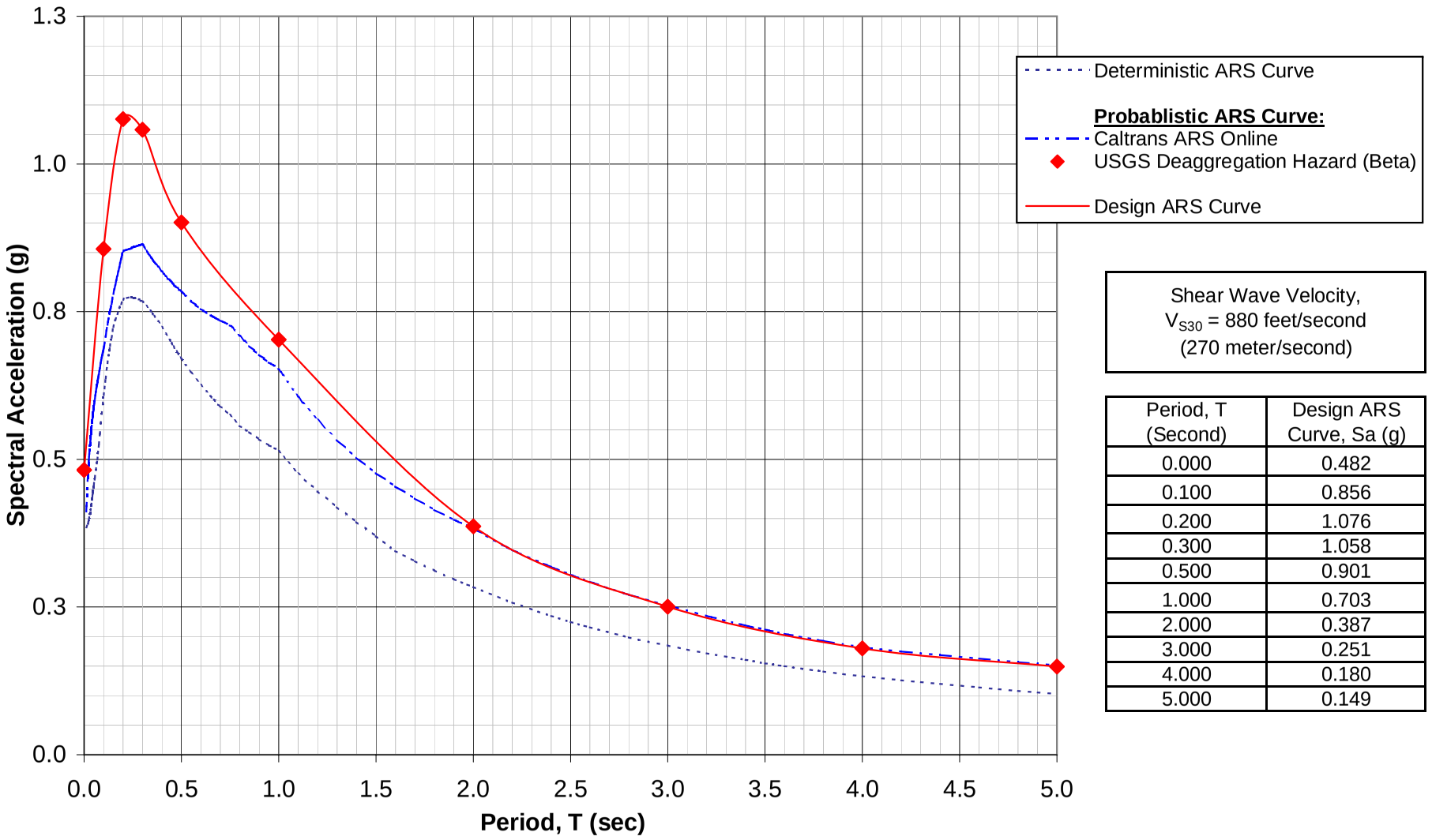
FAULT ACTIVITY MAP

Douglass Road Undercrossing Widening
Northbound SR 57 Widening
Anaheim, California

Project No.	602231-002
Scale (Approx)	1:750,000
Engr./Geol.	DJC / ELB
Drafted By	BQT
Date	6/09

Leighton

Figure 3



Shear Wave Velocity,
V_{S30} = 880 feet/second
(270 meter/second)

Period, T (Second)	Design ARS Curve, Sa (g)
0.000	0.482
0.100	0.856
0.200	1.076
0.300	1.058
0.500	0.901
1.000	0.703
2.000	0.387
3.000	0.251
4.000	0.180
5.000	0.149

CALTRANS ARS CURVES
DOUGLASS ROAD OH
SR-57 NORTHBOUND WIDENING
ORANGE COUNTY, CALIFORNIA

Project Name:	SR-57 WIDENING
Project No.:	602231-002
Designed/Checked by:	TK/DJC
Date:	2/8/2010

Figure 4

APPENDIX A

Boring No.	A-09-004	A-09-004	A-09-004	A-09-004	A-09-004	A-09-005	A-09-005	A-09-005
Sample No.	R-1	R-2	R-3	R-4	R-5	R-1	R-3	R-4
Depth (ft.)	5.0	10.0	20.0	30.0	40.0	5.0	20.0	30.0
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	Drive
Soil Identification	Gray silty clay (CL-ML)	Gray clayey sand (SC)	Dark grayish brown clayey sand (SC)	Gray silty clay (CL-ML)	Gray poorly graded sand (SP)	Light yellow to brown poorly graded sand (SP)	Light yellow to brown poorly graded sand (SP)	Light brown poorly graded sand with silt (SP-SM)
Pocket Penetrometer (tons/ft^2)	>4.50			4.25				
Weight Soil + Rings / Tube (g)	1179.60	1020.02	1010.67	1216.47	972.07	957.61	1042.77	1051.32
Weight of Rings / Tube (g)	266.40	222.00	266.40	266.40	222.00	222.00	266.40	266.40
Average Length (in.)	6.00	5.00	6.00	6.00	5.00	5.00	6.00	6.00
Average Diameter (in.)	2.416	2.416	2.416	2.416	2.416	2.416	2.416	2.416
Wet. Wt. of Soil + Cont. (g)	212.92	247.46	210.72	204.78	240.15	289.81	293.01	540.04
Dry Wt. of Soil + Cont. (g)	181.32	218.52	207.47	176.72	223.90	282.12	286.50	529.04
Weight of Container (g)	38.64	38.62	38.88	38.95	38.66	38.64	38.82	132.82
Container No.								
Wet Density	126.5	132.6	103.1	131.6	124.7	122.3	107.5	108.7
Moisture Content (%)	**22**	**16**	**2**	**20**	**9**	**3**	**3**	**3**
Dry Density (pcf)	**104**	**114**	**101**	**109**	**115**	**119**	**105**	**106**
Degree of Saturation (%)	95.2	91.4	7.8	101.5	50.3	20.2	11.7	12.6

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MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/13/09

Boring No.	A-09-004	A-09-004	A-09-004	A-09-004	A-09-004			
Sample No.	S-8	S-11	S-12	S-13	S-15			
Depth (ft.)	65	80	85	90	100			
Sample Type	SPT	SPT	SPT	SPT	SPT			
Soil Identification	Brown poorly-graded sand with silt (SP-SM)	Brown poorly-graded sand with silt (SP-SM)	Brown clayey sand (SC)	Brown silty sand (SM)	Brown clayey sand (SC)			
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00			
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00			
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00			
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00			
Sample Dry Weight Determination								
Weight of Sample + Container (g)	426.56	546.25	540.17	602.08	581.67			
Weight of Container (g)	154.68	137.86	140.12	135.78	144.92			
Weight of Dry Sample (g)	271.88	408.39	400.05	466.30	436.75			
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B			
Dry Weight of Sample + Cont. (g)	412.58	509.26	484.32	492.28	380.02			
Weight of Container (g)	154.68	137.86	140.12	135.78	144.92			
Dry Weight of Sample (g)	257.90	371.40	344.20	356.50	235.10			
% Passing No. 200 Sieve	**5.1**	**9.1**	**14.0**	**23.5**	**46.2**			
% Retained No. 200 Sieve	94.9	90.9	86.0	76.5	53.8			

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PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: SF / GB Date: 03/13/09

Boring No.	A-09-005	A-09-005	A-09-005	A-09-005				
Sample No.	R-4	S-3	R-5	S-5				
Depth (ft.)	30	35	40	50				
Sample Type	Drive	SPT	Drive	SPT				
Soil Identification	Light brown poorly-graded sand with silt (SP-SM)	Light brown poorly-graded sand with silt (SP-SM)	Light brown sandy silt (ML)	Light brown silty sand (SM)				
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00				
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00				
Weight of Container (g)	1.00	1.00	1.00	1.00				
Moisture Content (%)	0.00	0.00	0.00	0.00				
Sample Dry Weight Determination								
Weight of Sample + Container (g)	529.04	466.71	569.50	639.77				
Weight of Container (g)	132.82	140.94	137.10	144.89				
Weight of Dry Sample (g)	396.22	325.77	432.40	494.88				
Container No.:								
After Wash								
Method (A or B)	B	B	B	B				
Dry Weight of Sample + Cont. (g)	508.42	448.24	220.41	470.09				
Weight of Container (g)	132.82	140.94	137.10	144.89				
Dry Weight of Sample (g)	375.60	307.30	83.31	325.20				
% Passing No. 200 Sieve	**5.2**	**5.7**	**80.7**	**34.3**				
% Retained No. 200 Sieve	94.8	94.3	19.3	65.7				

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PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/04/09

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SAND EQUIVALENT TEST

DOT CA Test 217

Project Name: SR-57 Widening

Tested By: G. Bathala

Date: 03/11/09

Project No. : 602231-002

Input By: J. Ward

Date: 06/11/10

Boring No.	Sample No.	Depth (ft.)	Soil Type	T1	T2	T3	T4	R1	R2	SE	Average SE
A-09-004	Bag-1	1.5-5	Clayey sand with gravel (SC)	13:16	13:26	13:28	13:48	12.6	1.7	14	**15**
				13:19	13:29	13:31	13:51	11.7	1.7	15	

T1 = Starting Time

T2 = (T1 + 10 min) Begin Agitation

(131 cycles in 45 sec)

T3 = Settlement Starting Time

T4 = (T3 + 20 min) Take Clay Reading (R1)

and Sand Reading (R2)

Sand Equivalent = R2 / R1 * 100

Record SE as Next Higher Integer

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ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	03/17/09
Project No. :	602231-002	Input By:	J. Ward	Date:	03/18/09
Boring No.:	A-09-004	Checked By:	J. Ward		
Sample No.:	S-16	Depth (ft.)	105.0		
Soil Identification:	Reddish brown silty clay (CL-ML)				

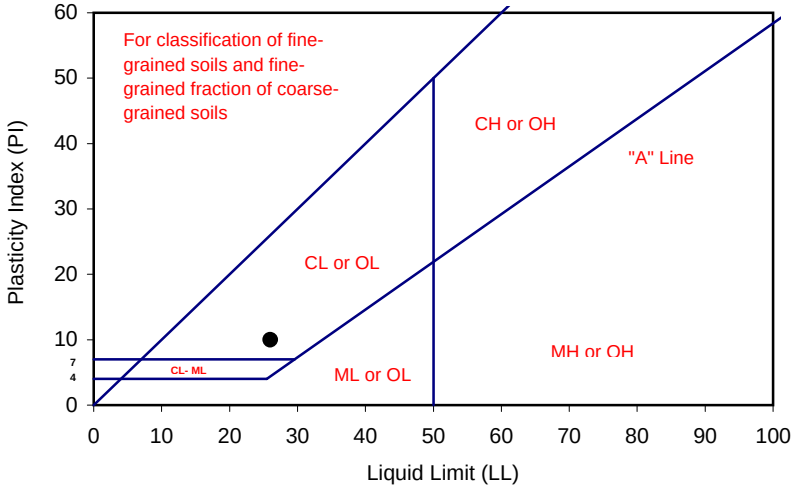
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			30	24	16	
Wet Wt. of Soil + Cont. (g)	9.95	10.13	20.45	19.08	23.62	
Dry Wt. of Soil + Cont. (g)	8.72	8.88	16.60	15.40	18.79	
Wt. of Container (g)	1.06	1.04	1.06	1.07	1.08	
Moisture Content (%) [Wn]	16.06	15.94	24.77	25.68	27.27	

Liquid Limit	**26**
Plastic Limit	**16**
Plasticity Index	**10**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 4.38

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



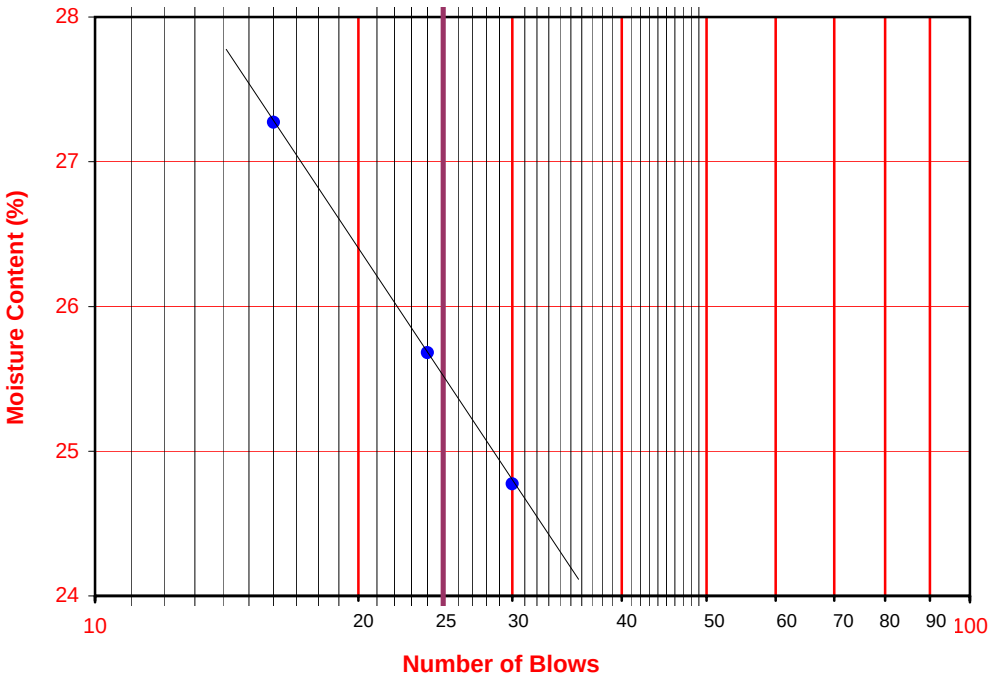
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



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ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	03/17/09
Project No. :	602231-002	Input By:	J. Ward	Date:	03/23/09
Boring No.:	A-09-005	Checked By:	J. Ward		
Sample No.:	S-8	Depth (ft.)	65.0		
Soil Identification:	Yellowish red silty clay with sand (CL- ML)				

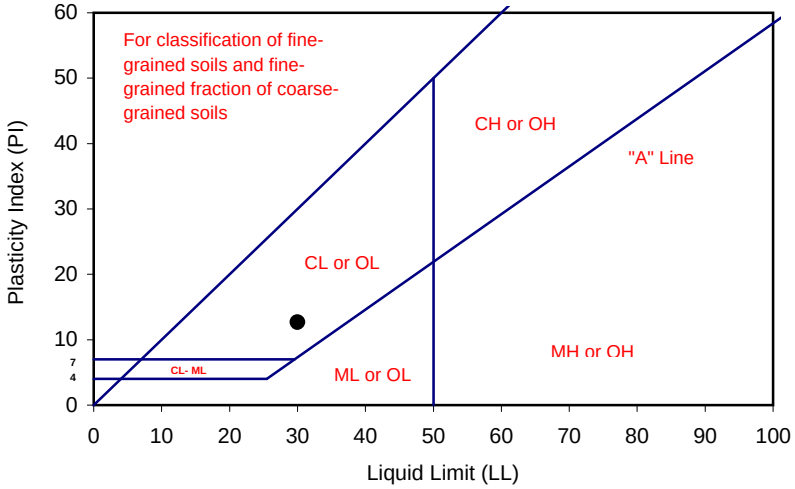
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			36	25	16	
Wet Wt. of Soil + Cont. (g)	9.82	10.41	21.05	22.25	22.72	
Dry Wt. of Soil + Cont. (g)	8.53	9.03	16.66	17.40	17.51	
Wt. of Container (g)	1.08	1.07	1.06	1.05	1.04	
Moisture Content (%) [Wn]	17.32	17.34	28.14	29.66	31.63	

Liquid Limit	**30**
Plastic Limit	**17**
Plasticity Index	**13**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 7.3

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



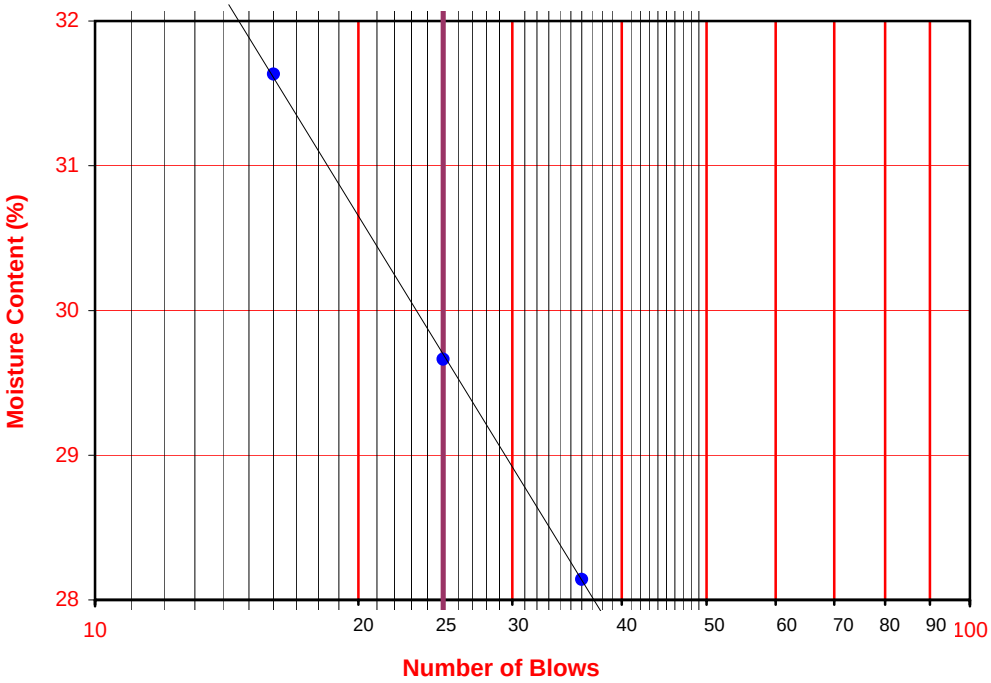
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



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ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	03/19/09
Project No. :	602231-002	Input By:	J. Ward	Date:	03/23/09
Boring No.:	A-09-005	Checked By:	J. Ward		
Sample No.:	S-10	Depth (ft.)	75.0		
Soil Identification:	Yellowish red silty clay (CL-ML)				

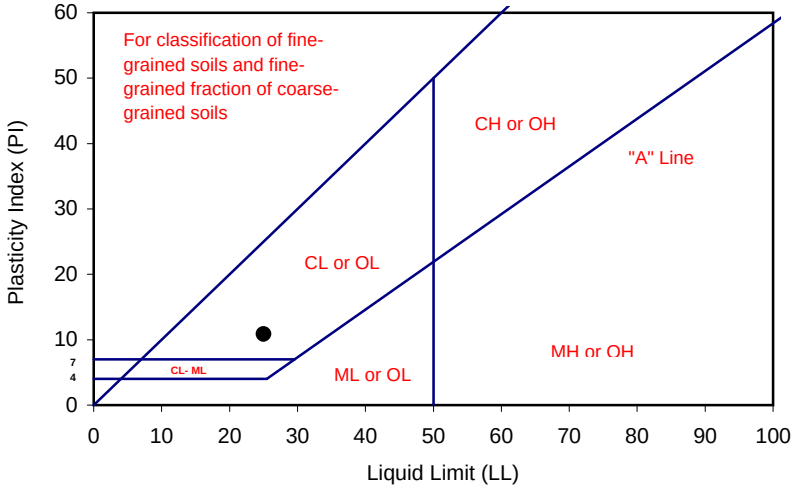
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			29	24	20	
Wet Wt. of Soil + Cont. (g)	10.60	10.06	20.70	21.73	21.36	
Dry Wt. of Soil + Cont. (g)	9.42	8.95	16.80	17.52	17.12	
Wt. of Container (g)	1.09	1.06	1.04	1.07	1.09	
Moisture Content (%) [Wn]	14.17	14.07	24.75	25.59	26.45	

Liquid Limit	**25**
Plastic Limit	**14**
Plasticity Index	**11**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 3.65

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test

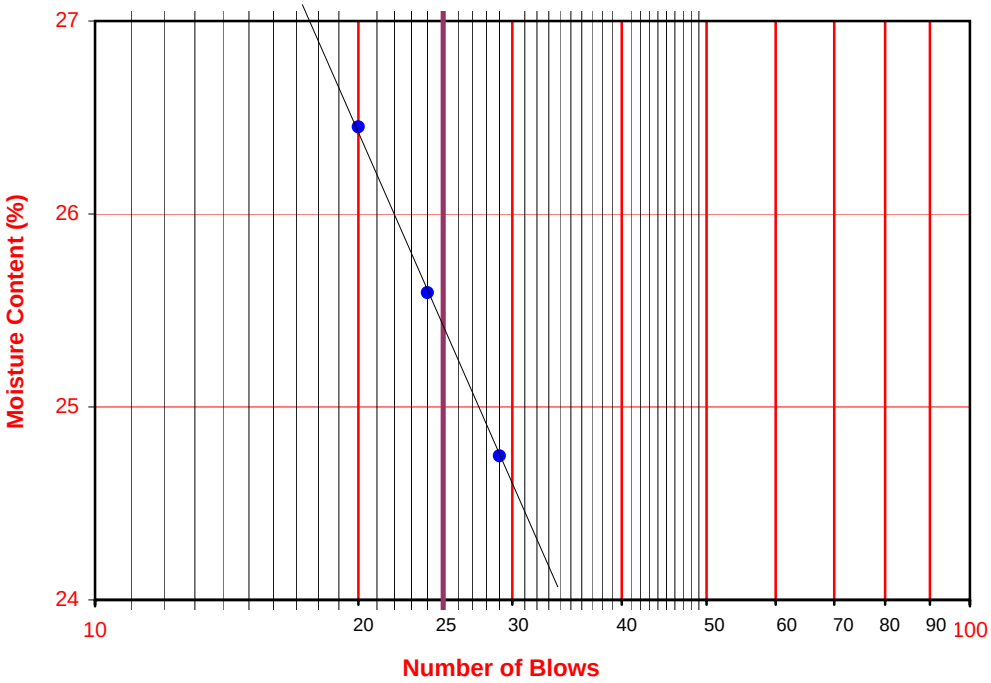


TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

				Gradation				Atterberg Limits		Maximum Density		Shear Strength Peak		Shear Strength Ultimate		Chemical Analyses					
Boring No.	Sample Type	Top of Sample (ft)	Bottom of Sample (ft)	Gravel (%)	Sand (%)	Silt (%)	Clay <5μm (%)	LL:PL:PI	Sand Equivalent	Max Dry Density (pcf)	Optimum Moisture Content (%)	ϕ' (deg)	C' (psf)	ϕ' (deg)	C' (psf)	pH	Sulfate (ppm)	Chloride (ppm)	Resistivity (Ω-cm)	Expansion Index of Soil	R-Value
A-09-004	BULK	0	5	12	54	34			15							6.6	271	41	804	48	28
	R/SPT	10	20													5.7	383	82	574		
	SPT	65.0	66.5	95		5															
	SPT	70.0	71.5	1	50	49															
	SPT	80.0	81.5	91		9															
	SPT	85.0	86.5	86		14															
	SPT	90.0	91.5	76		24															
	SPT	95.0	96.5	0	36	64															
	SPT	100.0	101.5	54		46															
	SPT	105.0	106.5					26:16:10													
	SPT	110.0	111.5	3	49	48															
A-09-005	BULK	1.5	5.0													7.5	67	40	13500		
	RING	10.0	11.5									38	160	33	35						
	SPT	25.0	26.5													7.4	41	40			
	RING	30.0	31.5	95		5															
	SPT	35.0	36.5	94		6															
	RING	40.0	41.5	19		81						32	125	28	60						
	SPT	45.0	46.5													7.7	33	40			
	SPT	50.0	51.5	66		34															
	SPT	60.0	61.5	0	15	85															
	SPT	65.0	66.5					30:17:13													
	SPT	70.0	71.5	0	33	67															
	SPT	75.0	76.5					25:14:11													

NOTE: The laboratory tests were performed in general accordance with the following standards:

Sand Equivalent- California Test Method 217

Sieve Analysis - ASTM D 422

Atterberg Limits - ASTM D 4318

Direct Shear Test - ASTM D 3080

R-Value - ASTM D2844

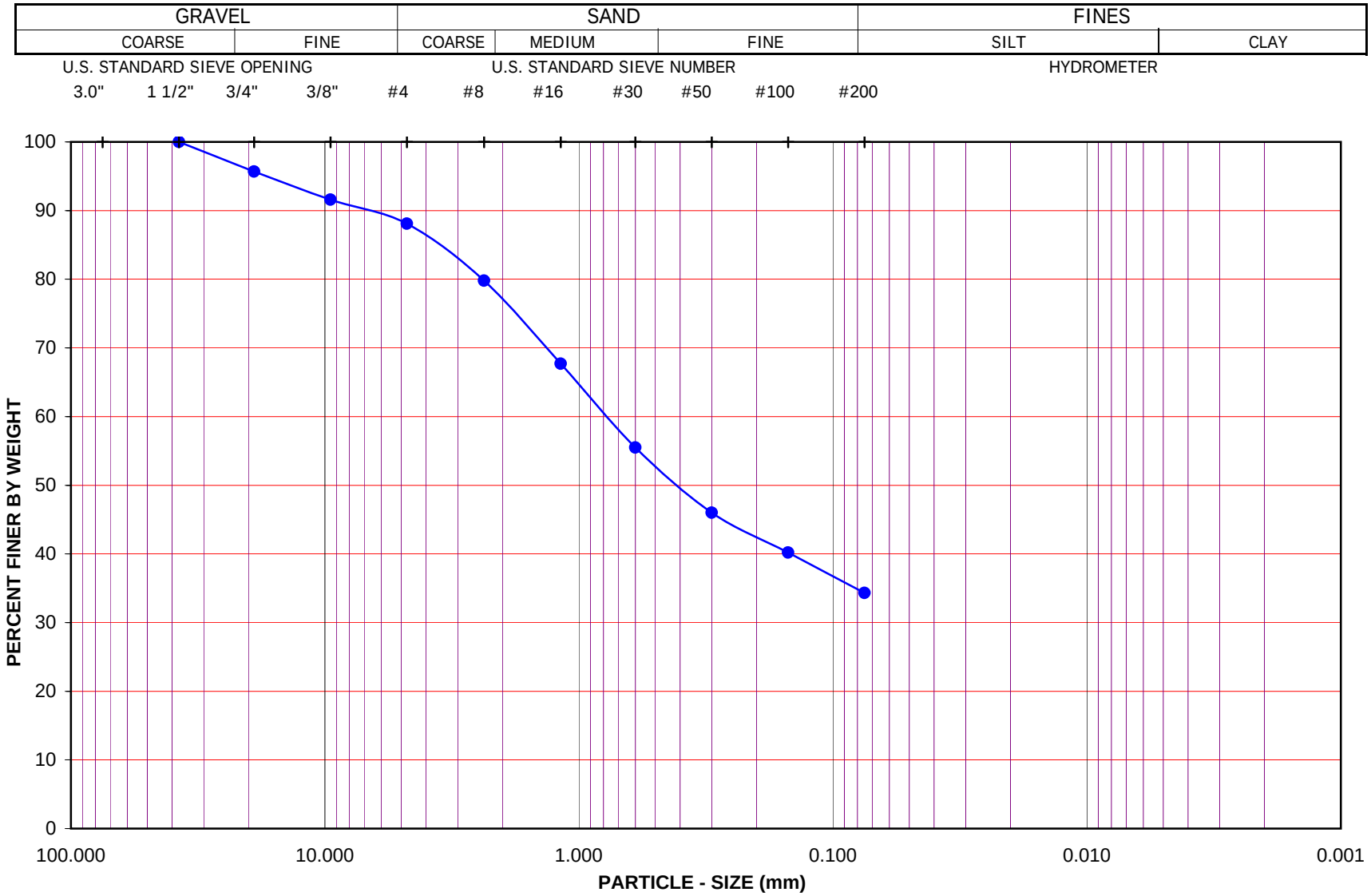
Expansion Index of the Soil-ASTM D 4829

Corrosivity Tests - DOT CA 532/643 - pH, DOT CA 417 - soluble sulfates, DOT CA 422 - chlorides, DOT CA 643 - minimum resistivity

Leighton Consulting, Inc.

SR-57 Widening

Project No: 602231-002



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-004 Sample No.: Bag-1

Depth (feet): 0-5 Soil Type : (SC)

Soil Identification: Gray clayey sand with gravel (SC)

GR:SA:FI : (%) 12 : 54 : 34

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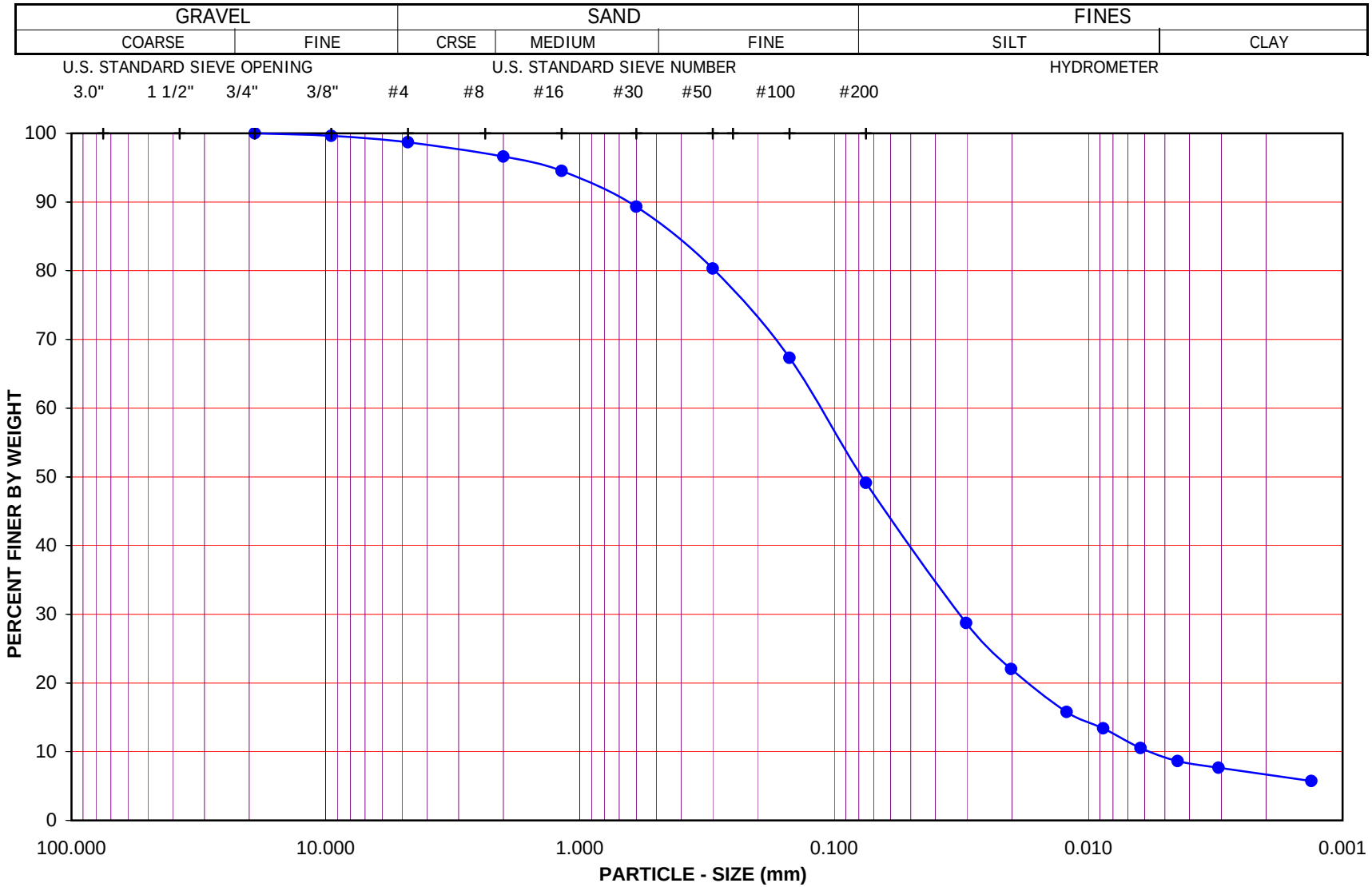
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10

SA B-4 BB-1.xls



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-004 Sample No.: S-9

Depth (feet) : 70.0 Soil Type : (SM)

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 1 : 50 : 49

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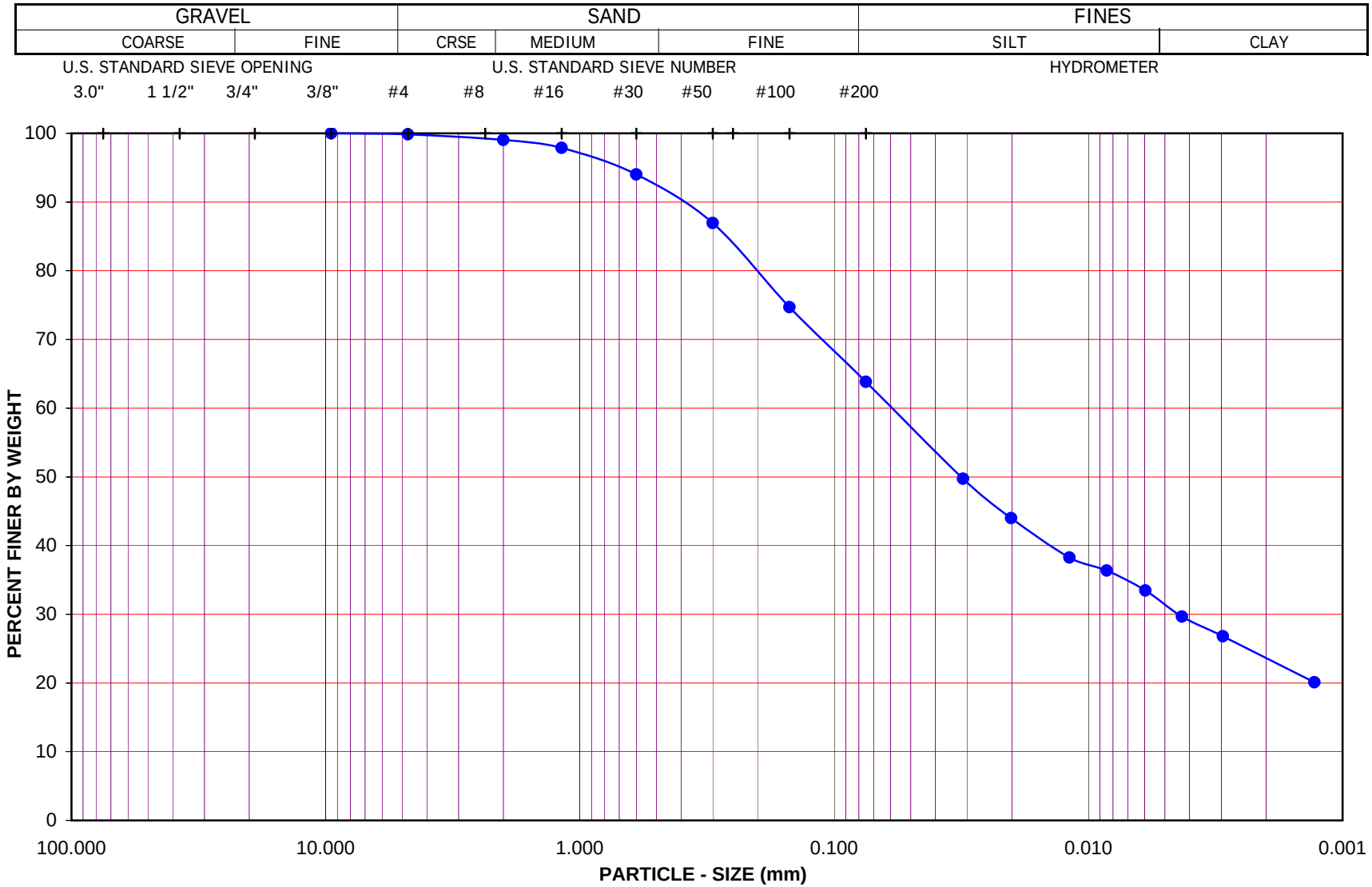
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-004 Sample No.: S-14

Depth (feet) : 95.0 Soil Type : (CL-ML)

Soil Identification: Reddish brown sandy clay (CL-ML)

GR:SA:FI : (%) 0 : 36 : 64

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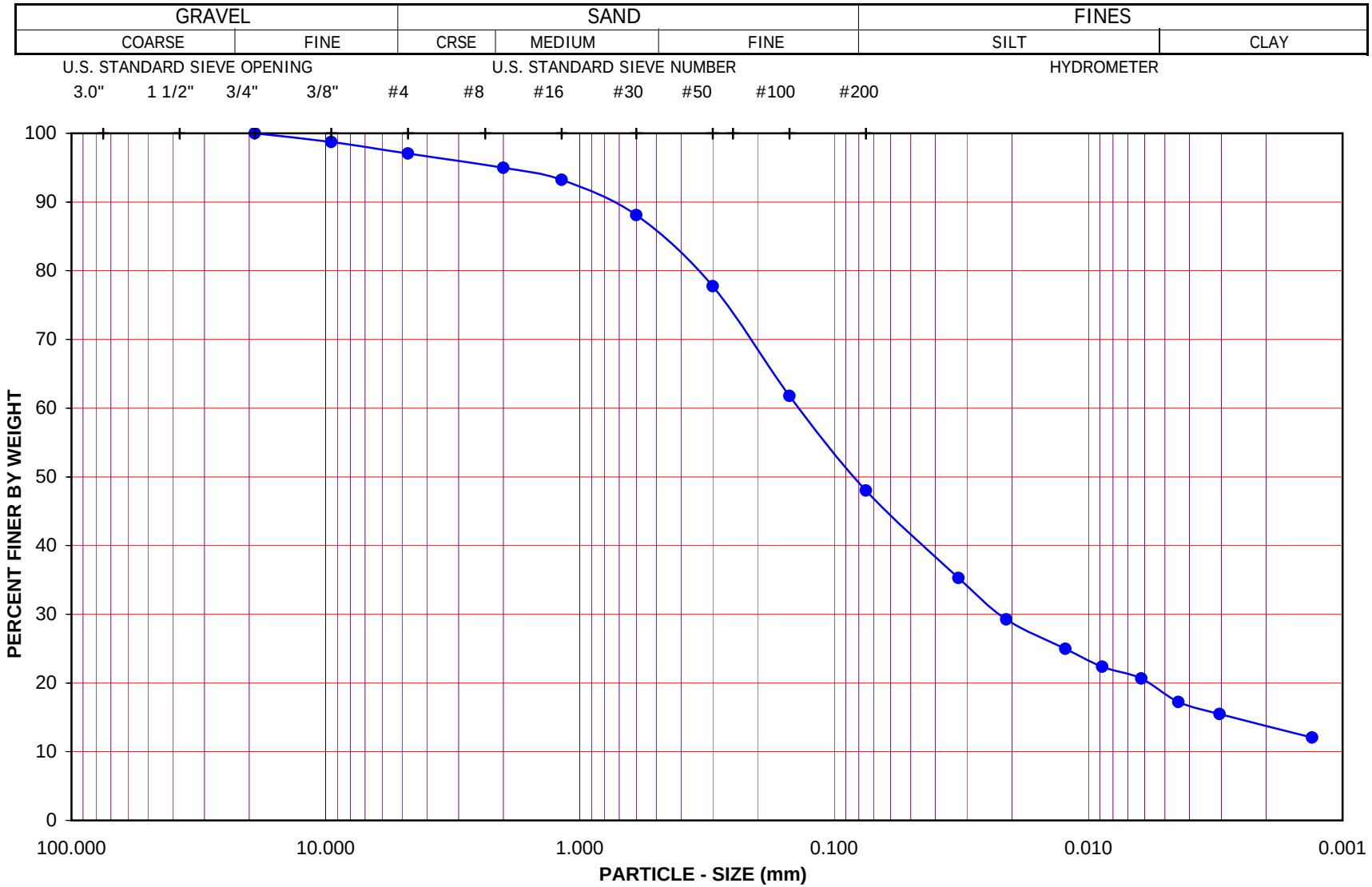
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10

S&H B-4 S-14.xls



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-004 Sample No.: S-17

Depth (feet) : 110.0 Soil Type : (SM)

Soil Identification: Reddish brown silty sand (SM)

GR:SA:FI : (%) 3 : 49 : 48

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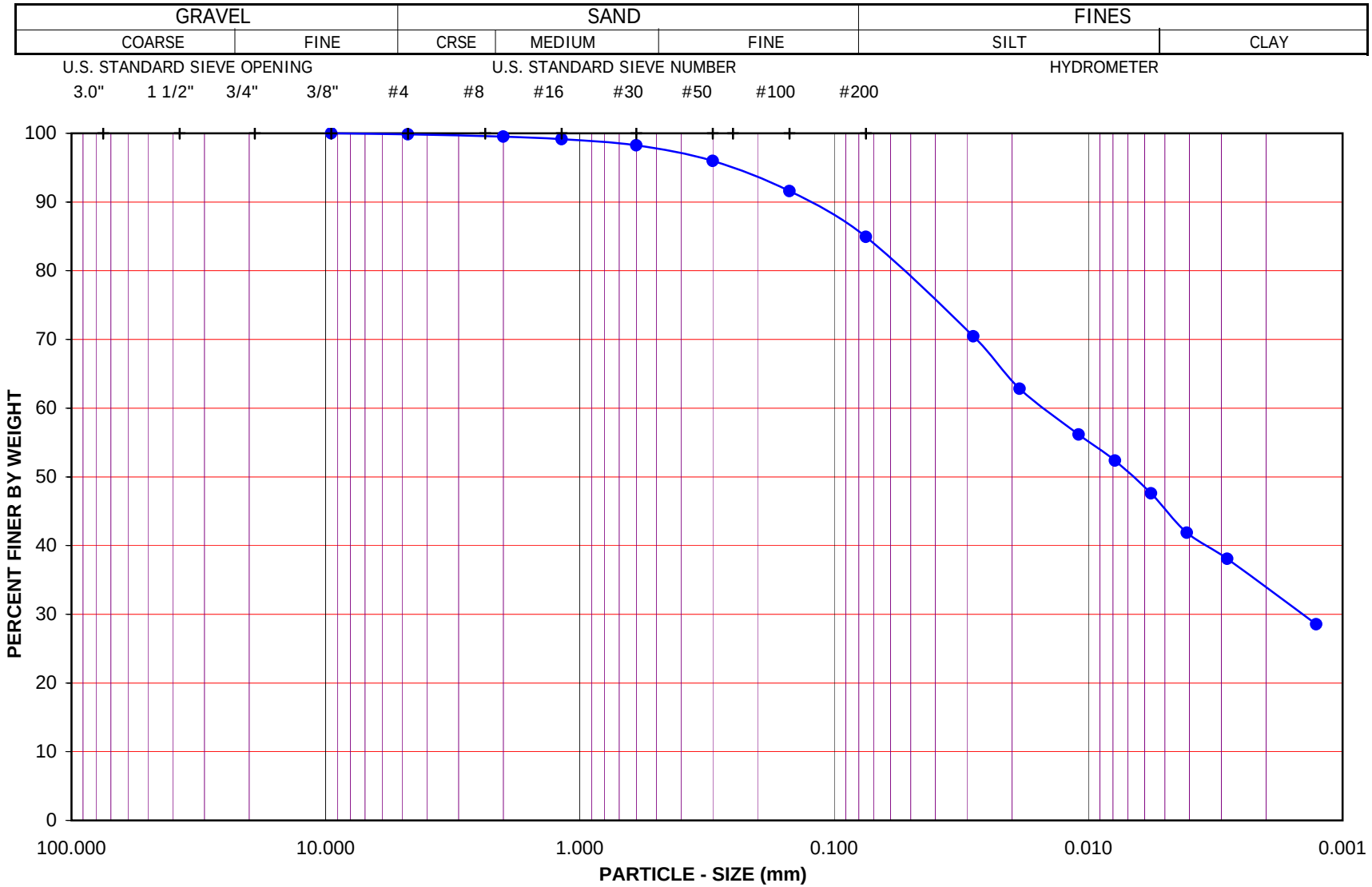
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-005 Sample No.: S-7

Depth (feet) : 60.0 Soil Type : (CL-ML)

Soil Identification: Yellowish red silty clay with sand (CL-ML)

GR:SA:FI : (%) 0 : 15 : 85

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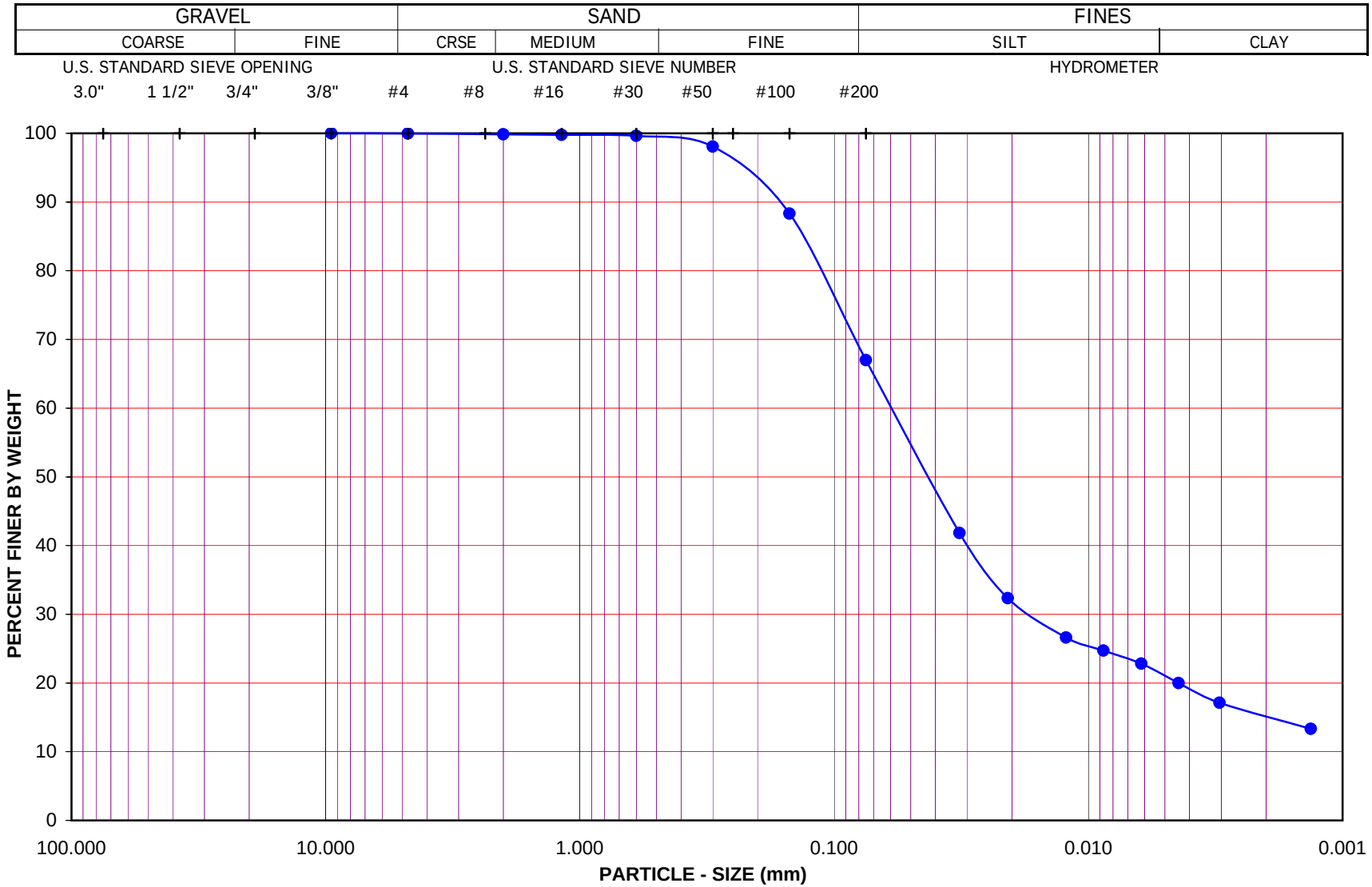
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-005 Sample No.: S-9

Depth (feet) : 70.0 Soil Type : (ML)

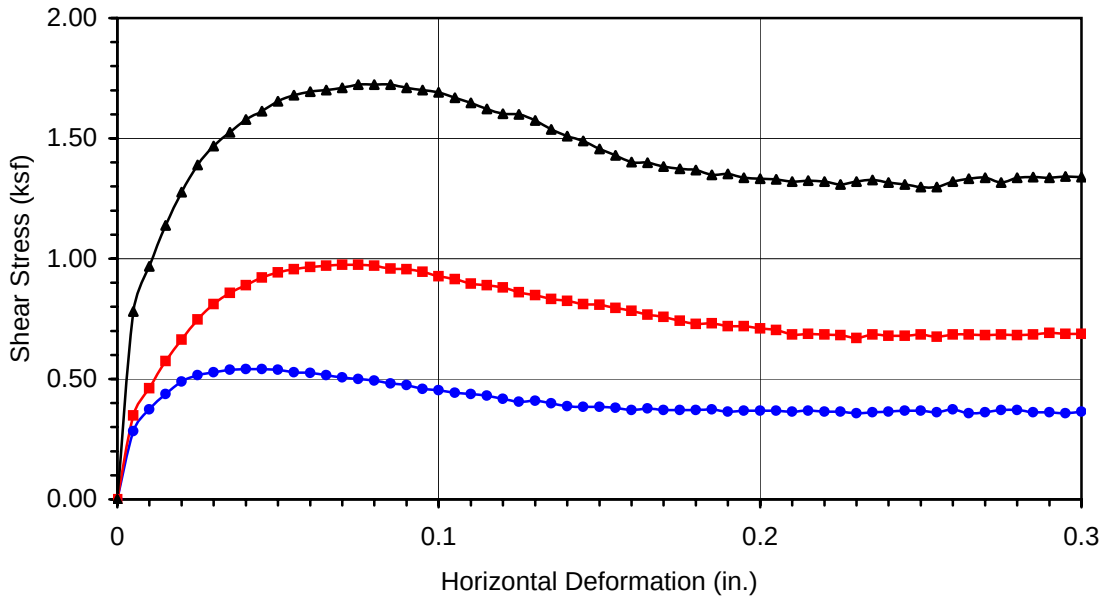
Soil Identification: Yellowish red sandy silt (ML)

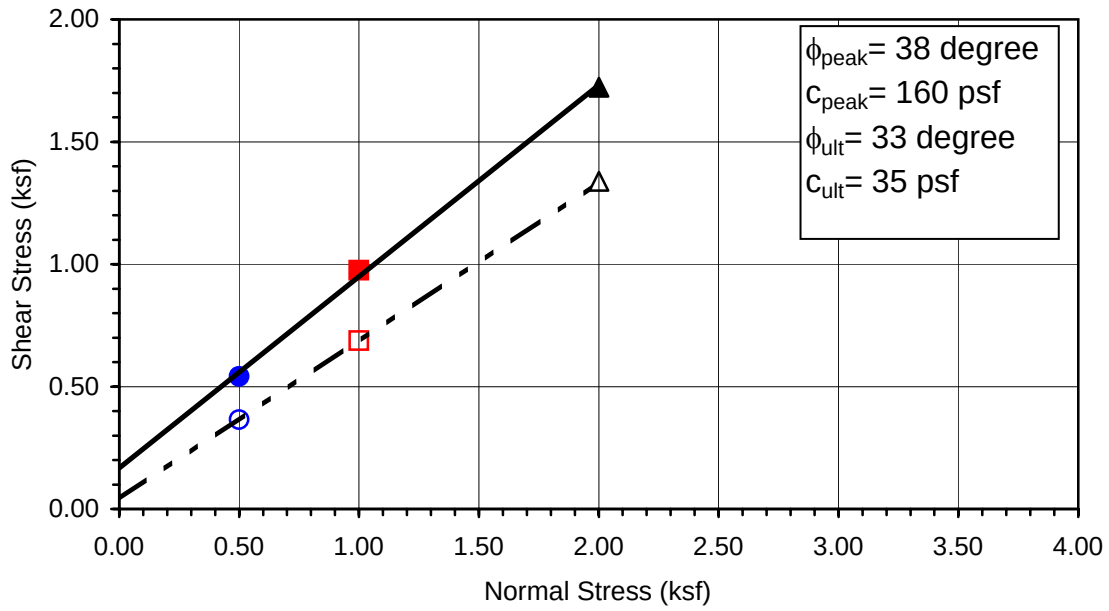
GR:SA:FI : (%) 0 : 33 : 67

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10





Boring No.	**A-09-005**
Sample No.	**R-2**
Depth (ft)	**10**

Sample Type:

Drive

Soil Identification:
Light yellowish brown poorly graded sand (SP)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.541	■ 0.975	▲ 1.723
Shear Stress @ End of Test (ksf)	○ 0.365	□ 0.688	△ 1.339
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	2.50	2.50	2.50
Dry Density (pcf)	101.4	100.2	102.6
Saturation (%)	10.2	9.9	10.5
Soil Height Before Shearing (in.)	0.9957	0.9900	0.9885
Final Moisture Content (%)	22.1	22.9	21.8

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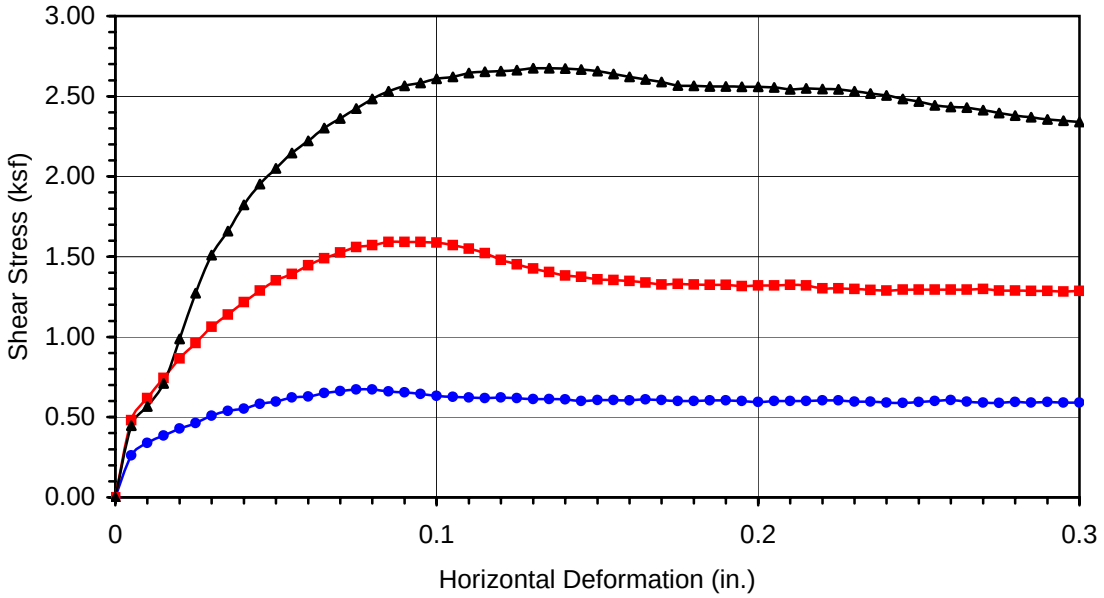
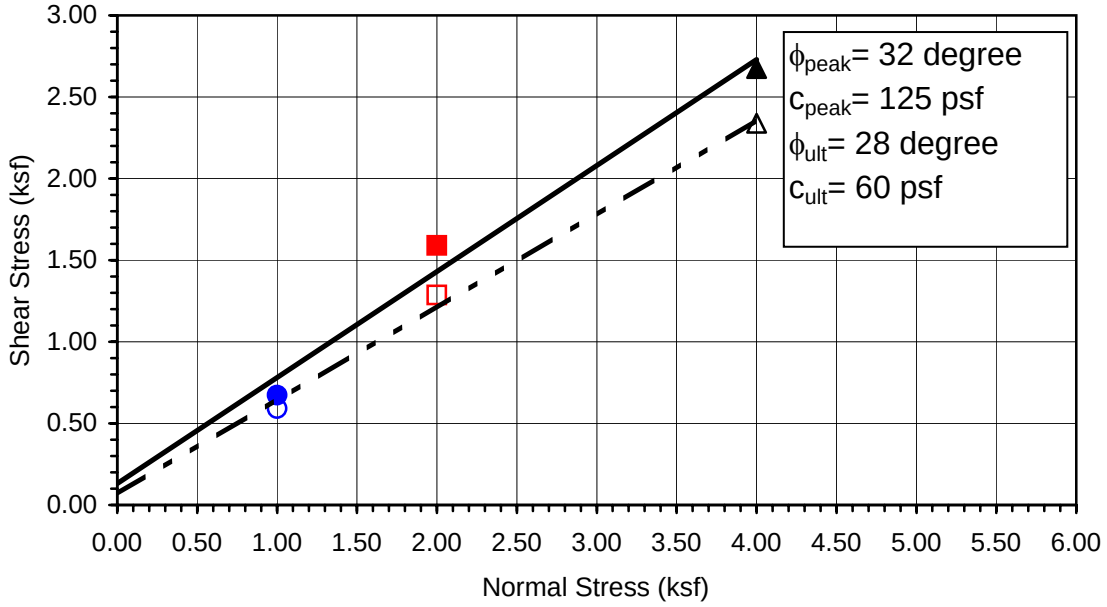
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09





Boring No.	**A-09-005**
Sample No.	**R-5**
Depth (ft)	**40**

Sample Type:

Drive

Soil Identification:
Light brown sandy silt (ML)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.673	■ 1.591	▲ 2.675
Shear Stress @ End of Test (ksf)	○ 0.591	□ 1.286	△ 2.339
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	35.13	35.13	35.13
Dry Density (pcf)	88.0	90.1	90.5
Saturation (%)	103.5	109.0	109.9
Soil Height Before Shearing (in.)	0.9660	0.9576	0.9440
Final Moisture Content (%)	36.8	24.9	31.1

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DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09

Leighton

R-VALUE TEST RESULTS

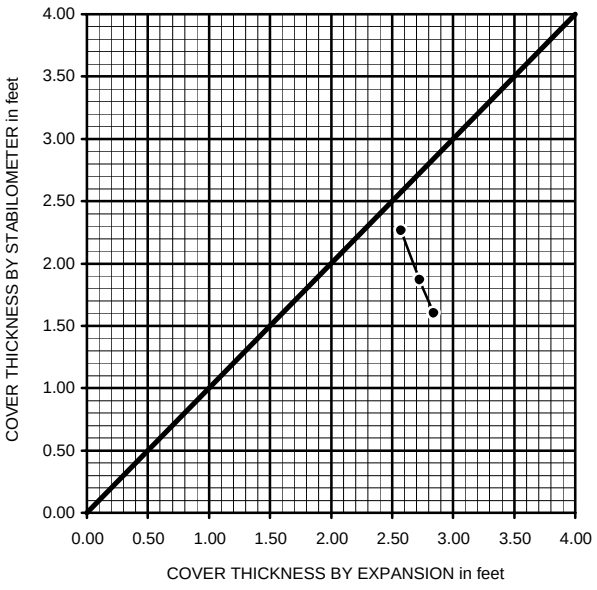
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	A-09-004 @ 1.5-5'
SAMPLE DESCRIPTION:	Gray clayey sand with gravel (SC)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

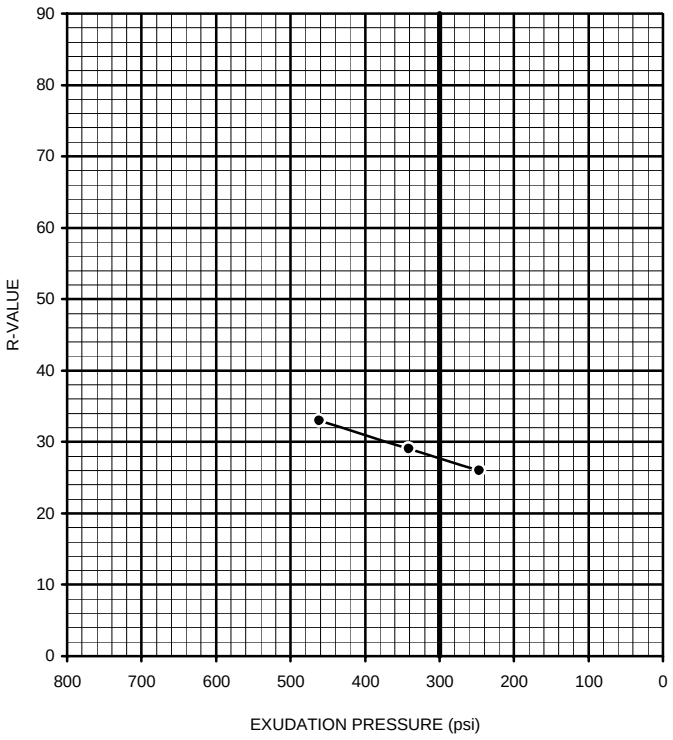
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	12.9	13.4	13.8
HEIGHT OF SAMPLE, Inches	2.51	2.51	2.57
DRY DENSITY, pcf	121.5	119.7	118.4
COMPACTOR PRESSURE, psi	100	75	50
EXUDATION PRESSURE, psi	461	341	247
EXPANSION, Inches x 10exp-4	68	56	48
STABILITY Ph 2,000 lbs (160 psi)	101	105	106
TURNS DISPLACEMENT	2.90	3.17	3.58
R-VALUE UNCORRECTED	33	29	26
R-VALUE CORRECTED	33	29	26

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	2.57	2.73	2.84
EXPANSION PRESSURE THICKNESS, ft.	2.27	1.87	1.60

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	36
R-VALUE BY EXUDATION:	28
EQUILIBRIUM R-VALUE:	28

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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	03/18/09
Project No. :	602231-002	Checked By:	J. Ward	Date:	06/11/10
Boring No.:	A-09-004	Depth (ft.)	1.5-5		
Sample No. :	Bag-1				
Soil Identification:	Gray clayey sand with gravel (SC)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0475
Wt. Comp. Soil + Mold	(g)	595.10	443.20
Wt. of Mold	(g)	190.30	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	806.10	633.50
Dry Wt. of Soil + Cont.	(g)	735.50	559.60
Wt. of Container	(g)	0.00	190.30
Moisture Content	(%)	9.60	20.01
Wet Density	(pcf)	122.1	127.6
Dry Density	(pcf)	111.4	106.3
Void Ratio		0.513	0.585
Total Porosity		0.339	0.369
Pore Volume	(cc)	70.2	80.0
Degree of Saturation (%) [S_{meas}]		**50.5**	92.3

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
03/18/09	13:43	1.0	0	0.2160
03/18/09	13:53	1.0	10	0.2160
Add Distilled Water to the Specimen				
03/18/09	14:00	1.0	7	0.2275
03/19/09	7:15	1.0	1042	0.2635
03/19/09	10:15	1.0	1222	0.2635

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**48**

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SOIL RESISTIVITY TEST

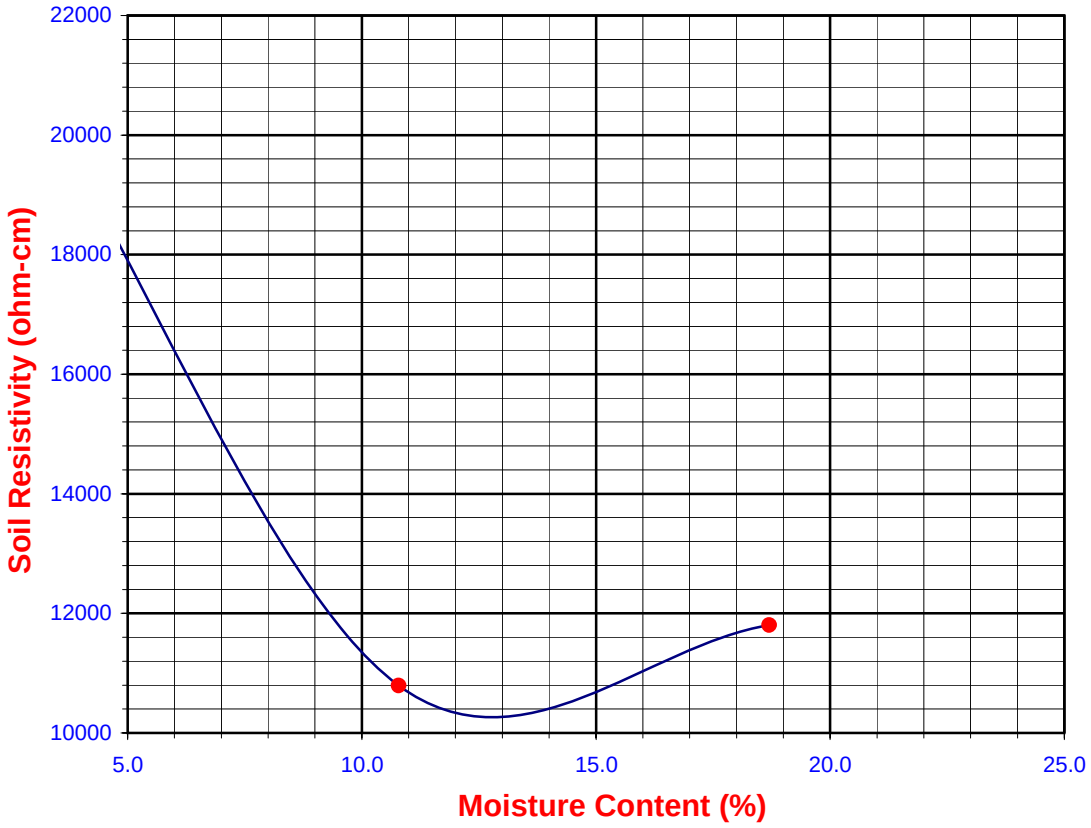
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/11/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	A-09-004	Depth (ft.) :	0-5		
Sample No. :	Bag-1				
Soil Identification:	Gray (SC)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	0	2.88	3100	20913
2	100	10.79	1600	10794
3	200	18.70	1750	11806
4				
5				

Moisture Content (%) (MCi)	2.88
Wet Wt. of Soil + Cont. (g)	152.50
Dry Wt. of Soil + Cont. (g)	149.90
Wt. of Container (g)	59.50
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
804	**42.6**	**271**	**41**	**6.64**	**18.6**



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SOIL RESISTIVITY TEST

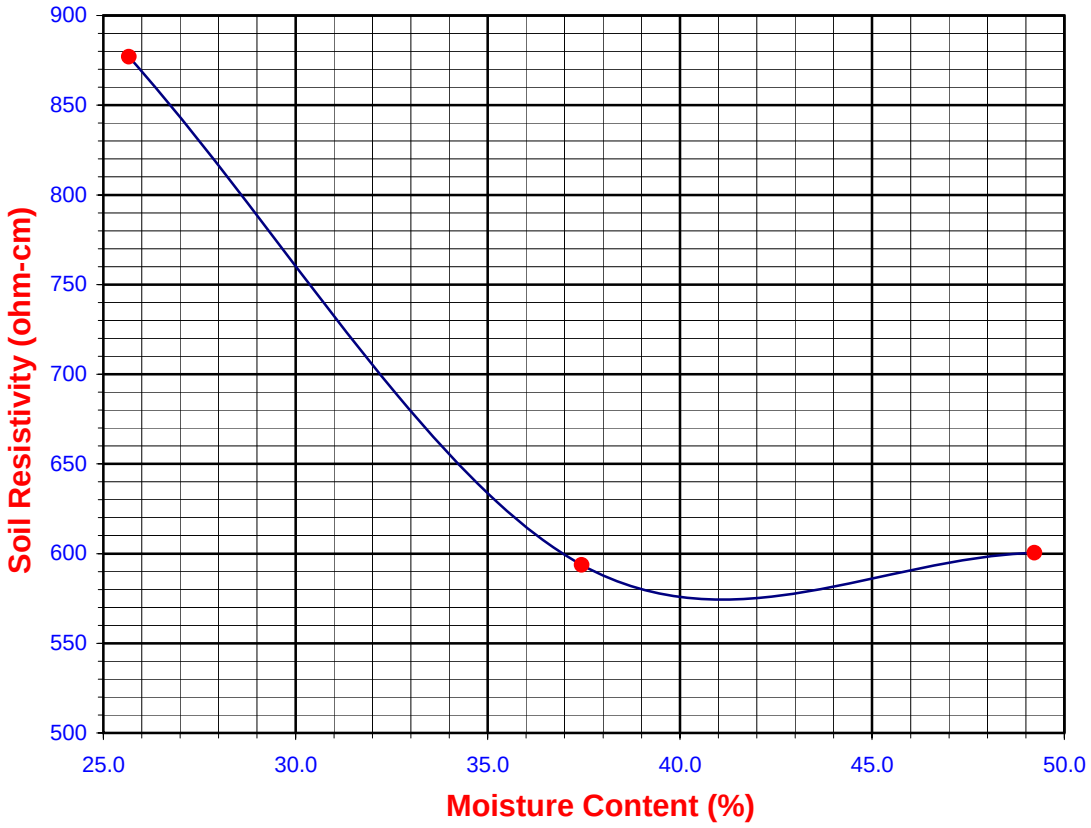
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/18/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	A-09-004	Depth (ft.) :	10-20		
Sample No. :	R-2, S-1, R-3 combined				
Soil Identification:	Gray (CL-ML) /(SC)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	300	25.66	130	877
2	450	37.44	88	594
3	600	49.23	89	600
4				
5				

Moisture Content (%) (MCi)	2.10
Wet Wt. of Soil + Cont. (g)	246.20
Dry Wt. of Soil + Cont. (g)	241.90
Wt. of Container (g)	37.30
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
574	**41.1**	**383**	**82**	**5.73**	**20.2**



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SOIL RESISTIVITY TEST

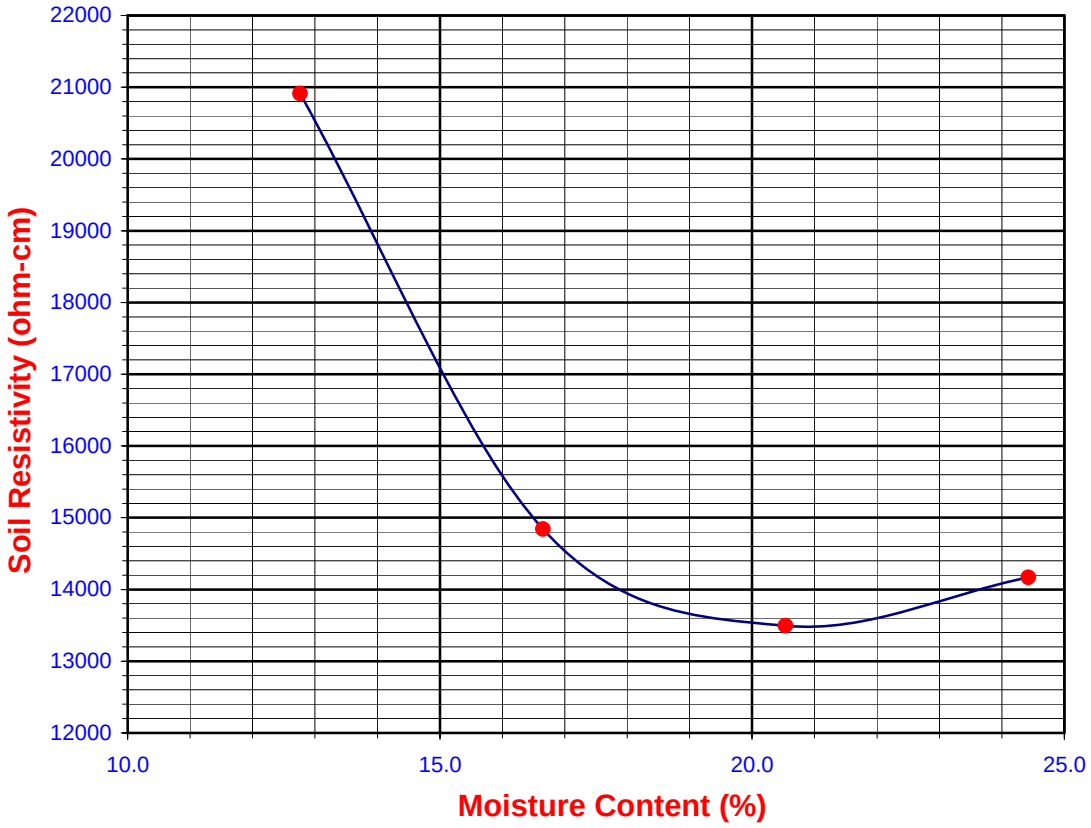
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/16/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/19/09
Boring No.:	A-09-005	Depth (ft.) :	1.5-5		
Sample No. :	Bag-1				
Soil Identification:	Light brown (SP)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	150	12.76	3100	20913
2	200	16.65	2200	14841
3	250	20.54	2000	13492
4	300	24.43	2100	14167
5				

Moisture Content (%) (MCi)	1.10
Wet Wt. of Soil + Cont. (g)	204.30
Dry Wt. of Soil + Cont. (g)	202.70
Wt. of Container (g)	56.80
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
13500	**20.9**	**67**	**40**	**7.52**	**19.3**



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TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 N Widening | Tested By : V. Juliano | Date: 01/18/10

Project No. : 602231-002 | Data Input By: J. Ward | Date: 01/20/10

Boring No.	A-09-005	A-09-005		
Sample No.	S-2	S-4		
Sample Depth (ft)	25.0	45.0		
Soil Identification:	Light yellow to brown (SP)	Light brown (ML)		
Wet Weight of Soil + Container (g)	192.30	198.10		
Dry Weight of Soil + Container (g)	191.90	197.50		
Weight of Container (g)	61.00	77.80		
Moisture Content (%)	0.31	0.50		
Weight of Soaked Soil (g)	100.10	100.60		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	9	10		
Crucible No.	23	27		
Furnace Temperature (°C)	0	0		
Time In / Time Out	0:00	0:00		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	18.4166	17.6421		
Wt. of Crucible (g)	18.4156	17.6413		
Wt. of Residue (g) (A)	0.0010	0.0008		
PPM of Sulfate (A) x 41150	41.15	32.92		
PPM of Sulfate, Dry Weight Basis	**41**	**33**		

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30		
ml of AgNO3 Soln. Used in Titration (C)	0.6	0.6		
PPM of Chloride (C -0.2) * 100 * 30 / B	40	40		
PPM of Chloride, Dry Wt. Basis	**40**	**40**		

pH TEST, DOT California Test 532/643

pH Value	**7.36**	**7.65**		
Temperature °C	20.5	20.6		

APPENDIX B

Lateral Earth Pressure Calculation

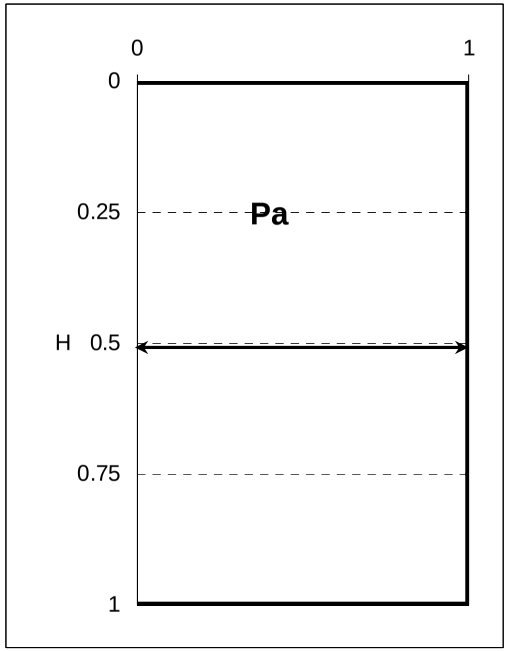
ϕ (degree)	32		
γ (pcf)	125.0		
Individual Pile	No		
Factor of Safety	1.0		
	Level Backfill	Both Back and Front slope	
H, Horizontal		2	
V, Vertical		1	
Friction resistance	0.42		
K_p	3.25	1.23	
K_0	0.47	0.72	
K_a	0.31	0.47	
P_p (pcf)	**406.8**	**154.4**	
P_0 (pcf)	**58.8**	**89.9**	
P_a (pcf)	**38.4**	**58.8**	

Temporary Excavation - Braced Cut

	1	2	3	
	Sand	Soft & Medium Clay	Stiff Clay	

Soil Type: 1

Soil Pressure (psf): **25.0**



Assumption: Wall friction (δ) assumed to be 0.
Passive Pressure: Rankine Theory
Active Pressure: Rankine Theory for Level Backfill and NAVFAC DM 7.02 Ch 3 for Sloping Backfill
At rest condition: empirical relationship by Jaky 1944

Jaky, J., 1944, The Coefficient of Earth Pressure at Rest," Journal of the Society of Hungarian Architects and Engineers, Vol 7, 355-358

NAVFAC Figure 33, Passive pressure distribution for solider piles, p7.2-112

LATERAL EARTH PRESSURES-STATIC CONDITION
DOUGLASS ROAD OH
ANAHEIM, CALIFORNIA

PROJECT NAME : DOUGLASS ROAD WIDEN
PROJECT NO: 602231-001
DESIGNED BY: TK
CHECKED BY: DJC
DATE: 5/30/2008

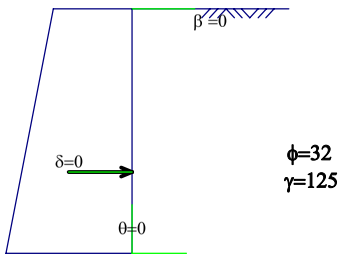
Figure B1

INPUT DATA

Condition:…… Horizontal Soil Layer (MCE)

ϕ, Soil friction (deg)	32.0
δ, Friction angle between soil and concrete wall (deg)	0.0
β, Backfill slope angle (deg)	0.0
θ, Angle of wall slope with vertical wall	0.0
γ, Wet unit weight of the soil (pcf)	125
PeakHorizontal Acceleration	0.42
k_h, Horizontal acceleration coefficient	0.21
k_v, Vertical acceleration coefficient	0.00
$\psi = \tan^{-1}(k_h/(1-k_v))$	11.9 deg

CONFIGURATION



OUTPUT

a) At Rest condition

1. Coeff of **Earth Pressure at Rest, Ko** :…….....…… **0.47**
   Equivalent Fluid Pressure…… 58.8 psf/ft

USE 59 psf/ft

Rankine Solution (For vertical wall only, θ = 0, assuming no wall friction, δ = 0, and upward backfill only, β>0)

1. Coeff of **Active Earth Pressure, K_A** :…….. **0.31**
   Equivalent Fluid Pressure…… 38.4 psf/ft

USE 39 psf/ft

$$K_A^{RANKINE} = \frac{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}$$

2. Coeff of **Passive Earth Pressure, K_P**:……..**3.25**
   Equivalent Fluid Pressure…… 406.8 psf/ft

USE 400 psf/ft

$$K_P^{RANKINE} = \frac{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}$$

3. Coeff of **Seismic & Static Active Earth Pressure, K_{AE}** :…… **0.45**
   Equivalent Fluid Pressure…… 56 psf/ft

$$K_{AE} = \frac{\cos^2(\phi-\theta-\psi)}{\cos\psi\cos^2\theta\cos(\delta+\theta+\psi)\left[1+\sqrt{\frac{\sin(\delta+\phi)\sin(\phi-\beta-\psi)}{\cos(\delta+\theta+\psi)\cos(\beta-\theta)}}\right]^2}$$

4. **Seismic Active Earth Pressure**
   Equivalent Fluid Pressure: 56 psf/ft- 39 psf/ft= 17.1 psf/ft

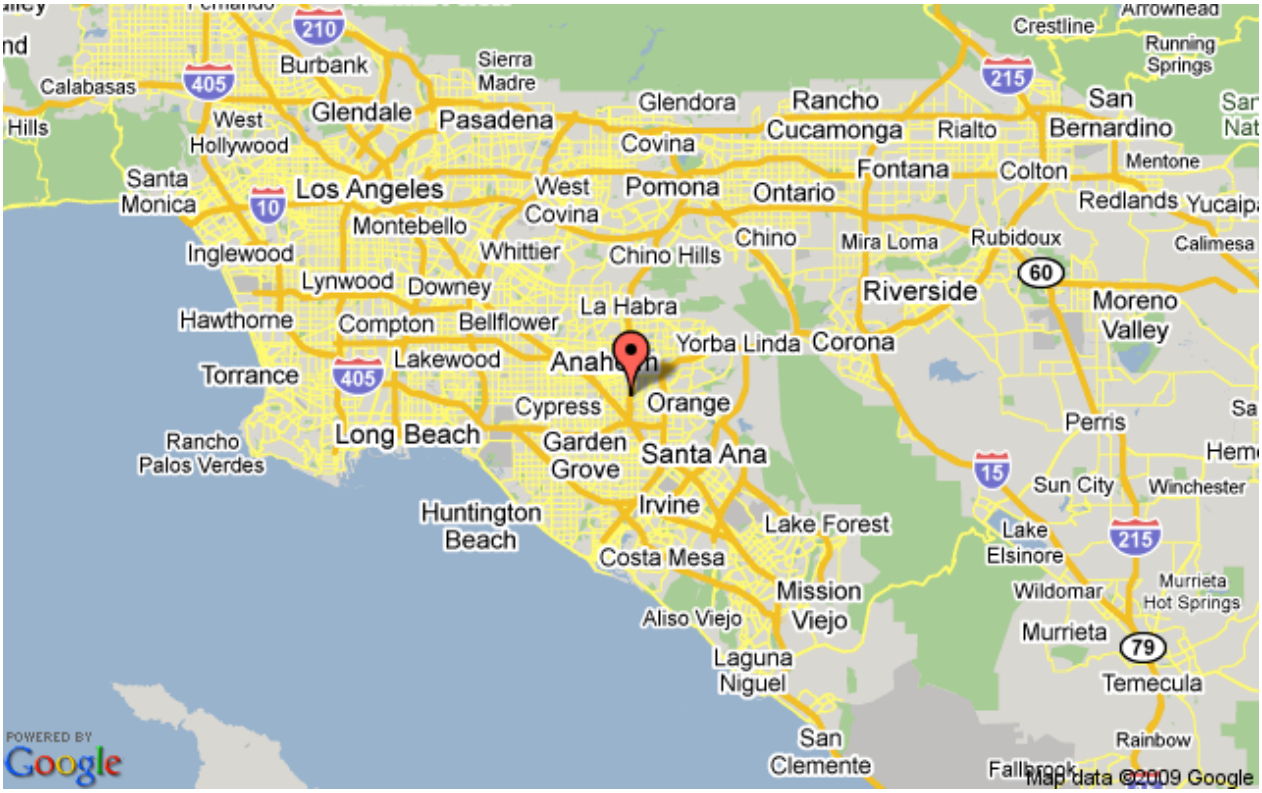
USE 18 psf/ft

Ref:
1. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prince Hall, 1996.
2. Donald P. Couto, "Foundation Design, Principles and Design", Prince Hall, 1994.

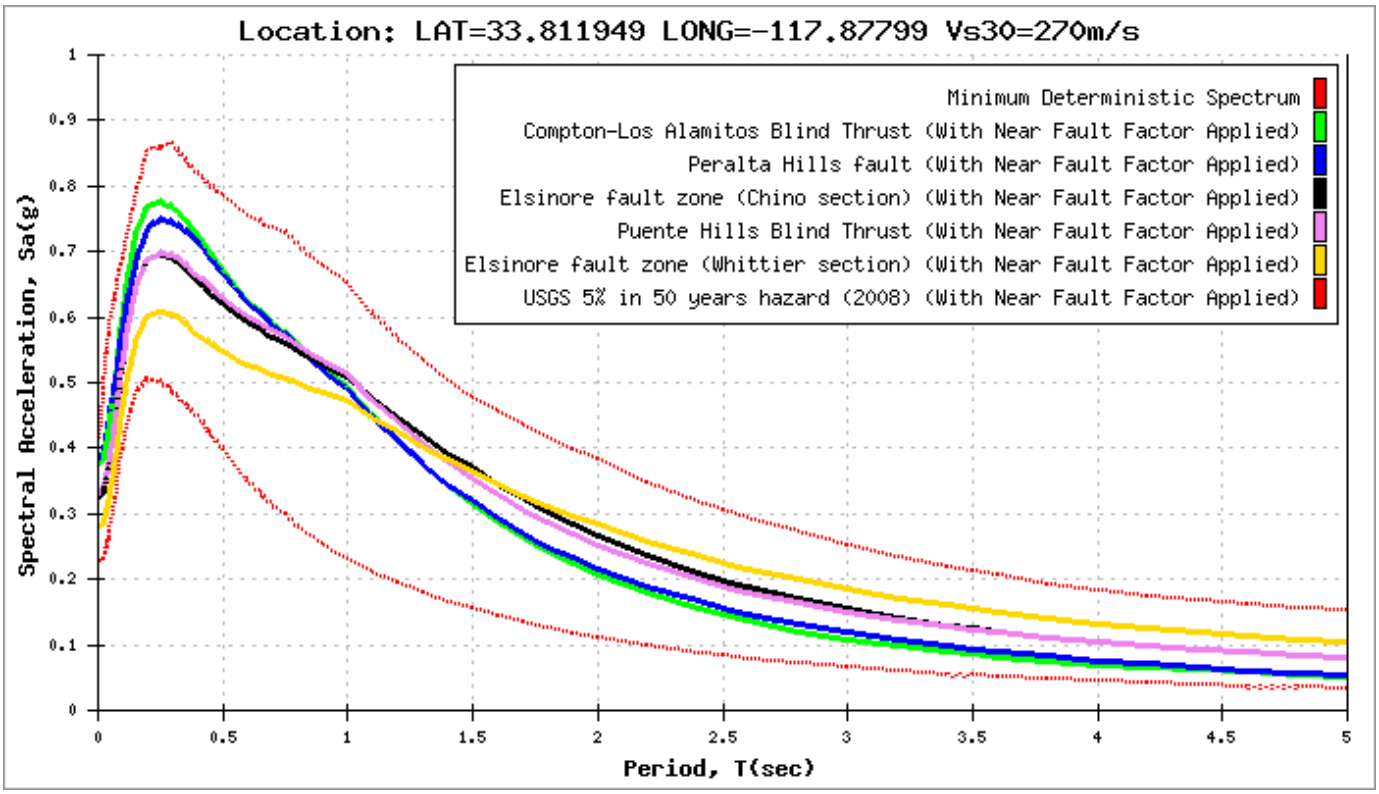
P:\Leighton Consulting\602231\602231.002 SR-57 Phase 2\BA\GI\Lateral Load\Douglass Rd\Active and Passive Pressures Seismic_Douglass.xls\Output

PASSIVE AND ACTIVE PRESSURES **DOUGLASS ROAD UNDERCROSSING** **ANAHEIM, CALIFORNIA**	PROJECT NAME : DOUGLASS RD UC PROJECT NUMBER : 602231-002 DESIGNED/CHECKED BY: TK/DJC	**Figure B2**

SELECT SITE LOCATION



CALCULATED SPECTRA



SITE DATA

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	6.2	(5 to 8.5)
F_{RV}	1	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	50	(0 to 90)
Z_{TOR} *(km)*	0	

Distance

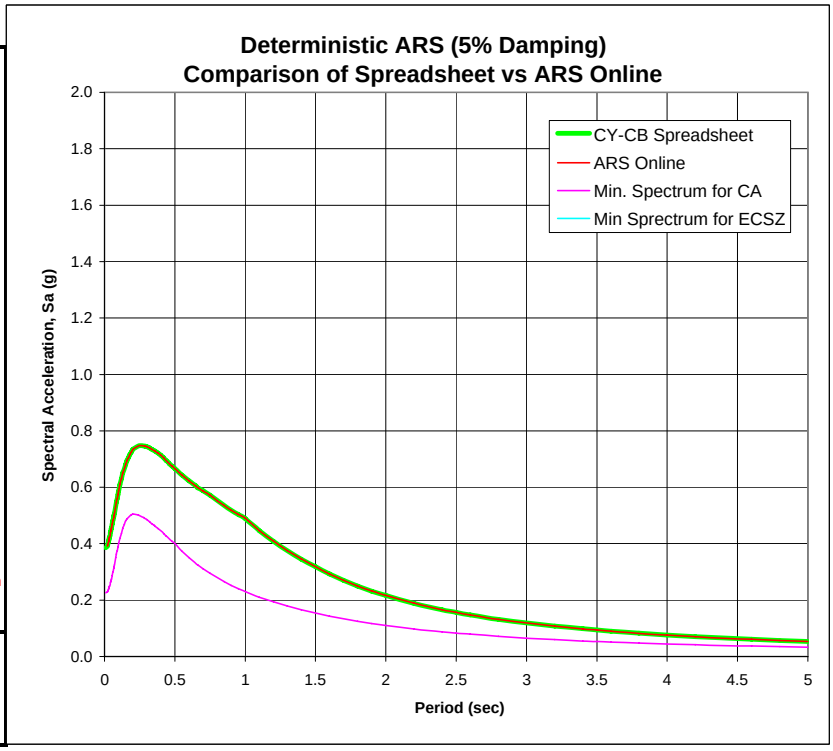
R_{RUP} *(km)*	3.7	
R_{JB} *(km)*	3.7	
R_X *(km)*	3.1	
Hanging Wall?	☐ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	270	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	415	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 1%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.38536
0.020	0.39107
0.022	0.39508
0.025	0.40048
0.029	0.40693
0.030	0.40883
0.032	0.41384
0.035	0.42103
0.036	0.42340
0.040	0.43242
0.042	0.43730
0.044	0.44218
0.045	0.44474
0.046	0.44730
0.048	0.45216
0.050	0.45702
0.055	0.46932
0.060	0.48180
0.065	0.49429
0.067	0.49944
0.070	0.50704
0.075	0.51971
0.080	0.53341
0.085	0.54696
0.090	0.56035
0.095	0.57354
0.100	0.58632
0.110	0.60967
0.120	0.63099
0.130	0.65002
0.133	0.65506
0.140	0.66616
0.150	0.68061
0.160	0.69392
0.170	0.70550
0.180	0.71605

Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.385	1	1	0.385	0%
0.02	0.391	1	1	0.391	0%
0.022	0.395	1	1	0.395	0%
0.025	0.4	1	1	0.4	0%
0.029	0.407	1	1	0.407	0%
0.03	0.409	1	1	0.409	0%
0.032	0.414	1	1	0.414	0%
0.035	0.421	1	1	0.421	0%
0.036	0.423	1	1	0.423	0%
0.04	0.432	1	1	0.432	0%
0.042	0.437	1	1	0.437	0%
0.044	0.442	1	1	0.442	0%
0.045	0.445	1	1	0.445	0%
0.046	0.447	1	1	0.447	0%
0.048	0.452	1	1	0.452	0%
0.05	0.457	1	1	0.457	0%
0.055	0.469	1	1	0.469	0%
0.06	0.482	1	1	0.482	0%
0.065	0.494	1	1	0.494	0%
0.067	0.499	1	1	0.499	0%
0.07	0.507	1	1	0.507	0%
0.075	0.52	1	1	0.52	0%
0.08	0.533	1	1	0.533	0%
0.085	0.547	1	1	0.547	0%
0.09	0.56	1	1	0.56	0%
0.095	0.574	1	1	0.574	0%
0.1	0.586	1	1	0.586	0%
0.11	0.61	1	1	0.61	0%
0.12	0.631	1	1	0.631	0%
0.13	0.65	1	1	0.65	0%
0.133	0.655	1	1	0.655	0%
0.14	0.666	1	1	0.666	0%
0.15	0.681	1	1	0.681	0%
0.16	0.694	1	1	0.694	0%
0.17	0.705	1	1	0.705	0%
0.18	0.716	1	1	0.716	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.235		
0.029	0.239		
0.03	0.24		
0.032	0.243		
0.035	0.248		
0.036	0.25		
0.04	0.257		
0.042	0.26		
0.044	0.264		
0.045	0.266		
0.046	0.268		
0.048	0.271		
0.05	0.275		
0.055	0.287		
0.06	0.3		
0.065	0.312		
0.067	0.317		
0.07	0.325		
0.075	0.337		
0.08	0.35		
0.085	0.363		
0.09	0.375		
0.095	0.388		
0.1	0.4		
0.11	0.419		
0.12	0.437		
0.13	0.454		
0.133	0.458		
0.14	0.468		
0.15	0.481		
0.16	0.488		
0.17	0.493		
0.18	0.498		

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	6.8	(5 to 8.5)
F_{RV}	1	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	20	(0 to 90)
Z_{TOR} *(km)*	5	

Distance

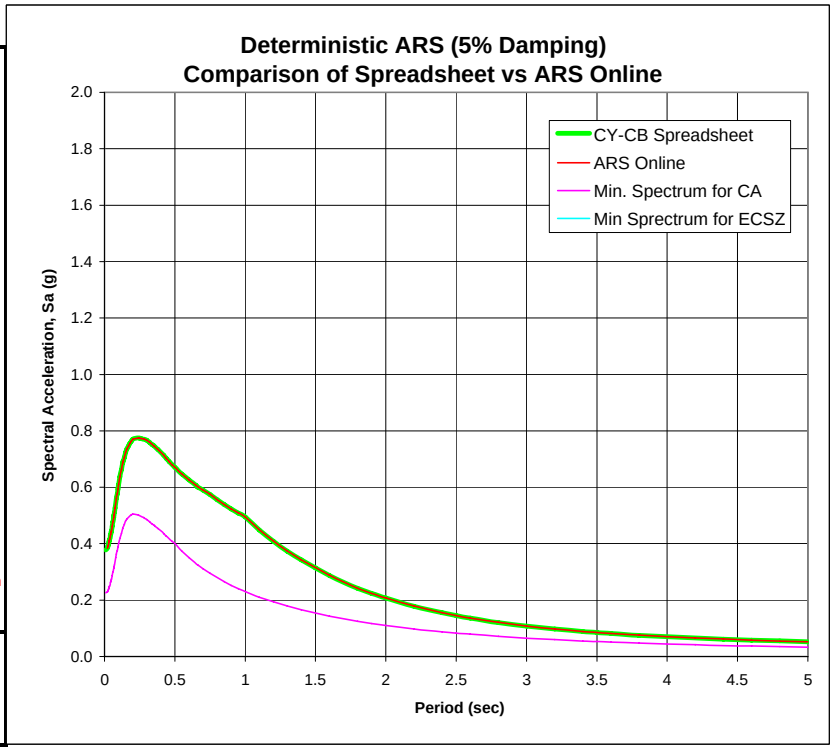
R_{RUP} *(km)*	11.8	
R_{JB} *(km)*	6.2	
R_X *(km)*	20.0	
Hanging Wall?	☑ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	270	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	415	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 1%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.37781
0.020	0.38417
0.022	0.38791
0.025	0.39298
0.029	0.39900
0.030	0.40083
0.032	0.40561
0.035	0.41233
0.036	0.41450
0.040	0.42294
0.042	0.42750
0.044	0.43208
0.045	0.43453
0.046	0.43689
0.048	0.44155
0.050	0.44609
0.055	0.46199
0.060	0.47795
0.065	0.49394
0.067	0.50042
0.070	0.51005
0.075	0.52602
0.080	0.54311
0.085	0.55990
0.090	0.57665
0.095	0.59316
0.100	0.60924
0.110	0.63709
0.120	0.66277
0.130	0.68592
0.133	0.69221
0.140	0.70601
0.150	0.72410
0.160	0.73612
0.170	0.74641
0.180	0.75546

Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.378	1	1	0.378	0%
0.02	0.384	1	1	0.384	0%
0.022	0.388	1	1	0.388	0%
0.025	0.393	1	1	0.393	0%
0.029	0.399	1	1	0.399	0%
0.03	0.401	1	1	0.401	0%
0.032	0.406	1	1	0.406	0%
0.035	0.412	1	1	0.412	0%
0.036	0.415	1	1	0.415	0%
0.04	0.423	1	1	0.423	0%
0.042	0.428	1	1	0.428	0%
0.044	0.432	1	1	0.432	0%
0.045	0.435	1	1	0.435	0%
0.046	0.437	1	1	0.437	0%
0.048	0.442	1	1	0.442	0%
0.05	0.446	1	1	0.446	0%
0.055	0.462	1	1	0.462	0%
0.06	0.478	1	1	0.478	0%
0.065	0.494	1	1	0.494	0%
0.067	0.5	1	1	0.5	0%
0.07	0.51	1	1	0.51	0%
0.075	0.526	1	1	0.526	0%
0.08	0.543	1	1	0.543	0%
0.085	0.56	1	1	0.56	0%
0.09	0.577	1	1	0.577	0%
0.095	0.593	1	1	0.593	0%
0.1	0.609	1	1	0.609	0%
0.11	0.637	1	1	0.637	0%
0.12	0.663	1	1	0.663	0%
0.13	0.686	1	1	0.686	0%
0.133	0.692	1	1	0.692	0%
0.14	0.706	1	1	0.706	0%
0.15	0.724	1	1	0.724	0%
0.16	0.736	1	1	0.736	0%
0.17	0.746	1	1	0.746	0%
0.18	0.756	1	1	0.756	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.235		
0.029	0.239		
0.03	0.24		
0.032	0.243		
0.035	0.248		
0.036	0.25		
0.04	0.257		
0.042	0.26		
0.044	0.264		
0.045	0.266		
0.046	0.268		
0.048	0.271		
0.05	0.275		
0.055	0.287		
0.06	0.3		
0.065	0.312		
0.067	0.317		
0.07	0.325		
0.075	0.337		
0.08	0.35		
0.085	0.363		
0.09	0.375		
0.095	0.388		
0.1	0.4		
0.11	0.419		
0.12	0.437		
0.13	0.454		
0.133	0.458		
0.14	0.468		
0.15	0.481		
0.16	0.488		
0.17	0.493		
0.18	0.498		

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	7.3	(5 to 8.5)
F_{RV}	1	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	25	(0 to 90)
Z_{TOR} *(km)*	2.6	

Distance

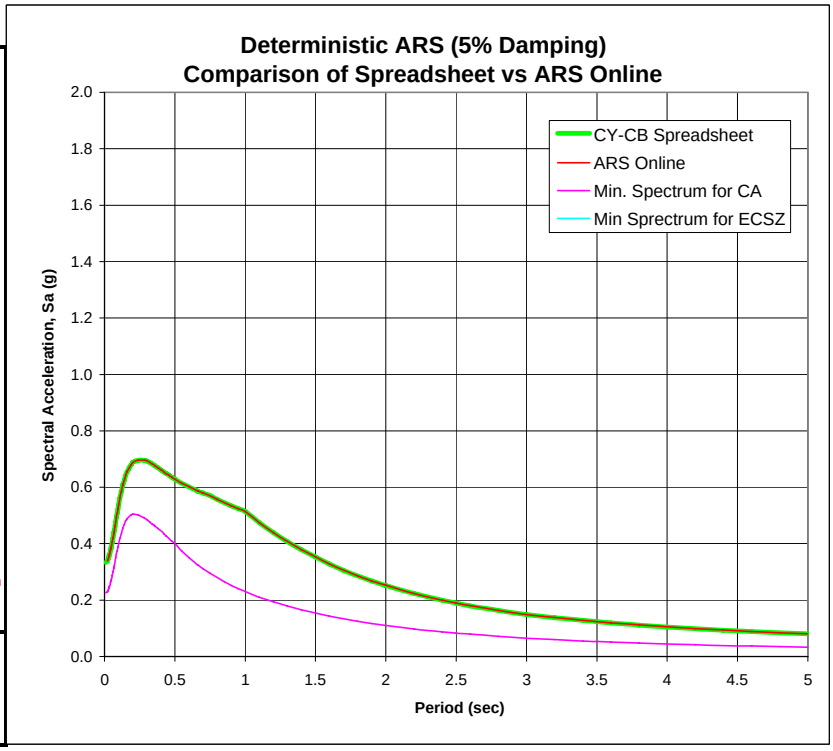
R_{RUP} *(km)*	12.3	
R_{JB} *(km)*	12.0	
R_X *(km)*	12.0	
Hanging Wall?	☐ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	270	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	415	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 1%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.33318
0.020	0.33750
0.022	0.34056
0.025	0.34473
0.029	0.34967
0.030	0.35119
0.032	0.35529
0.035	0.36116
0.036	0.36310
0.040	0.37059
0.042	0.37466
0.044	0.37874
0.045	0.38092
0.046	0.38304
0.048	0.38720
0.050	0.39133
0.055	0.40544
0.060	0.41970
0.065	0.43393
0.067	0.43973
0.070	0.44831
0.075	0.46257
0.080	0.47789
0.085	0.49305
0.090	0.50805
0.095	0.52286
0.100	0.53729
0.110	0.56250
0.120	0.58581
0.130	0.60691
0.133	0.61264
0.140	0.62535
0.150	0.64209
0.160	0.65384
0.170	0.66397
0.180	0.67309

Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.333	1	1	0.333	0%
0.02	0.338	1	1	0.338	0%
0.022	0.341	1	1	0.341	0%
0.025	0.345	1	1	0.345	0%
0.029	0.35	1	1	0.35	0%
0.03	0.351	1	1	0.351	0%
0.032	0.355	1	1	0.355	0%
0.035	0.361	1	1	0.361	0%
0.036	0.363	1	1	0.363	0%
0.04	0.371	1	1	0.371	0%
0.042	0.375	1	1	0.375	0%
0.044	0.379	1	1	0.379	0%
0.045	0.381	1	1	0.381	0%
0.046	0.383	1	1	0.383	0%
0.048	0.387	1	1	0.387	0%
0.05	0.391	1	1	0.391	0%
0.055	0.406	1	1	0.406	0%
0.06	0.42	1	1	0.42	0%
0.065	0.434	1	1	0.434	0%
0.067	0.44	1	1	0.44	0%
0.07	0.448	1	1	0.448	0%
0.075	0.463	1	1	0.463	0%
0.08	0.478	1	1	0.478	0%
0.085	0.493	1	1	0.493	0%
0.09	0.508	1	1	0.508	0%
0.095	0.523	1	1	0.523	0%
0.1	0.537	1	1	0.537	0%
0.11	0.563	1	1	0.563	0%
0.12	0.586	1	1	0.586	0%
0.13	0.607	1	1	0.607	0%
0.133	0.613	1	1	0.613	0%
0.14	0.625	1	1	0.625	0%
0.15	0.642	1	1	0.642	0%
0.16	0.654	1	1	0.654	0%
0.17	0.664	1	1	0.664	0%
0.18	0.673	1	1	0.673	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.235		
0.029	0.239		
0.03	0.24		
0.032	0.243		
0.035	0.248		
0.036	0.25		
0.04	0.257		
0.042	0.26		
0.044	0.264		
0.045	0.266		
0.046	0.268		
0.048	0.271		
0.05	0.275		
0.055	0.287		
0.06	0.3		
0.065	0.312		
0.067	0.317		
0.07	0.325		
0.075	0.337		
0.08	0.35		
0.085	0.363		
0.09	0.375		
0.095	0.388		
0.1	0.4		
0.11	0.419		
0.12	0.437		
0.13	0.454		
0.133	0.458		
0.14	0.468		
0.15	0.481		
0.16	0.488		
0.17	0.493		
0.18	0.498		

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	7.6	(5 to 8.5)
F_{RV}	0	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	75	(0 to 90)
Z_{TOR} *(km)*	0	

Distance

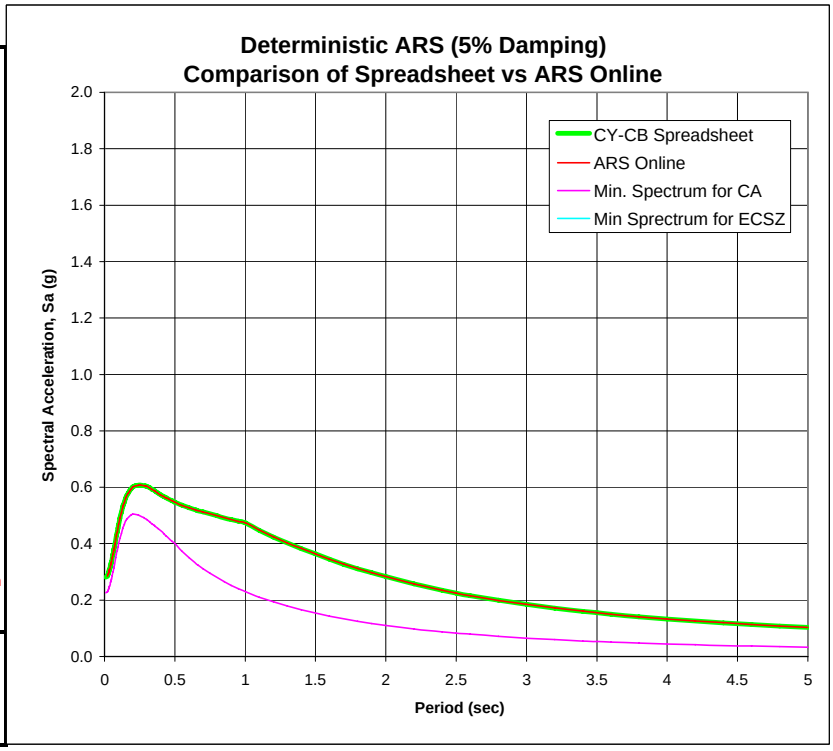
R_{RUP} *(km)*	13.1	
R_{JB} *(km)*	13.1	
R_X *(km)*	13.1	
Hanging Wall?	☐ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	270	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	415	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 0%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.28147
0.020	0.28529
0.022	0.28808
0.025	0.29193
0.029	0.29658
0.030	0.29799
0.032	0.30178
0.035	0.30731
0.036	0.30916
0.040	0.31629
0.042	0.32017
0.044	0.32405
0.045	0.32611
0.046	0.32815
0.048	0.33210
0.050	0.33607
0.055	0.34881
0.060	0.36177
0.065	0.37466
0.067	0.37996
0.070	0.38774
0.075	0.40072
0.080	0.41448
0.085	0.42816
0.090	0.44162
0.095	0.45492
0.100	0.46787
0.110	0.49051
0.120	0.51137
0.130	0.53020
0.133	0.53527
0.140	0.54656
0.150	0.56141
0.160	0.57178
0.170	0.58059
0.180	0.58854

Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.281	1	1	0.281	0%
0.02	0.285	1	1	0.285	0%
0.022	0.288	1	1	0.288	0%
0.025	0.292	1	1	0.292	0%
0.029	0.296	1	1	0.296	0%
0.03	0.298	1	1	0.298	0%
0.032	0.302	1	1	0.302	0%
0.035	0.307	1	1	0.307	0%
0.036	0.309	1	1	0.309	0%
0.04	0.316	1	1	0.316	0%
0.042	0.32	1	1	0.32	0%
0.044	0.324	1	1	0.324	0%
0.045	0.326	1	1	0.326	0%
0.046	0.328	1	1	0.328	0%
0.048	0.332	1	1	0.332	0%
0.05	0.336	1	1	0.336	0%
0.055	0.349	1	1	0.349	0%
0.06	0.362	1	1	0.362	0%
0.065	0.375	1	1	0.375	0%
0.067	0.38	1	1	0.38	0%
0.07	0.388	1	1	0.388	0%
0.075	0.401	1	1	0.401	0%
0.08	0.414	1	1	0.414	0%
0.085	0.428	1	1	0.428	0%
0.09	0.441	1	1	0.441	0%
0.095	0.455	1	1	0.455	0%
0.1	0.468	1	1	0.468	0%
0.11	0.49	1	1	0.49	0%
0.12	0.511	1	1	0.511	0%
0.13	0.53	1	1	0.53	0%
0.133	0.535	1	1	0.535	0%
0.14	0.546	1	1	0.546	0%
0.15	0.561	1	1	0.561	0%
0.16	0.572	1	1	0.572	0%
0.17	0.58	1	1	0.58	0%
0.18	0.588	1	1	0.588	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.235		
0.029	0.239		
0.03	0.24		
0.032	0.243		
0.035	0.248		
0.036	0.25		
0.04	0.257		
0.042	0.26		
0.044	0.264		
0.045	0.266		
0.046	0.268		
0.048	0.271		
0.05	0.275		
0.055	0.287		
0.06	0.3		
0.065	0.312		
0.067	0.317		
0.07	0.325		
0.075	0.337		
0.08	0.35		
0.085	0.363		
0.09	0.375		
0.095	0.388		
0.1	0.4		
0.11	0.419		
0.12	0.437		
0.13	0.454		
0.133	0.458		
0.14	0.468		
0.15	0.481		
0.16	0.488		
0.17	0.493		
0.18	0.498		

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	7.6	(5 to 8.5)
F_{RV}	1	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	50	(0 to 90)
Z_{TOR} *(km)*	0	

Distance

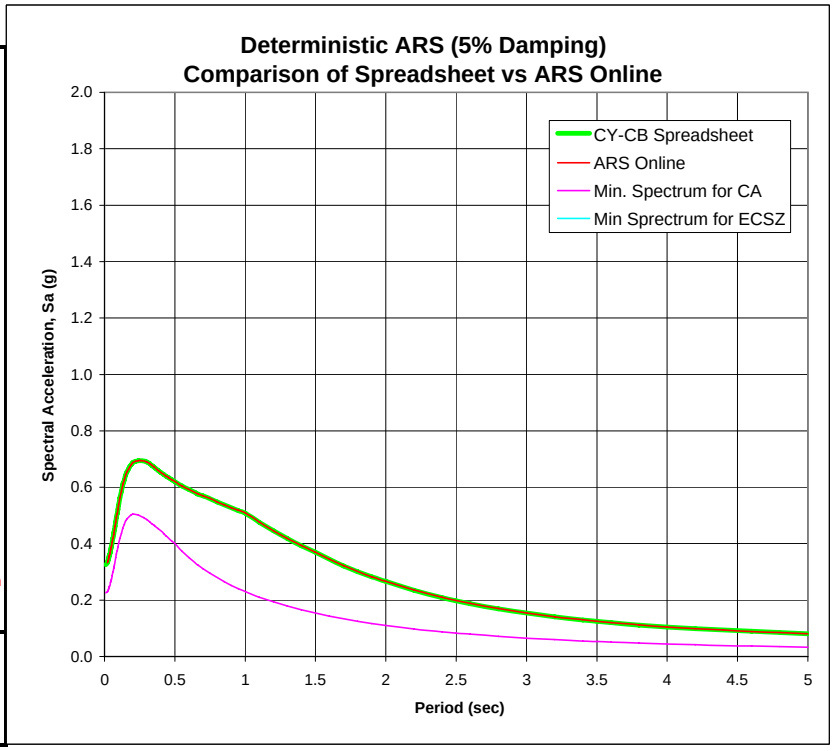
R_{RUP} *(km)*	16.8	
R_{JB} *(km)*	9.3	
R_X *(km)*	21.9	
Hanging Wall?	☑ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	270	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	415	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 0%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.32575
0.020	0.33207
0.022	0.33559
0.025	0.34042
0.029	0.34627
0.030	0.34805
0.032	0.35244
0.035	0.35877
0.036	0.36087
0.040	0.36886
0.042	0.37324
0.044	0.37764
0.045	0.37997
0.046	0.38228
0.048	0.38671
0.050	0.39113
0.055	0.40507
0.060	0.41921
0.065	0.43331
0.067	0.43913
0.070	0.44771
0.075	0.46203
0.080	0.47729
0.085	0.49243
0.090	0.50743
0.095	0.52228
0.100	0.53673
0.110	0.56265
0.120	0.58647
0.130	0.60788
0.133	0.61362
0.140	0.62630
0.150	0.64292
0.160	0.65462
0.170	0.66448
0.180	0.67330

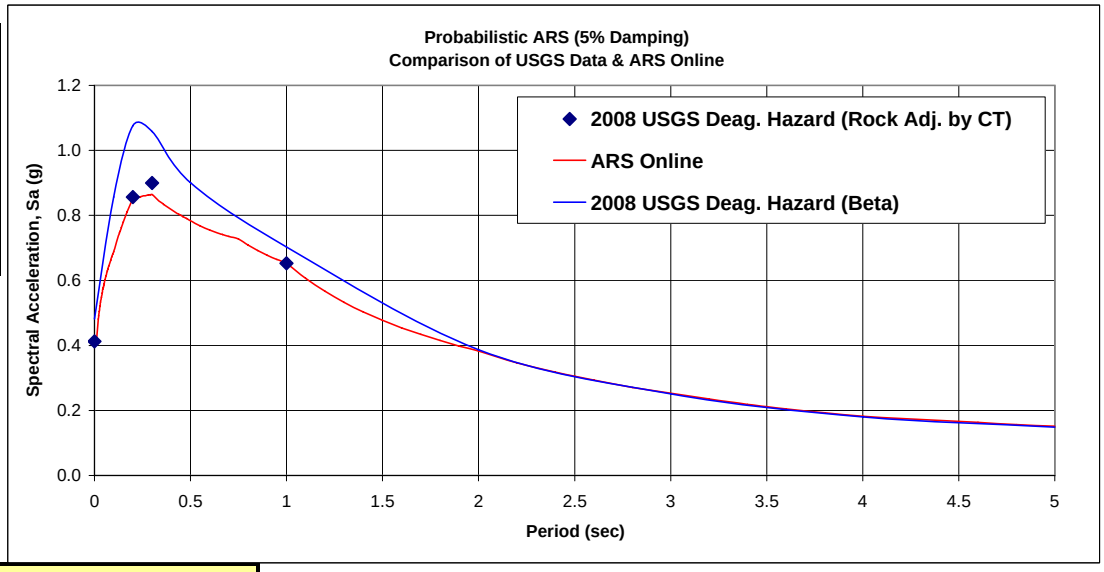
Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.326	1	1	0.326	0%
0.02	0.332	1	1	0.332	0%
0.022	0.336	1	1	0.336	0%
0.025	0.34	1	1	0.34	0%
0.029	0.346	1	1	0.346	0%
0.03	0.348	1	1	0.348	0%
0.032	0.352	1	1	0.352	0%
0.035	0.359	1	1	0.359	0%
0.036	0.361	1	1	0.361	0%
0.04	0.369	1	1	0.369	0%
0.042	0.373	1	1	0.373	0%
0.044	0.378	1	1	0.378	0%
0.045	0.38	1	1	0.38	0%
0.046	0.382	1	1	0.382	0%
0.048	0.387	1	1	0.387	0%
0.05	0.391	1	1	0.391	0%
0.055	0.405	1	1	0.405	0%
0.06	0.419	1	1	0.419	0%
0.065	0.433	1	1	0.433	0%
0.067	0.439	1	1	0.439	0%
0.07	0.448	1	1	0.448	0%
0.075	0.462	1	1	0.462	0%
0.08	0.477	1	1	0.477	0%
0.085	0.492	1	1	0.492	0%
0.09	0.507	1	1	0.507	0%
0.095	0.522	1	1	0.522	0%
0.1	0.537	1	1	0.537	0%
0.11	0.563	1	1	0.563	0%
0.12	0.586	1	1	0.586	0%
0.13	0.608	1	1	0.608	0%
0.133	0.614	1	1	0.614	0%
0.14	0.626	1	1	0.626	0%
0.15	0.643	1	1	0.643	0%
0.16	0.655	1	1	0.655	0%
0.17	0.664	1	1	0.664	0%
0.18	0.673	1	1	0.673	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.235		
0.029	0.239		
0.03	0.24		
0.032	0.243		
0.035	0.248		
0.036	0.25		
0.04	0.257		
0.042	0.26		
0.044	0.264		
0.045	0.266		
0.046	0.268		
0.048	0.271		
0.05	0.275		
0.055	0.287		
0.06	0.3		
0.065	0.312		
0.067	0.317		
0.07	0.325		
0.075	0.337		
0.08	0.35		
0.085	0.363		
0.09	0.375		
0.095	0.388		
0.1	0.4		
0.11	0.419		
0.12	0.437		
0.13	0.454		
0.133	0.458		
0.14	0.468		
0.15	0.481		
0.16	0.488		
0.17	0.493		
0.18	0.498		

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock spreadsheet "shmi")
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% in 50 yrs (or 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolation is used to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in the "calculation" tab.**

Input Site Information	
Latitude	Longitude
33.8119	-117.8780
V_{S30} (m/s) =	270
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	13.6
$Z_{1.0}$ (m) =	415
$Z_{2.5}$ (km) =	2



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.412	1	1	0.412
0.02	0.481	1	1	0.481
0.022	0.491	1	1	0.491
0.025	0.505	1	1	0.505
0.029	0.522	1	1	0.522
0.03	0.526	1	1	0.526
0.032	0.534	1	1	0.534
0.035	0.545	1	1	0.545
0.036	0.548	1	1	0.548
0.04	0.561	1	1	0.561
0.042	0.567	1	1	0.567
0.044	0.573	1	1	0.573
0.045	0.576	1	1	0.576
0.046	0.579	1	1	0.579
0.048	0.584	1	1	0.584
0.05	0.59	1	1	0.59
0.055	0.602	1	1	0.602
0.06	0.614	1	1	0.614
0.065	0.625	1	1	0.625
0.067	0.629	1	1	0.629
0.07	0.635	1	1	0.635
0.075	0.645	1	1	0.645
0.08	0.654	1	1	0.654
0.085	0.663	1	1	0.663
0.09	0.672	1	1	0.672
0.095	0.68	1	1	0.68
0.1	0.688	1	1	0.688
0.11	0.708	1	1	0.708
0.12	0.728	1	1	0.728
0.13	0.746	1	1	0.746
0.133	0.751	1	1	0.751
0.14	0.763	1	1	0.763
0.15	0.78	1	1	0.78
0.16	0.795	1	1	0.795
0.17	0.811	1	1	0.811
0.18	0.825	1	1	0.825
0.19	0.839	1	1	0.839
0.2	0.852	1	1	0.852
0.22	0.855	1	1	0.855

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. By CT)

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.405	1.000	1.018	1.000	0.412	0.412	0.1%
0.2	0.986	1.000	0.868	1.000	0.856	0.852	0.5%
0.3	0.808	1.000	1.114	1.000	0.900	0.864	4.0%
1	0.300	1.200	1.808	1.002	0.653	0.652	0.1%

Max % Difference = 4.0%

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.4818	1.000	1.000	0.482	0.412	14.5%
0.1	0.8562	1.000	1.000	0.856	0.688	19.6%
0.2	1.076	1.000	1.000	1.076	0.852	20.8%
0.3	1.0581	1.000	1.000	1.058	0.864	18.3%
0.5	0.9012	1.000	1.000	0.901	0.784	13.0%
1	0.5844	1.200	1.002	0.703	0.652	7.2%
2	0.3148	1.200	1.023	0.387	0.383	0.9%
3	0.2032	1.200	1.028	0.251	0.253	0.9%
4	0.14586	1.200	1.029	0.180	0.182	1.0%
5	0.12063	1.200	1.030	0.149	0.152	2.0%

Max % Difference = 13.0%

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

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Project Information

Dist – EA: 12-0F0401 County: ORA Route: 57 PM: 12.98

Bridge/Facility Name: Douglass Overhead Bridge/Facility No.: 55-0337

Latitude: 33.811949 Longitude: -117.87799

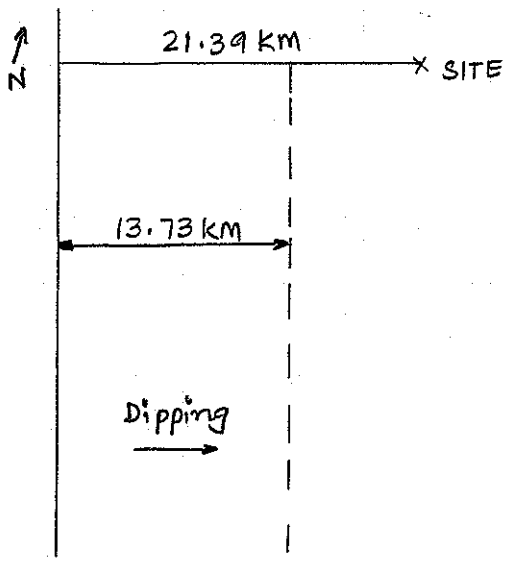
Deterministic Fault Information

Fault Name: Compton-Los Alamitos Fault ID#: 291 M_{MAX}: 6.8 Fault Type: R

Fault Dip: 20° Dip Direction: NE Top of Rupture: 5km Bottom of Rupture: 10km.

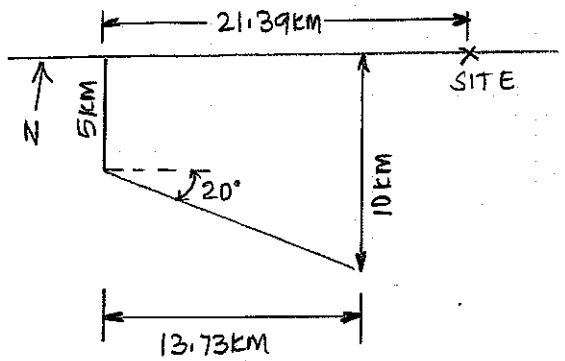
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	12.60 km	☒	Calculated / graphically	☐	Same as Rx (by definition)
R_{JB}:	7.66 km	☒	Calculated / graphically	☐	Same as Rx (by definition)
R_X:	21.39 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

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Project Information

Dist – EA: 12-0F0401 County: ORA Route: 57 PM: 12.98

Bridge/Facility Name: Douglass Overhead Bridge/Facility No.: 55-0337

Latitude: 33.811949 Longitude: -117.87799

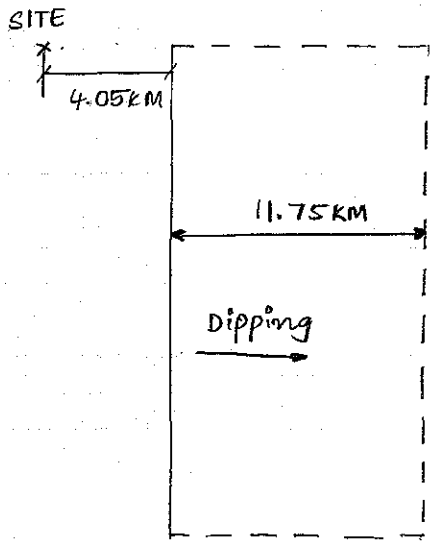
Deterministic Fault Information

Fault Name: Peralta Hills Fault ID#: 146 M_{MAX}: 6.2 Fault Type: R

Fault Dip: 50° Dip Direction: N Top of Rupture: 0 KM Bottom of Rupture: 14 KM

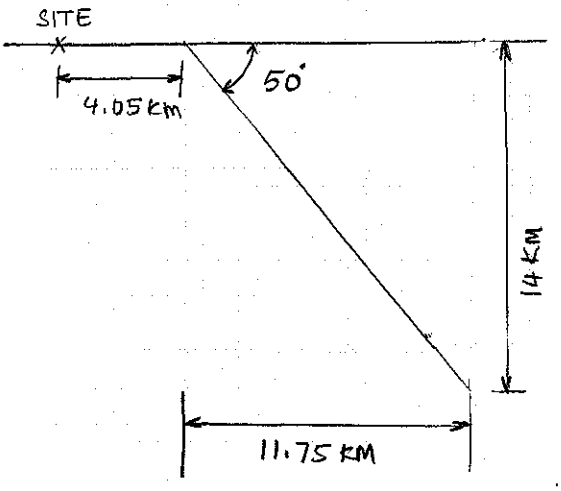
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	4.05 km	☐	Calculated / graphically	☒	Same as Rx (by definition)
R_{JB}:	4.05 km	☐	Calculated / graphically	☒	Same as Rx (by definition)
R_X:	4.05 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

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Project Information

Dist – EA: 12-0F0401 County: ORA Route: 57 PM: 12.98

Bridge/Facility Name: Douglass Overhead Bridge/Facility No.: 55-0337

Latitude: 33.811949 Longitude: -117.87799

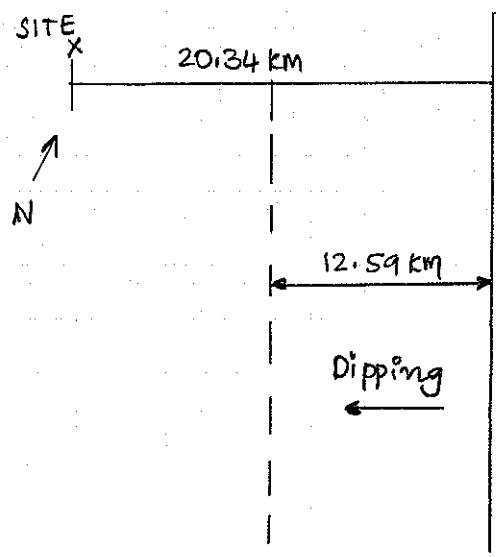
Deterministic Fault Information

Fault Name: Elsinore (Chino) Fault ID#: 242 M_{MAX}: 7.6 Fault Type: R

Fault Dip: 50° Dip Direction: W Top of Rupture: 0 km Bottom of Rupture: 15 km.

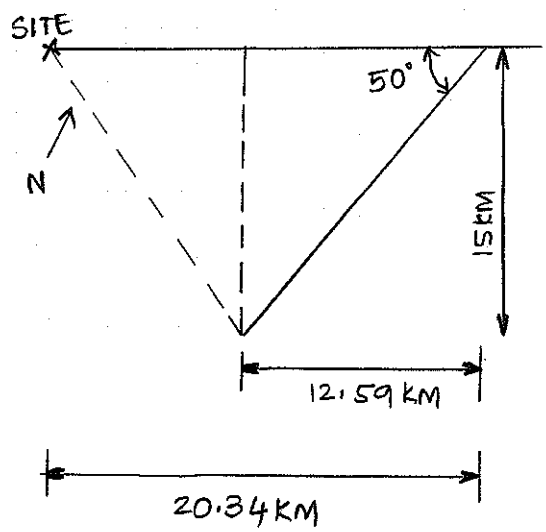
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	16.88 km	☒	Calculated / graphically	☐	Same as Rx (by definition)
R_{JB}:	7.75 km	☒	Calculated / graphically	☐	Same as Rx (by definition)
R_X:	20.34 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

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Project Information

Dist – EA: 12-0F0401 County: ORA Route: 57 PM: 12.98

Bridge/Facility Name: Douglass Overhead Bridge/Facility No.: 55-0337

Latitude: 33.811949 Longitude: -117.87799

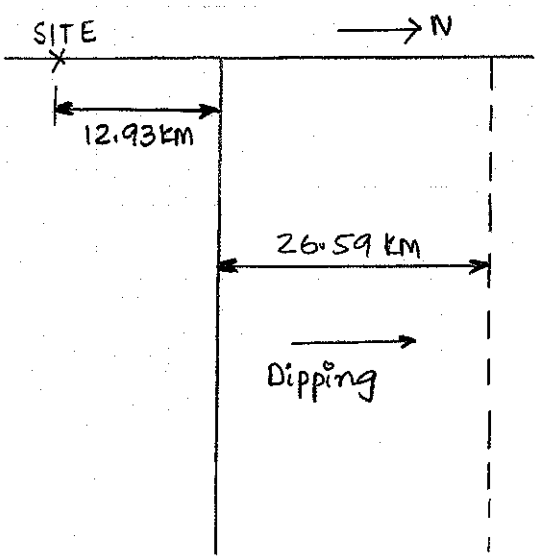
Deterministic Fault Information

Fault Name: Puente Hills Fault ID#: 240 M_{MAX}: 7.3 Fault Type: R

Fault Dip: 25° Dip Direction: N Top of Rupture: 2.6 km Bottom of Rupture: 15 km

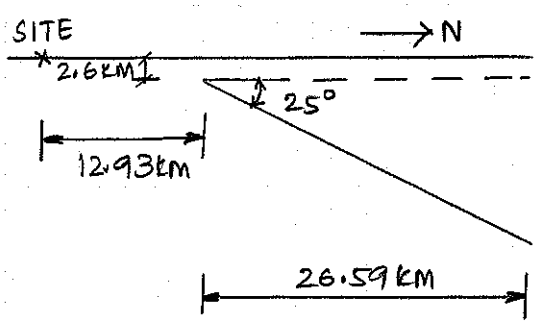
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	13.18 km	☒	Calculated / graphically	☐	Same as Rx (by definition)
R_{JB}:	12.93 km	☐	Calculated / graphically	☒	Same as Rx (by definition)
R_X:	12.93 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

This document is to be filled out by *checker* to evaluate the fault parameters and design response spectrum used for seismic design recommendations for bridge structures. To facilitate the quality check, the designer shall provide the checker all pertinent project information, geologic information and approved exceptions (if applicable) needed to complete this form. The *checker* must be familiar with the Seismic Design Criteria (Appendix B), Deterministic PGA Map and ARS Online Report, and Geotechnical Services Design Manual in order to successfully perform a quality check. Tools available to checkers include the Deterministic Response Spectrum Spreadsheet, Probabilistic Response Spectrum Spreadsheet (after USGS), 2008 USGS National Seismic Hazard Map and the ARS Online web tool. The above documents and tools are available at http://dap3.dot.ca.gov/shake_stable/technical.php.

Project Information

Dist – EA: 12-0F0401 County: ORA Route: 57 PM: 12.98

Bridge/Facility Name: Douglass Overhead Bridge/Facility No.: 55-0337

Latitude: 33.811949 Longitude: -117.87799

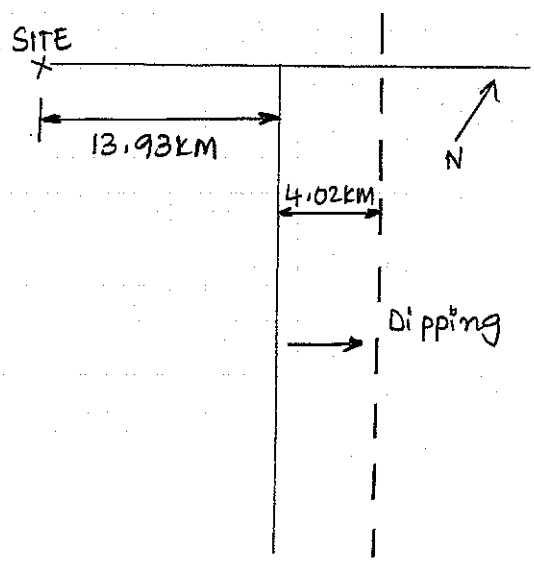
Deterministic Fault Information

Fault Name: Elsinore (Whittier) Fault ID#: 241 M_{MAX}: 7.6 Fault Type: RLSS

Fault Dip: 75° Dip Direction: NE Top of Rupture: 0km Bottom of Rupture: 15km

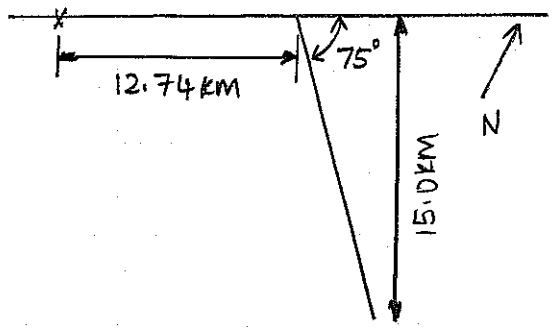
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	12.74 km	☐	Calculated / graphically	☒	Same as Rx (by definition)
R_{JB}:	12.74 km	☐	Calculated / graphically	☒	Same as Rx (by definition)
R_X:	12.74 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

Determination of V_{S30}

V_{S30} (m/s): 270 M/S

Method of Determining V_{S30}: SPT Correlations (e.g. P-S logging, Geophysics, SPT correlations, etc)

Additional Explanation (if needed): _____

Determination of Z1.0 and Z2.5 (if site located in designated California deep basin)

$Z_{1.0}$ (m/s): 415 $Z_{2.5}$ (km/s): 2

Method of Determining $Z_{1.0}$ & $Z_{2.5}$: ARS Online (e.g. ARS Online, SDC figure, other)

Additional Explanation (if needed): _____

Deterministic - Special Conditions

Yes	No	N/A	
☒	☐		Was the Errata Deterministic Fault Database Spreadsheet reviewed to ensure that the correct fault parameters used in the analysis.
☒	☐	☐	Were the Near-Fault Factors applied correctly? *Applies to sites with a R_{RUP} distance of 25 km or less, as defined in the SDC.*
☒	☐	☐	Were deep basin depths ($Z_{1.0}$ & $Z_{2.5}$) estimated correctly? *Applies to sites located in deep basins as shown in Figures B.5 - B.11 of the SDC or ARS Online.*
☐	☐	☒	If the site is located within the Eastern California Shear Zone (ECSZ), was the design ARS larger than the minimum spectrum for the ECSZ (as defined in the SDC, Appendix B, Figure B.2)?
☐	☐	☒	If the controlling fault is the Cascadia Subduction Zone, was the alternate seismic procedure applied correctly (as defined in the SDC, Appendix B)?
☐	☒	☐	If the deterministic ARS falls below the Minimum Deterministic Spectra (as defined in the SDC), did the Minimum Deterministic Spectra control the deterministic design spectrum?
☒	☐		Did the ARS Online deterministic spectrum correspond within 10% of the calculated deterministic spectrum? If not, note it in the comments section of this document and email a copy to the ARS Online development team, ARS_Online@dot.ca.gov, so that they may address the potential bug.

Probabilistic - Special Conditions

Yes	No	N/A	
☒	☐	☐	Were Near-Fault Factors applied correctly (as defined by SDC)? *Applies to sites with a deaggregation R distance of 25 km or less.*
☒	☐	☐	Were deep basin depths ($Z_{1.0}$ & $Z_{2.5}$) estimated correctly? *Applies to sites located in deep basins as shown in Figures B.5 - B.11 of the SDC or ARS Online.*
☒	☐	☐	If the site has a V_{S30} of less than 300 m/s, was the resulting ARS curve checked against spectral acceleration from USGS Interactive Deaggregation tool?
☒	☐	☐	If the USGS Interactive Deaggregation tool and spectral acceleration data were used, were the appropriate near-fault and basin correction factors applied?

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

Yes	No	N/A	
☐	☒	☐	If the probabilistic ARS falls below the Minimum Deterministic Spectra (as defined in the SDC), did the Minimum Deterministic Spectra control the design spectrum?
☒	☐		Did the ARS Online design spectrum correspond within 10% of the USGS spectral acceleration data from the verification spreadsheet? If not, note it in the comments section of this document and email a copy to the ARS Online development team, ARS_Online@dot.ca.gov, so that they may address the potential bug.

Comments / Observations Encountered during QC/QA process:

I certify that I have performed a quality check of the referenced fault information and design response spectrum provided by the geotechnical designer. The quality check is based on Seismic Design Criteria (Appendix B), Deterministic PGA Map and ARS Online Report, and the Geotechnical Services Design Manual.

SREEKAR PULIJALA — Sr. STAFF ENGINEER

Checker (Print) — Title

P. Sreekar — 01/25/2010

Checker (Signature) — Date

I certify that the referenced project complies with Geotechnical Service's Quality Control/Quality Assurance procedures, as described in the memorandum, "Quality Control/Quality Assurance for the 2009 Seismic Design Procedures", dated August 12, 2009.

DJAN CHANDRA — Sr. Principal

Functional Supervisor (Print) — Title

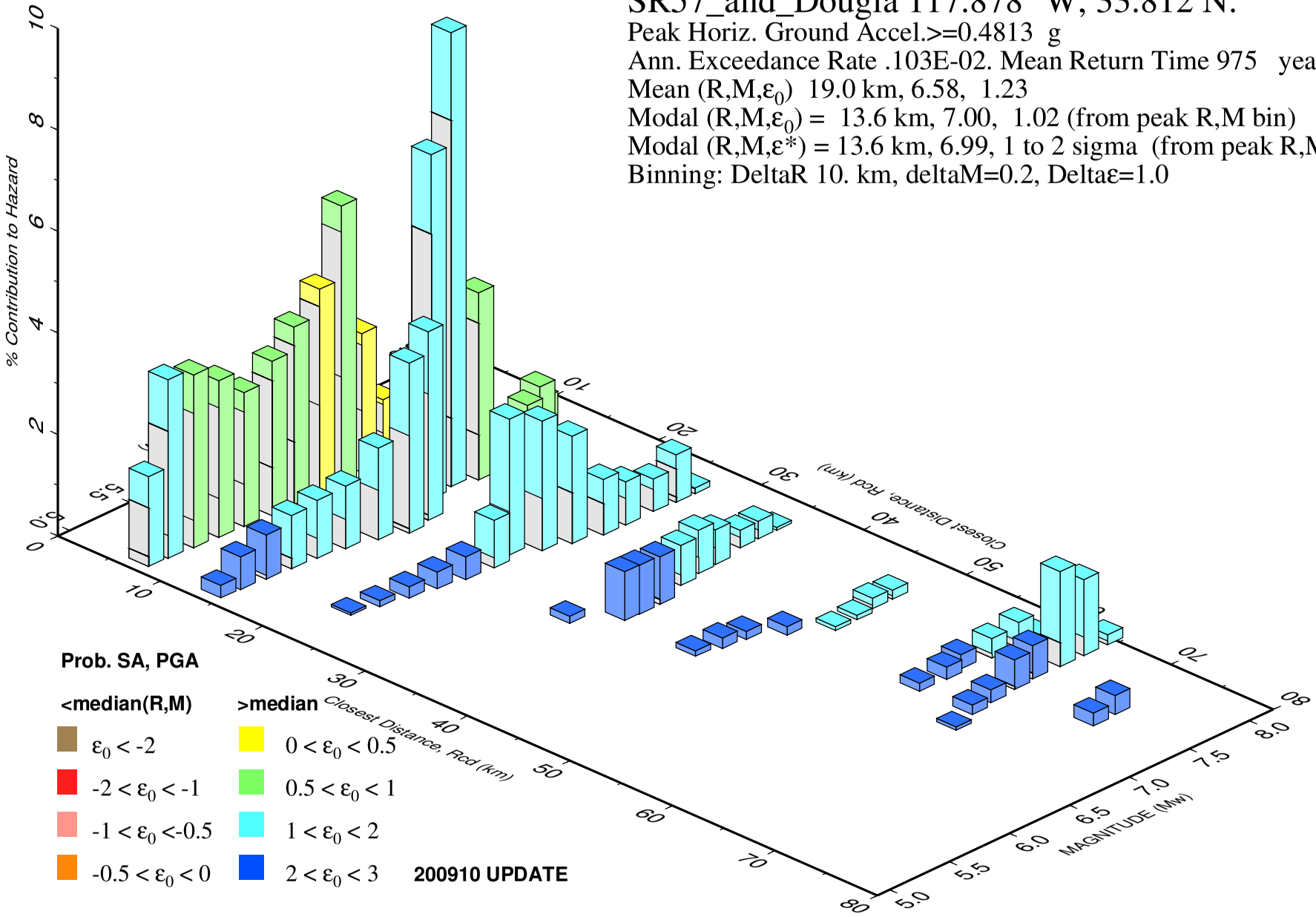
Djan Chandra — 2/5/2010

Functional Supervisor (Signature) — Date

(This original checklist and signature sheet shall be placed in the geotechnical project file, and a copy sent to the Mark Willian of the Geotechnical Services Corporate Unit).

PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

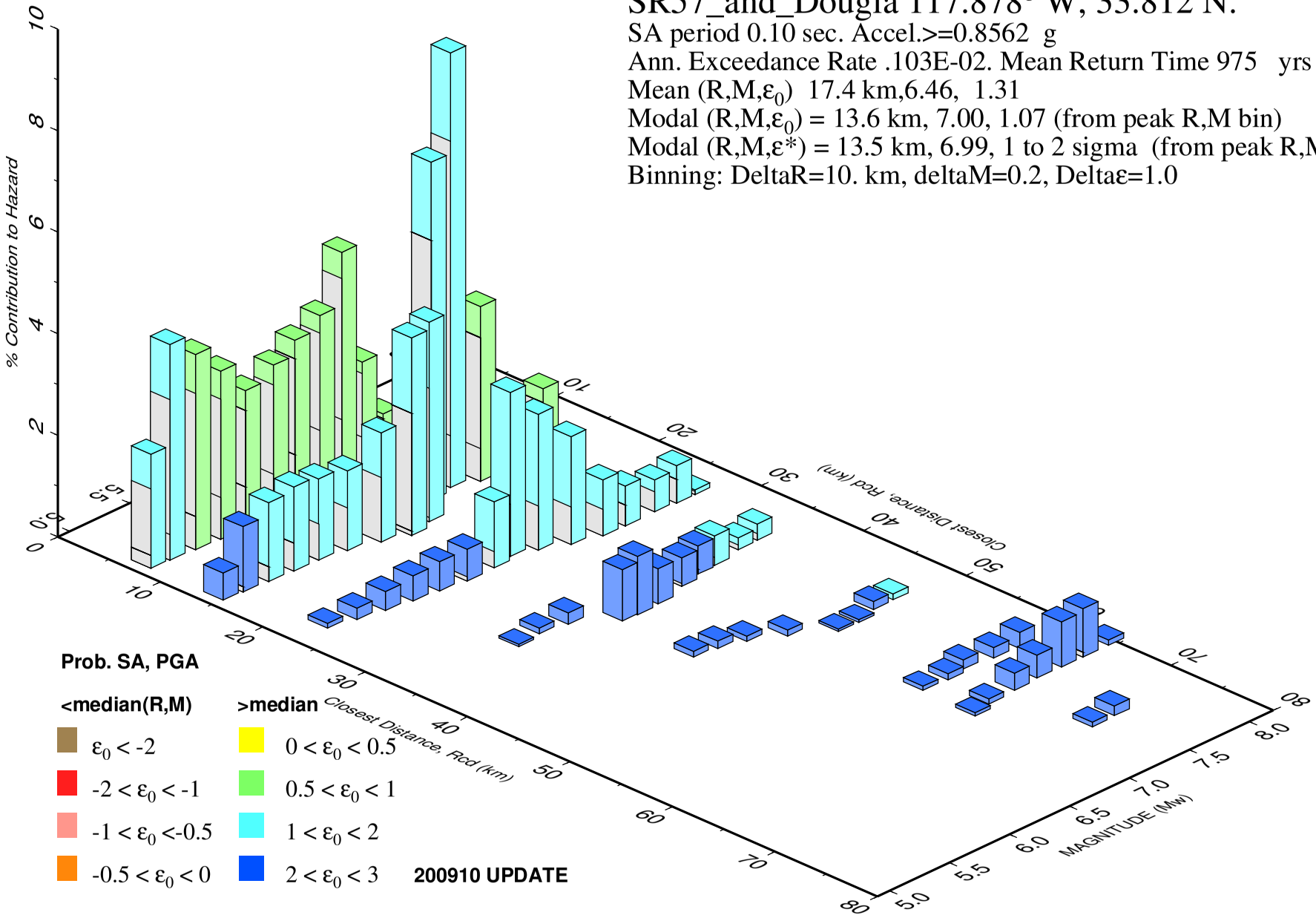
Peak Horiz. Ground Accel.>=0.4813 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 years
Mean (R,M,ε_0) 19.0 km, 6.58, 1.23
Modal (R,M,ε_0) = 13.6 km, 7.00, 1.02 (from peak R,M bin)
Modal (R,M,ε*) = 13.6 km, 6.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 20:06:33 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

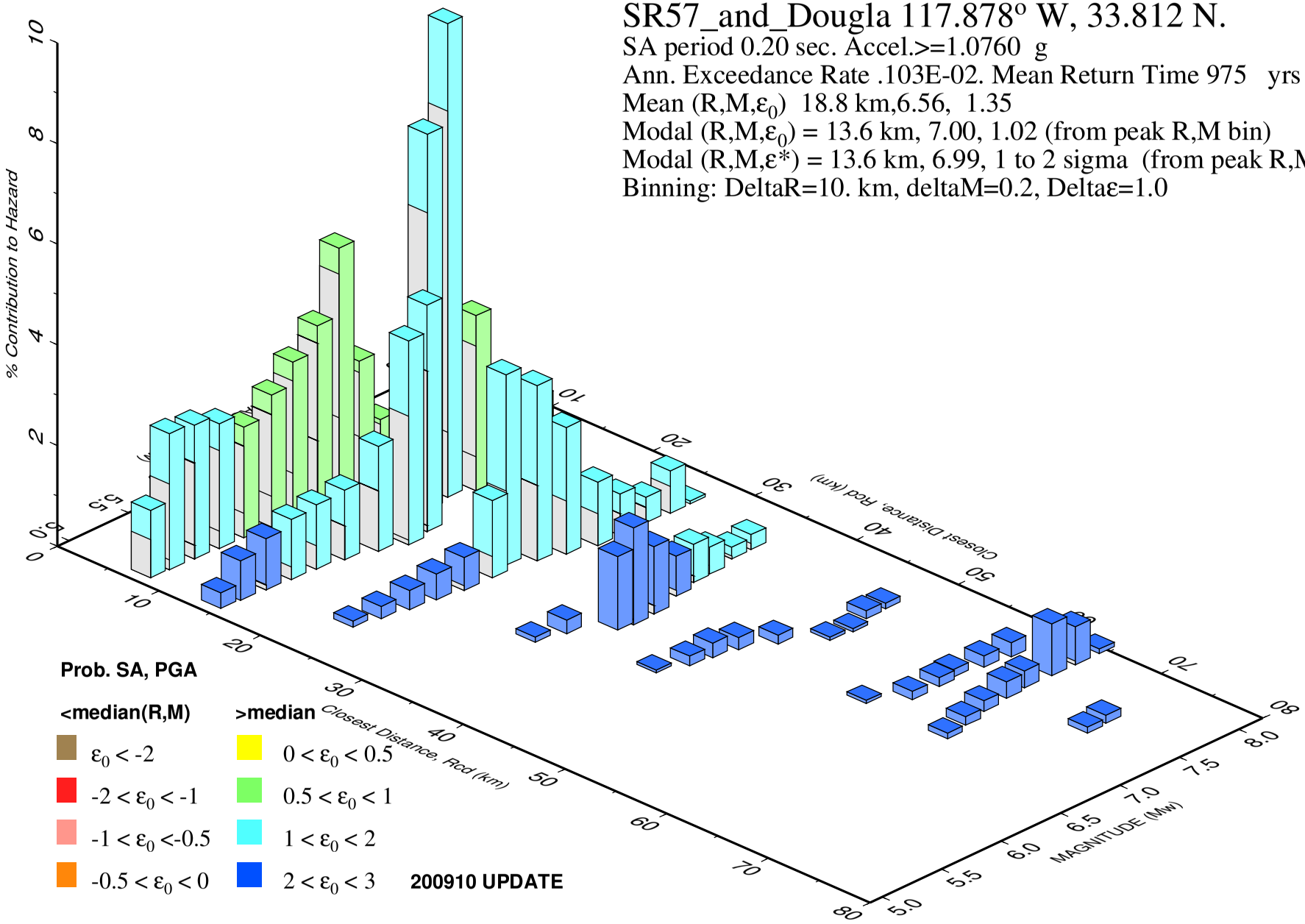
SA period 0.10 sec. Accel.>=0.8562 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 17.4 km,6.46, 1.31
Modal (R,M,ε_0) = 13.6 km, 7.00, 1.07 (from peak R,M bin)
Modal (R,M,ε*) = 13.5 km, 6.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 20:07:21 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

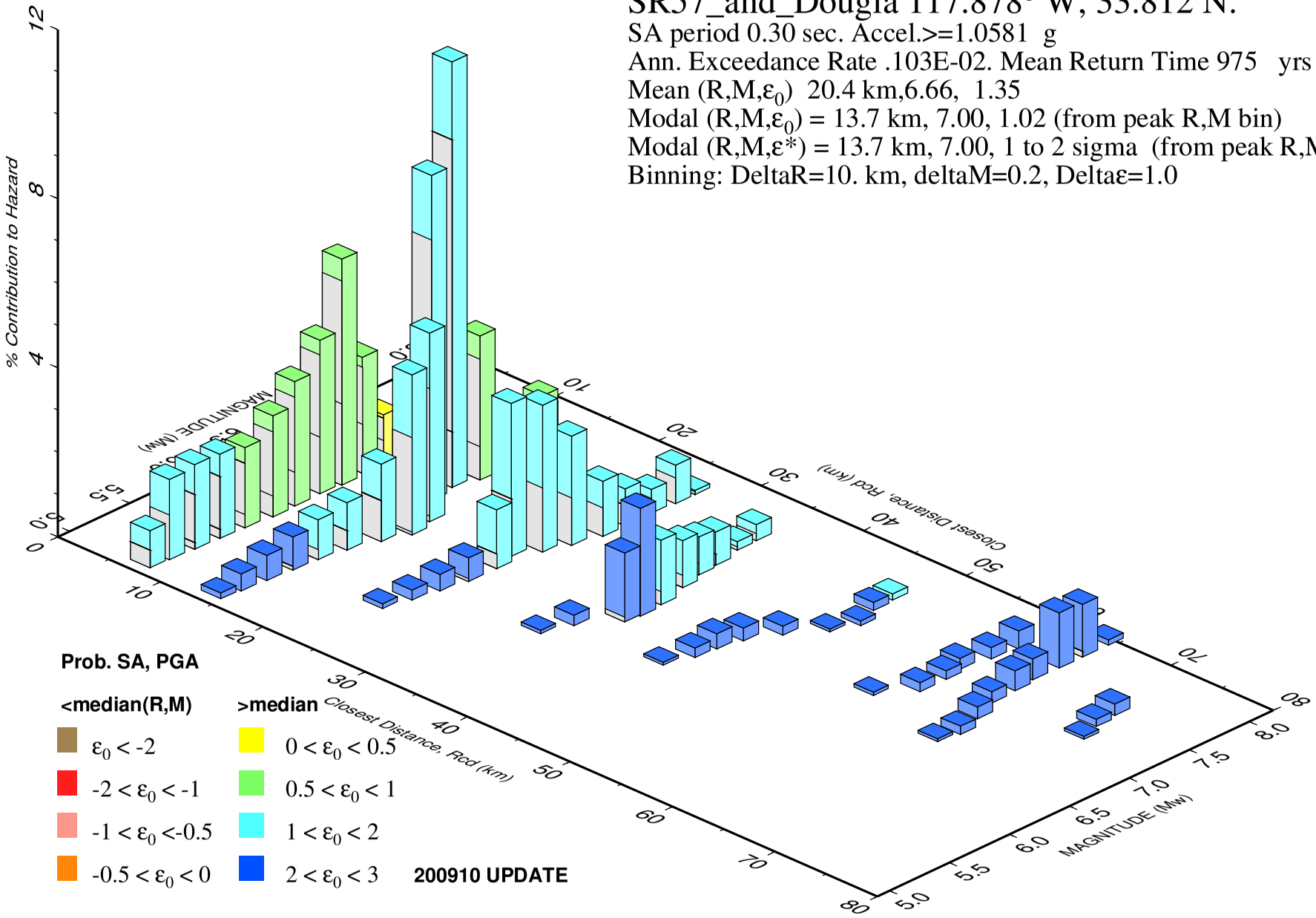
SA period 0.20 sec. Accel.>=1.0760 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 18.8 km,6.56, 1.35
Modal (R,M,ε_0) = 13.6 km, 7.00, 1.02 (from peak R,M bin)
Modal (R,M,ε*) = 13.6 km, 6.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 20:09:14 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

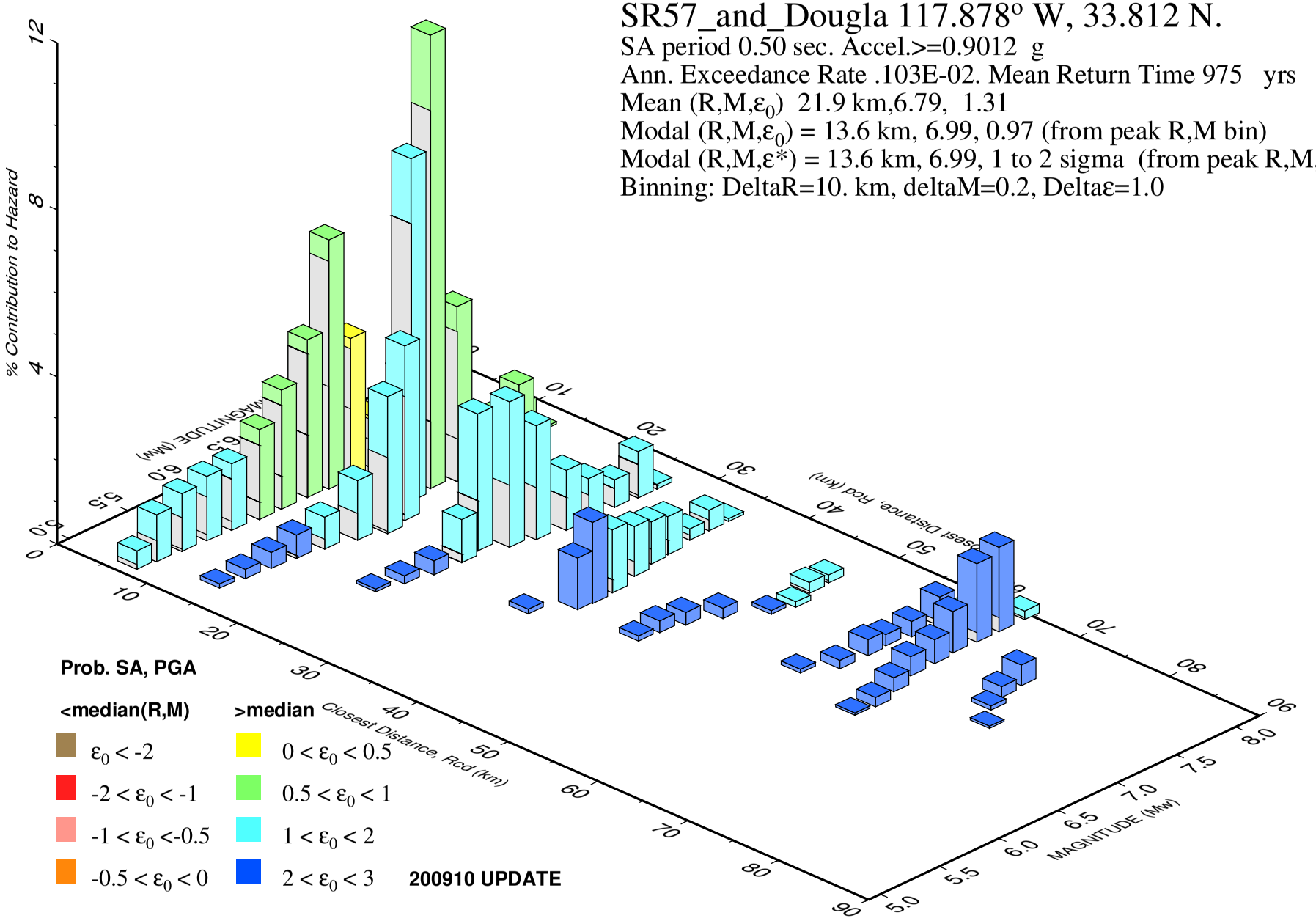
SA period 0.30 sec. Accel.>=1.0581 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 20.4 km,6.66, 1.35
Modal (R,M,ε_0) = 13.7 km, 7.00, 1.02 (from peak R,M bin)
Modal (R,M,ε*) = 13.7 km, 7.00, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 20:10:28 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

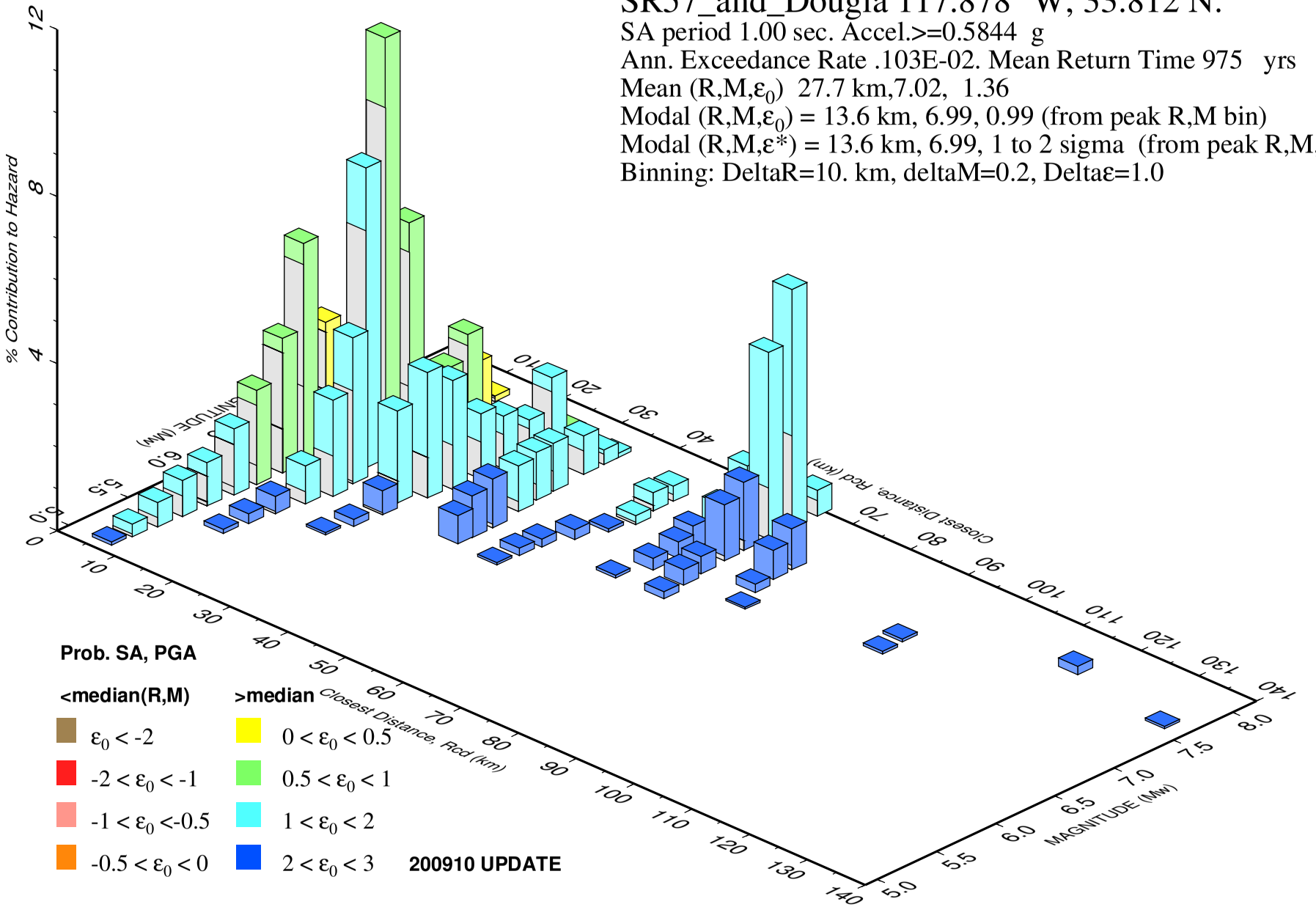
SA period 0.50 sec. Accel.>=0.9012 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 21.9 km,6.79, 1.31
Modal (R,M,ε_0) = 13.6 km, 6.99, 0.97 (from peak R,M bin)
Modal (R,M,ε*) = 13.6 km, 6.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 20:11:24 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

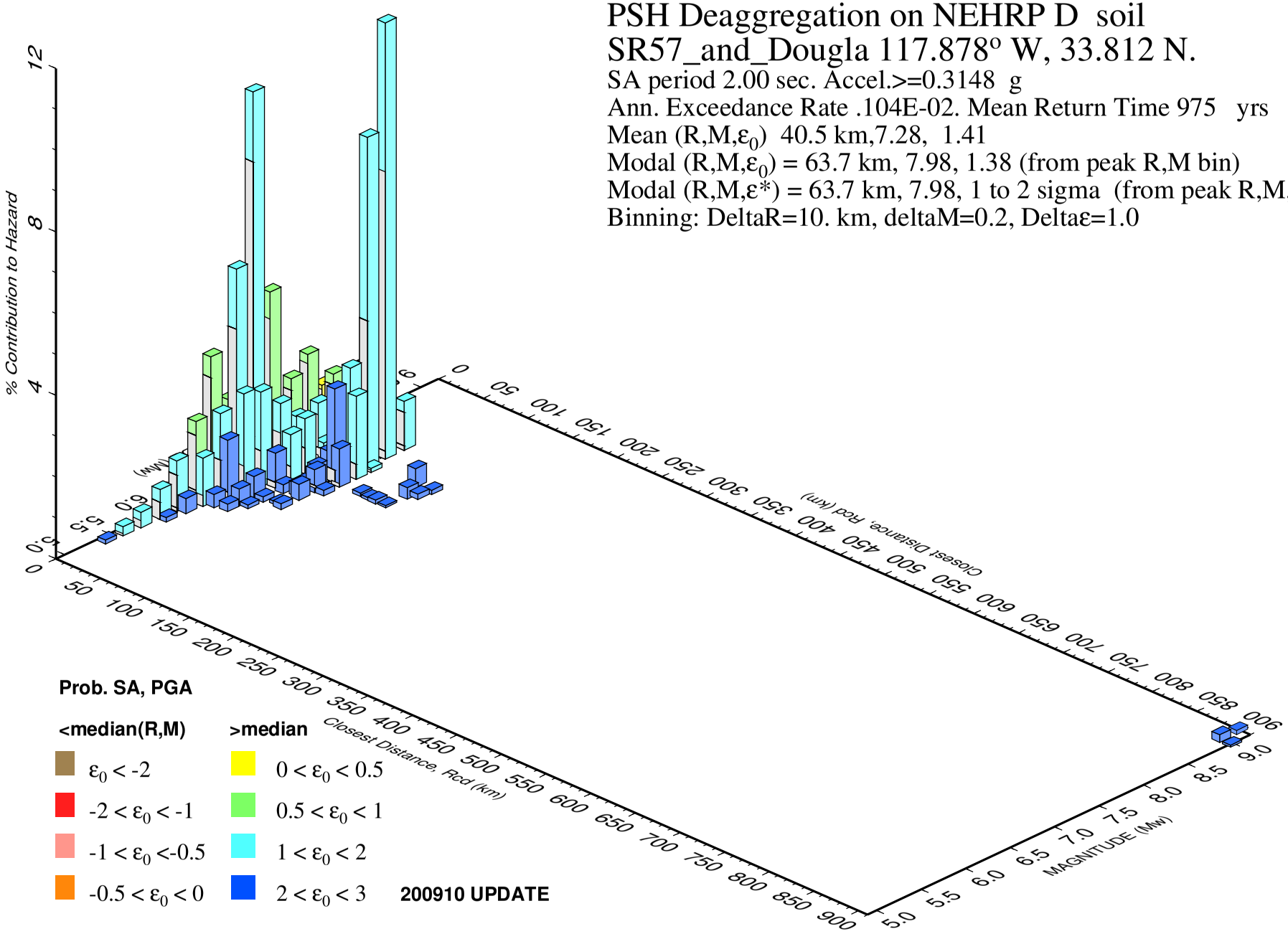
SA period 1.00 sec. Accel.>=0.5844 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 27.7 km,7.02, 1.36
Modal (R,M,ε_0) = 13.6 km, 6.99, 0.99 (from peak R,M bin)
Modal (R,M,ε*) = 13.6 km, 6.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 20:11:45 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

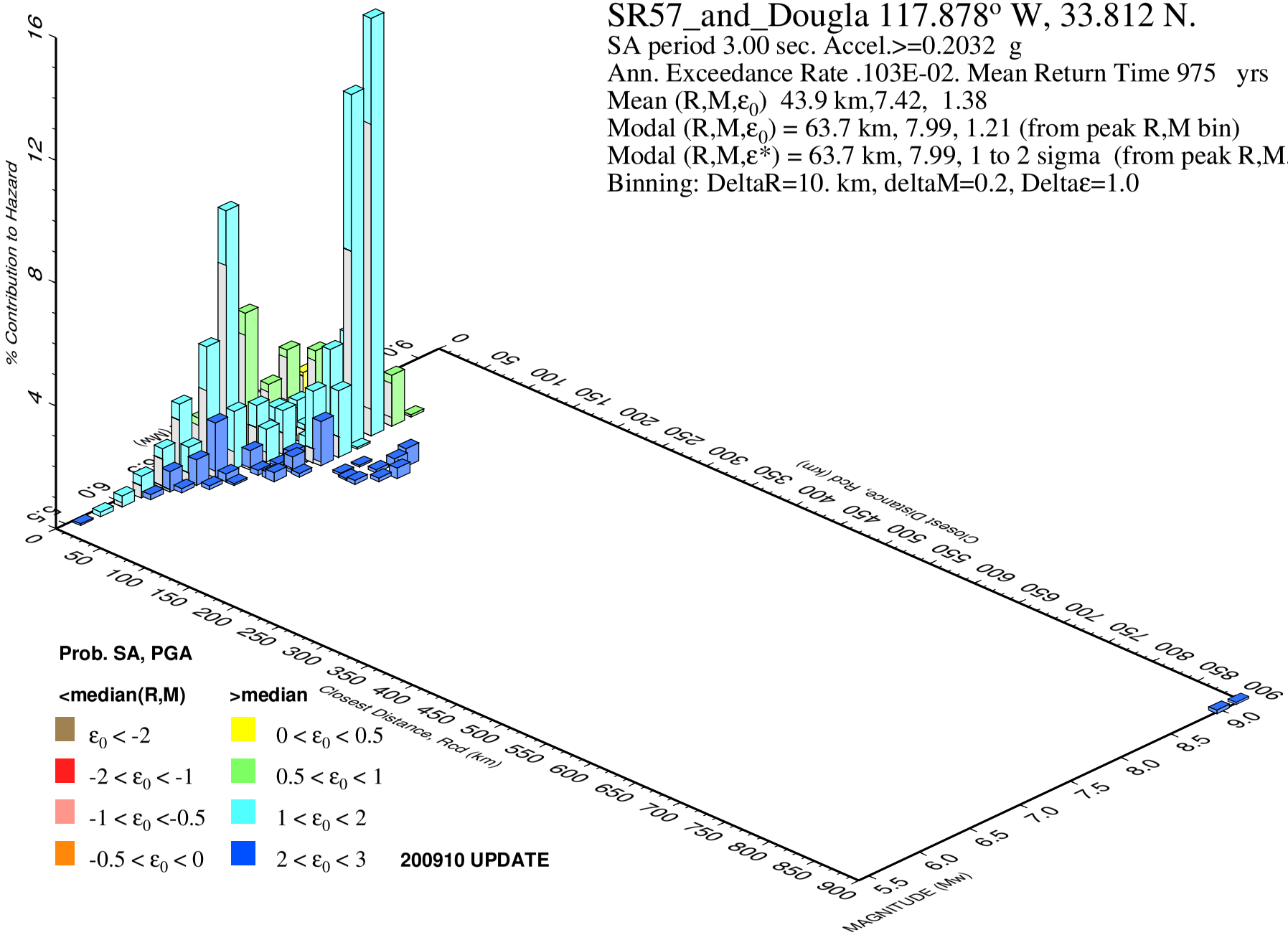
SA period 2.00 sec. Accel.>=0.3148 g
Ann. Exceedance Rate .104E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 40.5 km,7.28, 1.41
Modal (R,M,ε_0) = 63.7 km, 7.98, 1.38 (from peak R,M bin)
Modal (R,M,ε*) = 63.7 km, 7.98, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 20:12:22 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

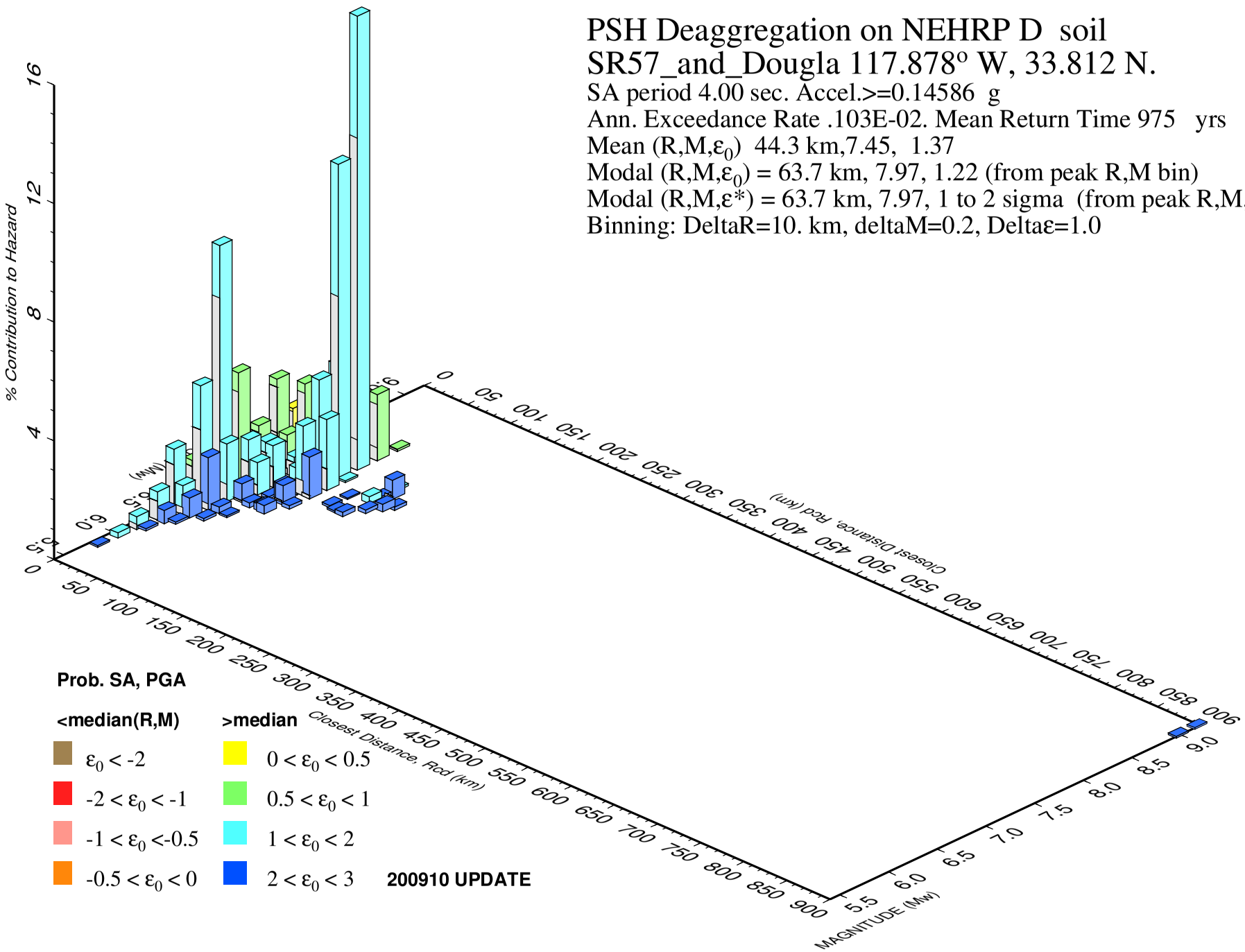
SA period 3.00 sec. Accel.>=0.2032 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 43.9 km,7.42, 1.38
Modal (R,M,ε_0) = 63.7 km, 7.99, 1.21 (from peak R,M bin)
Modal (R,M,ε*) = 63.7 km, 7.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 20:13:29 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

SA period 4.00 sec. Accel.>=0.14586 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 44.3 km,7.45, 1.37
Modal (R,M,ε_0) = 63.7 km, 7.97, 1.22 (from peak R,M bin)
Modal (R,M,ε*) = 63.7 km, 7.97, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0

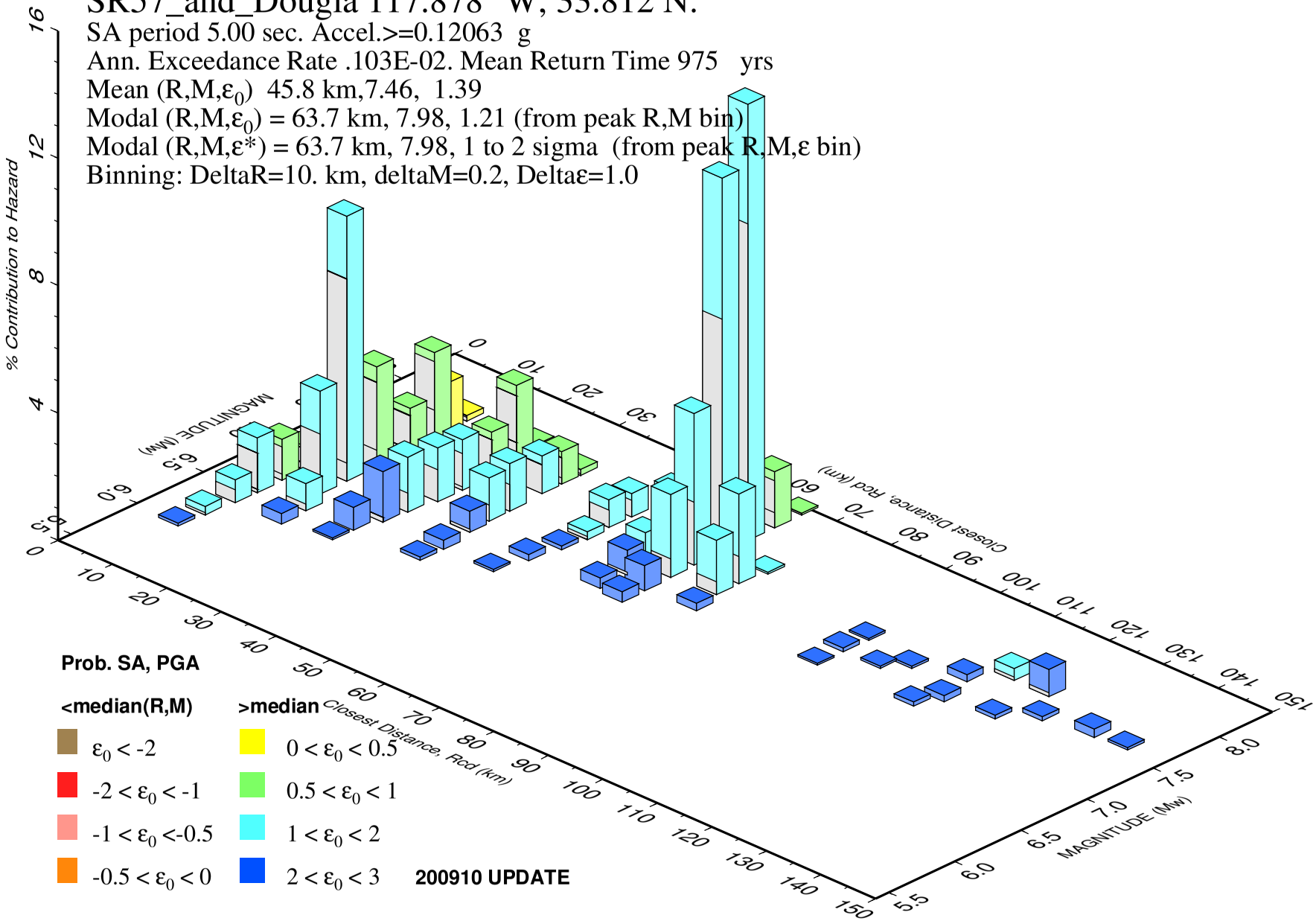


GMT 2009 Dec 8 20:14:17 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

PSH Deaggregation on NEHRP D soil

SR57_and_Dougla 117.878° W, 33.812 N.

SA period 5.00 sec. Accel.>=0.12063 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 45.8 km,7.46, 1.39
Modal (R,M,ε_0) = 63.7 km, 7.98, 1.21 (from peak R,M bin)
Modal (R,M,ε*) = 63.7 km, 7.98, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



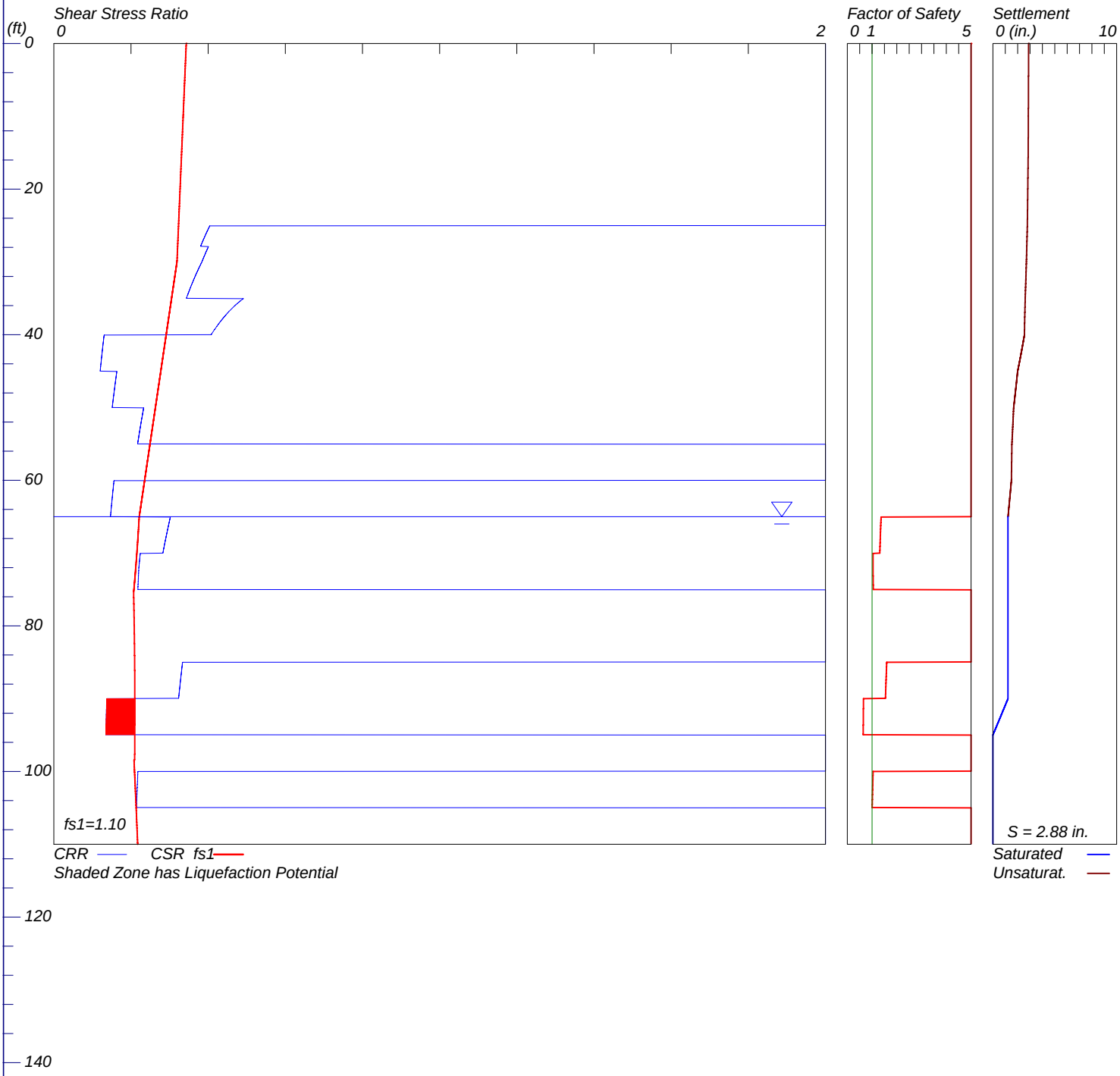
GMT 2009 Dec 8 20:15:13 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

LIQUEFACTION ANALYSIS

Douglass Road OH

Hole No.=A-09-004 Water Depth=65 ft Surface Elev.=203

Magnitude=6.6
Acceleration=0.48g



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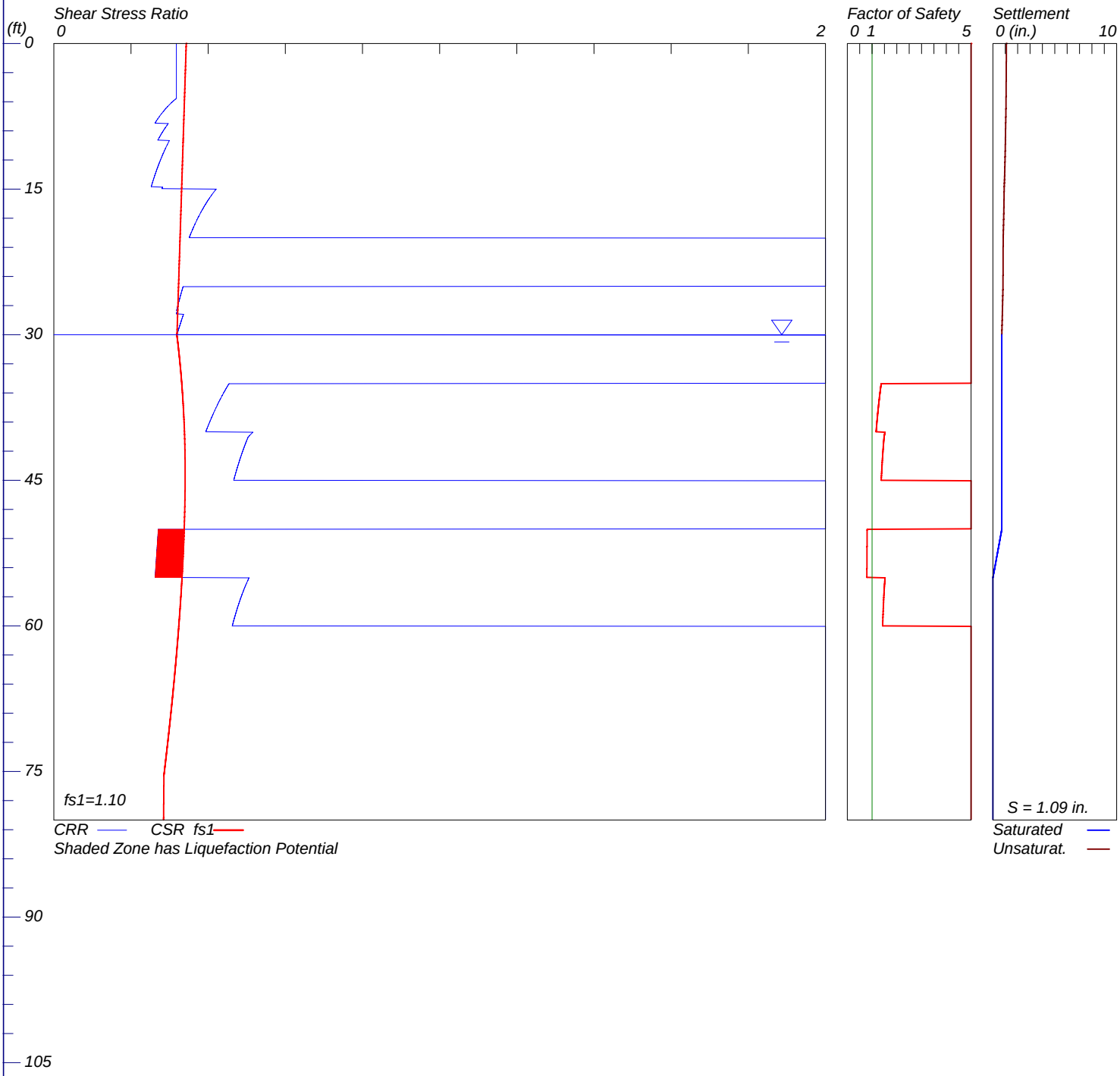
LIQUEFACTION ANALYSIS

Douglass Road OH

Hole No.=A-09-005 Water Depth=30 ft Surface Elev.=171

Magnitude=6.6
Acceleration=0.48g



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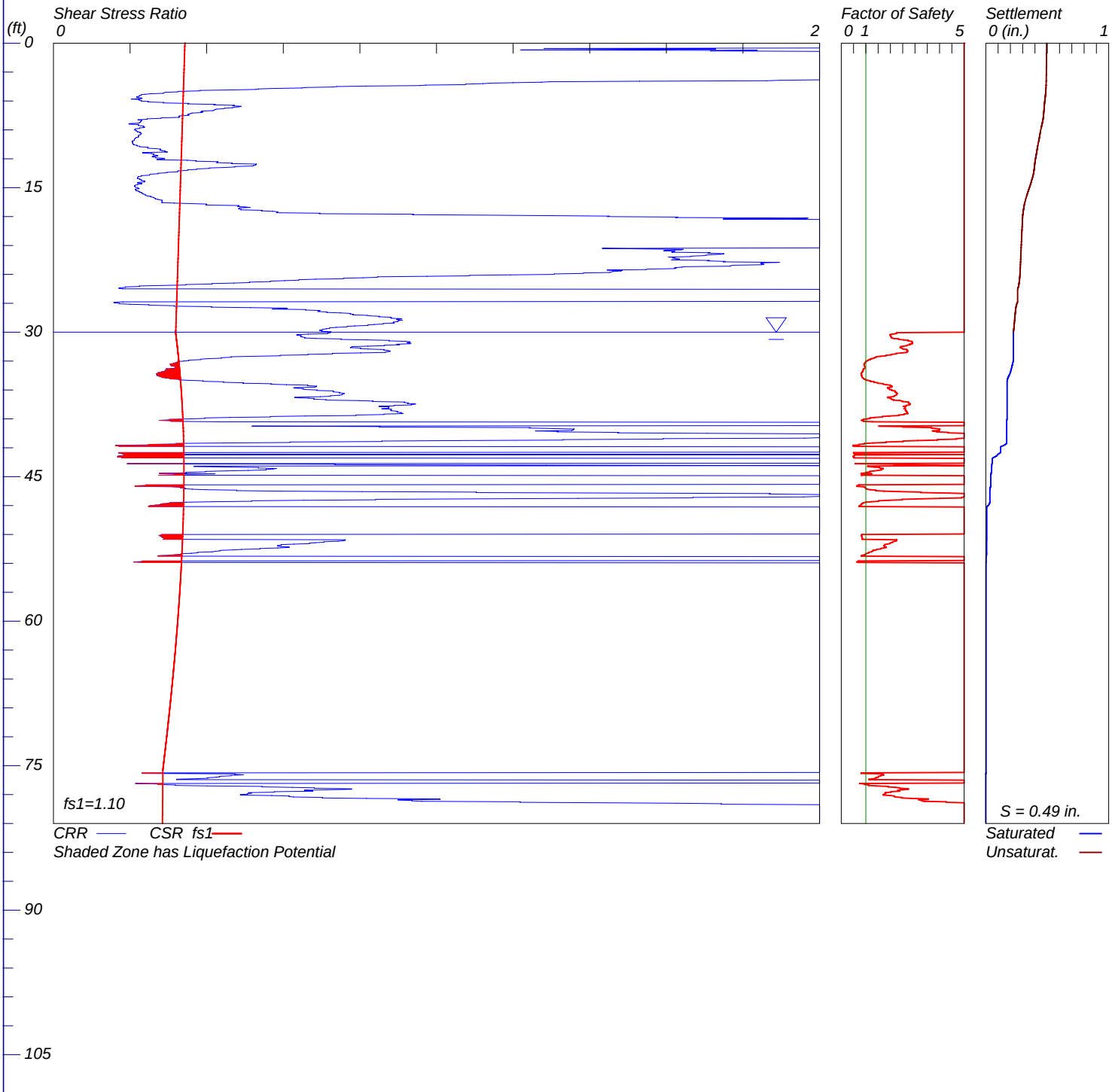
LIQUEFACTION ANALYSIS

Douglass Road OH

Hole No.=CPT-09-006 Water Depth=30 ft Surface Elev.=171.2

Magnitude=6.6
Acceleration=0.48g



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                                    LIQUEFACTION ANALYSIS SUMMARY
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*******************************************************************************
        Font: Courier New, Regular, Size 8 is recommended for this report.
        Licensed to ,    2/4/2010 11:03:29 AM
        Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase
2\ENG\Liquefaction\B-4.liq
        Title:  Douglass Road OH
        Subtitle:  602231-002

        Surface Elev.=203
        Hole No.=A-09-004
        Depth of Hole= 110.00 ft
        Water Table during Earthquake= 65.00 ft
        Water Table during In-Situ Testing= 72.00 ft
        Max. Acceleration= 0.48 g
        Earthquake Magnitude= 6.60

 Input Data:
        Surface Elev.=203
        Hole No.=A-09-004
        Depth of Hole=110.00 ft
        Water Table during Earthquake= 65.00 ft
        Water Table during In-Situ Testing= 72.00 ft
        Max. Acceleration=0.48 g
        Earthquake Magnitude=6.60

        1. SPT or BPT Calculation.
        2. Settlement Analysis Method: Tokimatsu, M-correction
        3. Fines Correction for Liquefaction: Stark/Olson et al.*
        4. Fine Correction for Settlement: During Liquefaction*
        5. Settlement Calculation in: All zones*
        6. Hammer Energy Ratio,                                   Ce = 1.333
        7. Borehole Diameter,                                         Cb= 1.15
        8. Sampling Method,                                          Cs= 1.2
        9. User request factor of safety (apply to CSR) ,   User= 1.1
           Plot one CSR curve (fs1=User)
        10. Use Curve Smoothing: No
        * Recommended Options
```

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	15.00	126.00	50.00
10.00	25.00	132.00	20.00
15.00	16.00	132.00	50.00
20.00	17.00	103.00	50.00
25.00	13.00	103.00	50.00
30.00	13.00	130.00	50.00
35.00	23.00	130.00	5.00
40.00	8.00	125.00	5.00
45.00	11.00	120.00	5.00
50.00	17.00	120.00	5.00
55.00	32.00	120.00	5.00
60.00	13.00	120.00	5.00
65.00	26.00	120.00	5.10
70.00	13.00	120.00	49.00
75.00	38.00	120.00	9.10
80.00	8.00	120.00	NoLiq
85.00	29.00	120.00	14.00
90.00	9.00	120.00	23.50
95.00	9.00	120.00	NoLiq
100.00	15.00	120.00	46.20
105.00	13.00	120.00	NoLiq
110.00	26.00	120.00	NoLiq

Output Results:

Settlement of Saturated Sands=1.22 in.
Settlement of Unsaturated Sands=1.66 in.
Total Settlement of Saturated and Unsaturated Sands=2.88 in.
Differential Settlement=1.441 to 1.902 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.77	0.34	5.00	1.22	1.66	2.88
5.00	2.77	0.34	5.00	1.22	1.66	2.88
10.00	2.77	0.34	5.00	1.22	1.65	2.86
15.00	2.77	0.33	5.00	1.22	1.63	2.85
20.00	2.77	0.33	5.00	1.22	1.60	2.82
25.00	2.79	0.32	5.00	1.22	1.56	2.78
30.00	0.38	0.32	5.00	1.22	1.49	2.71
35.00	0.34	0.31	5.00	1.22	1.39	2.61
40.00	0.41	0.29	5.00	1.22	1.33	2.55
45.00	0.12	0.28	5.00	1.22	0.78	2.00
50.00	0.15	0.26	5.00	1.22	0.46	1.68
55.00	0.22	0.25	5.00	1.22	0.32	1.54
60.00	2.31	0.24	5.00	1.22	0.28	1.49
65.00	0.15	0.22	5.00	1.22	0.00	1.22
70.00	0.28	0.22	1.31	1.22	0.00	1.22
75.00	0.22	0.21	1.05	1.22	0.00	1.22
80.00	2.00	0.21	5.00	1.22	0.00	1.22
85.00	0.33	0.21	1.59	1.22	0.00	1.22
90.00	0.14	0.21	0.65*	1.22	0.00	1.22
95.00	2.00	0.21	5.00	0.00	0.00	0.00
100.00	0.22	0.21	1.04	0.00	0.00	0.00
105.00	2.00	0.21	5.00	0.00	0.00	0.00
110.00	2.00	0.22	5.00	0.00	0.00	0.00

```
* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5,    CRR is limited to 2,      CSR is limited to 2)

Units:  Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf,
        Settlement = in.
```

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils
NoLiq	No-Liquefy Soils

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LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\B-5.liq
Title: Douglass Road OH
Subtitle: 602231-002

Surface Elev.=171
Hole No.=A-09-005
Depth of Hole= 80.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 40.50 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:
Surface Elev.=171
Hole No.=A-09-005
Depth of Hole=80.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 40.50 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.333
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	9.00	122.50	5.00
10.00	10.00	104.00	5.00
15.00	14.00	104.00	5.00
20.00	28.00	108.00	5.00
25.00	15.00	108.00	5.00
30.00	25.00	109.00	5.20
35.00	21.00	109.00	5.70
40.00	18.00	120.00	80.70
45.00	32.00	120.00	80.00
50.00	11.00	120.00	34.30
55.00	20.00	120.00	34.30
60.00	23.00	120.00	NoLiq
65.00	10.00	120.00	NoLiq
70.00	7.00	120.00	NoLiq
75.00	8.00	120.00	NoLiq
80.00	39.00	120.00	20.00

Output Results:
Settlement of Saturated Sands=0.72 in.
Settlement of Unsaturated Sands=0.37 in.
Total Settlement of Saturated and Unsaturated Sands=1.09 in.
Differential Settlement=0.544 to 0.718 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.32	0.34	5.00	0.72	0.37	1.09
5.00	0.32	0.34	5.00	0.72	0.35	1.07
10.00	0.30	0.34	5.00	0.72	0.29	1.01
15.00	0.42	0.33	5.00	0.72	0.19	0.91
20.00	0.35	0.33	5.00	0.72	0.11	0.83
25.00	2.77	0.32	5.00	0.72	0.10	0.81
30.00	0.32	0.32	5.00	0.72	0.00	0.72
35.00	2.68	0.33	5.00	0.72	0.00	0.72
40.00	0.39	0.34	1.16	0.72	0.00	0.72
45.00	0.47	0.34	1.37	0.72	0.00	0.72
50.00	2.54	0.34	5.00	0.72	0.00	0.72
55.00	0.26	0.33	0.79*	0.01	0.00	0.01
60.00	0.46	0.32	1.43	0.00	0.00	0.00
65.00	2.00	0.31	5.00	0.00	0.00	0.00
70.00	2.00	0.30	5.00	0.00	0.00	0.00
75.00	2.00	0.29	5.00	0.00	0.00	0.00
80.00	2.36	0.28	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

```
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2\ENG\Liquefaction\CPT-4a.liq
        Title:  Douglass Road OH
        Subtitle:  602231-002

        Surface Elev.=171.2
        Hole No.=CPT-09-006
        Depth of Hole= 81.00 ft
        Water Table during Earthquake= 30.00 ft
        Water Table during In-Situ Testing= 40.50 ft
        Max. Acceleration= 0.48 g
        Earthquake Magnitude= 6.60

 Input Data:
        Surface Elev.=171.2
        Hole No.=CPT-09-006
        Depth of Hole=81.00 ft
        Water Table during Earthquake= 30.00 ft
        Water Table during In-Situ Testing= 40.50 ft
        Max. Acceleration=0.48 g
        Earthquake Magnitude=6.60

        1. CPT Calculation Method: Modify Robertson*
        2. Settlement Analysis Method: Tokimatsu, M-correction
        3. Fines Correction for Liquefaction: Stark/Olson et al.*
        4. Fine Correction for Settlement: During Liquefaction*
        5. Settlement Calculation in: All zones*
        6. Hammer Energy Ratio,                                  Ce = 1
        7. Borehole Diameter,                                     Cb= 1
        8. Sampling Method,                                      Cs= 1
        9. User request factor of safety (apply to CSR) ,   User= 1.1
           Plot one CSR curve (fs1=User)
        10. Use Curve Smoothing: No
        * Recommended Options
```

In-Situ Test Data:

Depth ft	qc atm	fs atm	gamma pcf	Fines %	D50 mm
0.00	13.30	1.16	120.00	0.00	0.50
0.38	20.00	1.13	120.00	0.00	0.50
0.46	25.90	2.21	120.00	0.00	0.50
0.53	33.50	0.52	120.00	0.00	0.50
0.60	43.90	0.44	120.00	0.00	0.50
0.67	36.80	0.58	120.00	0.00	0.50
0.74	39.80	0.95	120.00	0.00	0.50
0.80	227.20	1.30	120.00	0.00	0.50
0.87	357.20	1.53	120.00	0.00	0.50
0.94	282.90	1.59	120.00	0.00	0.50
1.02	284.10	1.58	120.00	0.00	0.50
1.09	245.80	1.55	120.00	0.00	0.50
1.16	242.30	1.42	120.00	0.00	0.50
1.23	241.70	1.27	120.00	0.00	0.50
1.31	231.40	1.09	120.00	0.00	0.50
1.38	242.40	0.97	120.00	0.00	0.50
1.46	251.50	0.90	120.00	0.00	0.50
1.54	253.90	0.88	120.00	0.00	0.50
1.61	250.60	0.89	120.00	0.00	0.50
1.69	243.10	0.91	120.00	0.00	0.50
1.76	235.40	0.89	120.00	0.00	0.50
1.83	227.00	0.85	120.00	0.00	0.50
1.91	217.20	0.79	120.00	0.00	0.50
1.99	207.00	0.74	120.00	0.00	0.50
2.06	202.80	0.71	120.00	0.00	0.50
2.14	195.60	0.66	120.00	0.00	0.50
2.23	189.40	0.61	120.00	0.00	0.50
2.31	186.20	0.60	120.00	0.00	0.50
2.38	183.40	0.60	120.00	0.00	0.50
2.47	179.60	0.51	120.00	0.00	0.50
2.56	180.70	0.51	120.00	0.00	0.50
2.64	177.80	0.49	120.00	0.00	0.50
2.72	161.20	0.50	120.00	0.00	0.50
2.81	162.50	0.49	120.00	0.00	0.50
2.89	160.80	0.48	120.00	0.00	0.50
2.97	159.00	0.47	120.00	0.00	0.50
3.05	158.00	0.46	120.00	0.00	0.50
3.12	155.70	0.45	120.00	0.00	0.50
3.19	152.10	0.45	120.00	0.00	0.50
3.26	147.50	0.46	120.00	0.00	0.50
3.34	141.80	0.44	120.00	0.00	0.50
3.41	136.70	0.43	120.00	0.00	0.50
3.48	134.50	0.42	120.00	0.00	0.50
3.56	131.90	0.39	120.00	0.00	0.50
3.63	128.40	0.38	120.00	0.00	0.50
3.70	126.60	0.39	120.00	0.00	0.50
3.78	120.30	0.40	120.00	0.00	0.50
3.85	115.40	0.38	120.00	0.00	0.50
3.92	108.30	0.37	120.00	0.00	0.50
3.99	102.60	0.33	120.00	0.00	0.50
4.06	101.00	0.32	120.00	0.00	0.50
4.13	99.70	0.33	120.00	0.00	0.50
4.21	98.80	0.33	120.00	0.00	0.50
4.28	99.30	0.31	120.00	0.00	0.50
4.35	96.20	0.29	120.00	0.00	0.50
4.42	91.00	0.28	120.00	0.00	0.50
4.50	88.10	0.28	120.00	0.00	0.50
4.57	85.00	0.29	120.00	0.00	0.50
4.65	81.30	0.29	120.00	0.00	0.50
4.73	79.40	0.28	120.00	0.00	0.50
4.81	75.90	0.26	120.00	0.00	0.50
4.89	69.60	0.25	120.00	0.00	0.50
4.99	65.10	0.23	120.00	0.00	0.50
5.09	61.90	0.23	120.00	0.00	0.50
5.21	57.10	0.22	120.00	0.00	0.50
5.28	54.70	0.22	120.00	0.00	0.50
5.35	52.50	0.23	120.00	0.00	0.50
5.41	51.60	0.24	120.00	0.00	0.50
5.55	51.50	0.22	120.00	0.00	0.50
5.61	52.00	0.24	120.00	0.00	0.50
5.68	54.10	0.25	120.00	0.00	0.50

5.76	48.00	0.24	120.00	0.00	0.50
5.83	53.70	0.24	120.00	0.00	0.50
5.93	55.50	0.24	120.00	0.00	0.50
6.03	60.00	0.24	120.00	0.00	0.50
6.12	67.20	0.27	120.00	0.00	0.50
6.24	75.60	0.31	120.00	0.00	0.50
6.34	82.80	0.34	120.00	0.00	0.50
6.43	87.70	0.35	120.00	0.00	0.50
6.53	89.80	0.35	120.00	0.00	0.50
6.63	89.00	0.35	120.00	0.00	0.50
6.73	87.60	0.33	120.00	0.00	0.50
6.83	86.20	0.31	120.00	0.00	0.50
6.92	86.40	0.30	120.00	0.00	0.50
7.02	83.90	0.31	120.00	0.00	0.50
7.11	84.70	0.32	120.00	0.00	0.50
7.22	82.30	0.34	120.00	0.00	0.50
7.31	81.90	0.33	120.00	0.00	0.50
7.41	82.60	0.31	120.00	0.00	0.50
7.51	80.20	0.28	120.00	0.00	0.50
7.61	80.80	0.26	120.00	0.00	0.50
7.72	74.90	0.28	120.00	0.00	0.50
7.85	68.10	0.26	120.00	0.00	0.50
7.91	62.30	0.26	120.00	0.00	0.50
7.99	64.10	0.29	120.00	0.00	0.50
8.05	65.20	0.26	120.00	0.00	0.50
8.12	64.90	0.27	120.00	0.00	0.50
8.19	64.00	0.29	120.00	0.00	0.50
8.25	62.50	0.30	120.00	0.00	0.50
8.35	54.20	0.32	120.00	0.00	0.50
8.43	62.50	0.32	120.00	0.00	0.50
8.50	63.80	0.30	120.00	0.00	0.50
8.58	67.30	0.31	120.00	0.00	0.50
8.67	67.80	0.33	120.00	0.00	0.50
8.76	64.90	0.32	120.00	0.00	0.50
8.85	63.10	0.29	120.00	0.00	0.50
8.95	63.30	0.28	120.00	0.00	0.50
9.05	65.00	0.28	120.00	0.00	0.50
9.15	66.60	0.28	120.00	0.00	0.50
9.25	68.60	0.29	120.00	0.00	0.50
9.35	69.60	0.30	120.00	0.00	0.50
9.45	69.40	0.30	120.00	0.00	0.50
9.55	68.30	0.30	120.00	0.00	0.50
9.66	67.60	0.33	120.00	0.00	0.50
9.78	65.90	0.33	120.00	0.00	0.50
9.90	64.80	0.34	120.00	0.00	0.50
10.01	64.90	0.34	104.00	0.00	0.50
10.12	64.00	0.33	104.00	0.00	0.50
10.24	63.90	0.34	104.00	0.00	0.50
10.35	64.20	0.35	104.00	0.00	0.50
10.46	64.70	0.37	104.00	0.00	0.50
10.57	67.50	0.38	104.00	0.00	0.50
10.68	69.90	0.39	104.00	0.00	0.50
10.80	76.10	0.41	104.00	0.00	0.50
10.93	81.50	0.43	104.00	0.00	0.50
11.00	84.20	0.45	104.00	0.00	0.50
11.07	86.50	0.38	104.00	0.00	0.50
11.14	87.70	0.39	104.00	0.00	0.50
11.20	88.80	0.42	104.00	0.00	0.50
11.27	89.50	0.45	104.00	0.00	0.50
11.34	73.00	0.43	104.00	0.00	0.50
11.41	80.50	0.42	104.00	0.00	0.50
11.49	82.50	0.42	104.00	0.00	0.50
11.61	84.80	0.45	104.00	0.00	0.50
11.72	84.70	0.36	104.00	0.00	0.50
11.84	85.90	0.40	104.00	0.00	0.50
11.95	91.20	0.43	104.00	0.00	0.50
12.03	86.20	0.44	104.00	0.00	0.50
12.12	103.50	0.45	104.00	0.00	0.50
12.19	107.10	0.46	104.00	0.00	0.50
12.29	114.70	0.46	104.00	0.00	0.50
12.41	119.70	0.50	104.00	0.00	0.50
12.53	126.80	0.55	104.00	0.00	0.50
12.60	127.00	0.57	104.00	0.00	0.50
12.69	126.70	0.61	104.00	0.00	0.50
12.77	122.10	0.66	104.00	0.00	0.50
12.86	118.40	0.68	104.00	0.00	0.50
12.95	111.00	0.70	104.00	0.00	0.50
13.04	104.70	0.71	104.00	0.00	0.50
13.15	100.50	0.70	104.00	0.00	0.50
13.25	95.90	0.68	104.00	0.00	0.50
13.36	91.80	0.61	104.00	0.00	0.50
13.48	88.80	0.53	104.00	0.00	0.50
13.59	85.60	0.46	104.00	0.00	0.50
13.71	82.70	0.36	104.00	0.00	0.50
13.82	81.30	0.33	104.00	0.00	0.50
13.94	82.70	0.29	104.00	0.00	0.50
14.06	83.70	0.33	104.00	0.00	0.50
14.17	83.90	0.37	104.00	0.00	0.50
14.29	86.40	0.39	104.00	0.00	0.50
14.41	78.40	0.43	104.00	0.00	0.50
14.52	82.40	0.44	104.00	0.00	0.50
14.63	81.90	0.36	104.00	0.00	0.50
14.74	82.40	0.29	104.00	0.00	0.50
14.87	83.20	0.29	104.00	0.00	0.50
14.99	84.70	0.33	104.00	0.00	0.50
15.06	85.60	0.34	104.00	0.00	0.50
15.13	81.60	0.35	104.00	0.00	0.50
15.22	83.40	0.33	104.00	0.00	0.50
15.31	84.40	0.36	104.00	0.00	0.50
15.40	85.50	0.37	104.00	0.00	0.50
15.47	87.40	0.38	104.00	0.00	0.50
15.57	87.80	0.41	104.00	0.00	0.50
15.70	90.30	0.41	104.00	0.00	0.50
15.76	90.60	0.42	104.00	0.00	0.50
15.83	92.10	0.42	104.00	0.00	0.50
15.90	95.70	0.41	104.00	0.00	0.50
15.96	97.50	0.43	104.00	0.00	0.50
16.03	97.90	0.43	104.00	0.00	0.50
16.09	99.10	0.44	104.00	0.00	0.50
16.16	101.20	0.44	104.00	0.00	0.50
16.23	102.30	0.44	104.00	0.00	0.50
16.30	104.20	0.46	104.00	0.00	0.50
16.36	104.10	0.47	104.00	0.00	0.50
16.43	105.40	0.44	104.00	0.00	0.50
16.56	113.30	0.47	104.00	0.00	0.50
16.63	121.10	0.53	104.00	0.00	0.50
16.70	127.50	0.57	104.00	0.00	0.50
16.83	139.40	0.67	104.00	0.00	0.50
16.96	141.90	0.80	104.00	0.00	0.50
17.02	143.40	0.85	104.00	0.00	0.50

17.09	138.90	0.85	104.00	0.00	0.50
17.22	141.70	0.78	104.00	0.00	0.50
17.35	148.50	0.77	104.00	0.00	0.50
17.42	152.00	0.76	104.00	0.00	0.50
17.48	153.70	0.73	104.00	0.00	0.50
17.61	165.40	0.74	104.00	0.00	0.50
17.74	186.30	0.80	104.00	0.00	0.50
17.81	199.40	0.79	104.00	0.00	0.50
17.88	210.40	0.63	104.00	0.00	0.50
17.94	219.70	0.74	104.00	0.00	0.50
18.01	229.70	0.86	104.00	0.00	0.50
18.14	246.30	1.00	104.00	0.00	0.50
18.22	236.70	1.04	104.00	0.00	0.50
18.29	252.80	1.08	104.00	0.00	0.50
18.36	261.80	1.14	104.00	0.00	0.50
18.44	270.10	1.22	104.00	0.00	0.50
18.53	279.60	1.29	104.00	0.00	0.50
18.64	281.70	1.29	104.00	0.00	0.50
18.73	285.30	1.29	104.00	0.00	0.50
18.83	280.20	1.34	104.00	0.00	0.50
18.93	277.60	1.41	104.00	0.00	0.50
19.03	275.00	1.48	104.00	0.00	0.50
19.12	266.80	1.41	104.00	0.00	0.50
19.24	265.50	1.50	104.00	0.00	0.50
19.37	261.60	1.56	104.00	0.00	0.50
19.49	262.30	1.60	104.00	0.00	0.50
19.56	266.00	1.57	104.00	0.00	0.50
19.69	279.90	1.53	104.00	0.00	0.50
19.82	273.30	1.54	104.00	0.00	0.50
19.95	291.00	1.53	104.00	0.00	0.50
20.08	292.50	1.66	108.00	0.00	0.50
20.19	293.20	1.64	108.00	0.00	0.50
20.31	293.00	1.72	108.00	0.00	0.50
20.42	289.60	1.83	108.00	0.00	0.50
20.53	284.10	1.88	108.00	0.00	0.50
20.63	279.60	1.91	108.00	0.00	0.50
20.73	278.20	1.94	108.00	0.00	0.50
20.83	275.60	1.96	108.00	0.00	0.50
20.93	274.80	1.97	108.00	0.00	0.50
21.05	271.50	2.00	108.00	0.00	0.50
21.17	268.20	1.98	108.00	0.00	0.50
21.25	237.00	1.92	108.00	0.00	0.50
21.32	242.90	1.85	108.00	0.00	0.50
21.39	249.60	1.76	108.00	0.00	0.50
21.46	247.60	1.71	108.00	0.00	0.50
21.55	249.50	1.66	108.00	0.00	0.50
21.64	249.60	1.66	108.00	0.00	0.50
21.73	255.30	1.71	108.00	0.00	0.50
21.81	257.80	1.79	108.00	0.00	0.50
21.90	256.60	1.87	108.00	0.00	0.50
21.99	256.20	1.92	108.00	0.00	0.50
22.05	254.80	1.92	108.00	0.00	0.50
22.15	251.90	1.91	108.00	0.00	0.50
22.24	253.10	1.92	108.00	0.00	0.50
22.30	253.80	1.91	108.00	0.00	0.50
22.37	254.60	1.88	108.00	0.00	0.50
22.46	254.00	1.84	108.00	0.00	0.50
22.54	259.70	1.79	108.00	0.00	0.50
22.62	262.50	1.80	108.00	0.00	0.50
22.70	270.40	1.81	108.00	0.00	0.50
22.78	268.50	1.80	108.00	0.00	0.50
22.86	268.90	1.80	108.00	0.00	0.50
22.94	269.50	1.79	108.00	0.00	0.50
23.02	265.80	1.75	108.00	0.00	0.50
23.10	266.00	1.69	108.00	0.00	0.50
23.18	259.60	1.64	108.00	0.00	0.50
23.26	258.80	1.60	108.00	0.00	0.50
23.34	259.30	1.56	108.00	0.00	0.50
23.43	255.50	1.53	108.00	0.00	0.50
23.51	249.60	1.51	108.00	0.00	0.50
23.59	252.30	1.50	108.00	0.00	0.50
23.67	251.30	1.49	108.00	0.00	0.50
23.75	251.30	1.47	108.00	0.00	0.50
23.83	247.30	1.47	108.00	0.00	0.50
23.91	242.70	1.49	108.00	0.00	0.50
24.00	235.10	1.48	108.00	0.00	0.50
24.07	227.40	1.43	108.00	0.00	0.50
24.15	218.80	1.37	108.00	0.00	0.50
24.23	207.60	1.30	108.00	0.00	0.50
24.30	204.30	1.25	108.00	0.00	0.50
24.38	199.50	1.23	108.00	0.00	0.50
24.46	192.00	1.24	108.00	0.00	0.50
24.53	186.40	1.26	108.00	0.00	0.50
24.61	180.20	1.27	108.00	0.00	0.50
24.69	173.50	1.28	108.00	0.00	0.50
24.77	162.90	1.29	108.00	0.00	0.50
24.86	155.70	1.25	108.00	0.00	0.50
24.94	145.10	1.17	108.00	0.00	0.50
25.02	129.40	1.08	108.00	0.00	0.50
25.11	113.90	0.94	108.00	0.00	0.50
25.19	91.70	0.82	108.00	0.00	0.50
25.28	74.00	0.70	108.00	0.00	0.50
25.36	57.60	0.66	108.00	0.00	0.50
25.45	43.50	0.67	108.00	0.00	0.50
25.53	31.70	0.67	108.00	0.00	0.50
25.62	22.80	0.61	108.00	0.00	0.50
25.71	18.30	0.53	108.00	0.00	0.50
25.79	16.20	0.48	108.00	0.00	0.50
25.88	14.00	0.44	108.00	0.00	0.50
25.97	12.80	0.39	108.00	0.00	0.50
26.06	12.60	0.33	108.00	0.00	0.50
26.13	12.50	0.30	108.00	0.00	0.50
26.19	12.50	0.30	108.00	0.00	0.50
26.27	14.10	0.34	108.00	0.00	0.50
26.36	18.60	0.38	108.00	0.00	0.50
26.44	22.20	0.45	108.00	0.00	0.50
26.53	21.70	0.52	108.00	0.00	0.50
26.62	20.40	0.52	108.00	0.00	0.50
26.72	23.90	0.49	108.00	0.00	0.50
26.80	33.30	0.51	108.00	0.00	0.50
26.89	49.80	0.56	108.00	0.00	0.50
26.97	66.80	0.64	108.00	0.00	0.50
27.06	85.90	0.73	108.00	0.00	0.50
27.14	107.30	0.87	108.00	0.00	0.50
27.23	131.00	0.95	108.00	0.00	0.50
27.32	154.60	1.12	108.00	0.00	0.50
27.41	173.60	1.29	108.00	0.00	0.50
27.49	189.00	1.42	108.00	0.00	0.50
27.56	179.70	1.50	108.00	0.00	0.50
27.64	194.20	1.57	108.00	0.00	0.50

27.72	198.00	1.65	108.00	0.00	0.50
27.80	195.90	1.71	108.00	0.00	0.50
27.87	198.90	1.76	108.00	0.00	0.50
27.95	203.60	1.81	108.00	0.00	0.50
28.03	206.70	1.86	108.00	0.00	0.50
28.11	206.80	1.92	108.00	0.00	0.50
28.20	209.60	2.04	108.00	0.00	0.50
28.27	209.10	2.10	108.00	0.00	0.50
28.34	210.20	2.22	108.00	0.00	0.50
28.42	211.70	2.35	108.00	0.00	0.50
28.49	210.00	2.43	108.00	0.00	0.50
28.57	212.30	2.51	108.00	0.00	0.50
28.64	210.40	2.53	108.00	0.00	0.50
28.71	212.90	2.53	108.00	0.00	0.50
28.79	211.20	2.55	108.00	0.00	0.50
28.86	211.60	2.54	108.00	0.00	0.50
28.93	212.00	2.48	108.00	0.00	0.50
29.01	214.30	2.42	108.00	0.00	0.50
29.08	212.60	2.34	108.00	0.00	0.50
29.16	211.00	2.28	108.00	0.00	0.50
29.23	210.40	2.22	108.00	0.00	0.50
29.30	207.10	2.16	108.00	0.00	0.50
29.38	205.80	2.10	108.00	0.00	0.50
29.45	203.40	2.03	108.00	0.00	0.50
29.53	202.20	1.98	108.00	0.00	0.50
29.60	202.10	1.94	108.00	0.00	0.50
29.67	202.70	1.87	108.00	0.00	0.50
29.76	203.30	1.81	108.00	0.00	0.50
29.84	208.50	1.67	108.00	0.00	0.50
29.93	214.00	1.63	108.00	0.00	0.50
30.01	214.40	1.62	109.00	0.00	0.50
30.09	213.70	1.62	109.00	0.00	0.50
30.17	204.90	1.63	109.00	0.00	0.50
30.24	201.50	1.57	109.00	0.00	0.50
30.31	204.70	1.54	109.00	0.00	0.50
30.39	204.90	1.54	109.00	0.00	0.50
30.46	205.70	1.55	109.00	0.00	0.50
30.53	206.70	1.57	109.00	0.00	0.50
30.60	210.70	1.62	109.00	0.00	0.50
30.68	220.10	1.71	109.00	0.00	0.50
30.76	227.30	1.85	109.00	0.00	0.50
30.82	234.00	1.95	109.00	0.00	0.50
30.91	238.10	2.05	109.00	0.00	0.50
30.98	239.00	2.09	109.00	0.00	0.50
31.05	238.60	2.08	109.00	0.00	0.50
31.14	241.10	2.05	109.00	0.00	0.50
31.20	237.00	2.02	109.00	0.00	0.50
31.27	238.90	2.00	109.00	0.00	0.50
31.34	235.00	1.94	109.00	0.00	0.50
31.41	229.80	1.90	109.00	0.00	0.50
31.48	224.10	1.88	109.00	0.00	0.50
31.55	223.30	1.90	109.00	0.00	0.50
31.63	226.40	1.96	109.00	0.00	0.50
31.70	228.10	2.03	109.00	0.00	0.50
31.77	233.20	2.10	109.00	0.00	0.50
31.85	233.00	2.18	109.00	0.00	0.50
31.93	233.50	2.21	109.00	0.00	0.50
32.02	232.00	2.22	109.00	0.00	0.50
32.10	223.80	2.16	109.00	0.00	0.50
32.19	215.10	2.03	109.00	0.00	0.50
32.27	207.30	1.90	109.00	0.00	0.50
32.36	196.10	1.80	109.00	0.00	0.50
32.45	184.10	1.72	109.00	0.00	0.50
32.53	173.00	1.59	109.00	0.00	0.50
32.62	169.30	1.50	109.00	0.00	0.50
32.71	162.00	1.42	109.00	0.00	0.50
32.79	159.90	1.32	109.00	0.00	0.50
32.88	152.20	1.26	109.00	0.00	0.50
32.95	149.30	1.22	109.00	0.00	0.50
33.02	144.40	1.21	109.00	0.00	0.50
33.09	143.50	1.21	109.00	0.00	0.50
33.17	140.70	1.21	109.00	0.00	0.50
33.25	138.20	1.18	109.00	0.00	0.50
33.33	139.50	1.16	109.00	0.00	0.50
33.41	142.60	1.11	109.00	0.00	0.50
33.50	144.50	1.16	109.00	0.00	0.50
33.58	145.30	1.18	109.00	0.00	0.50
33.67	144.90	1.17	109.00	0.00	0.50
33.75	136.80	1.15	109.00	0.00	0.50
33.82	139.90	1.11	109.00	0.00	0.50
33.91	137.60	1.11	109.00	0.00	0.50
34.00	137.20	1.14	109.00	0.00	0.50
34.09	132.50	1.15	109.00	0.00	0.50
34.19	128.70	1.14	109.00	0.00	0.50
34.28	127.60	1.13	109.00	0.00	0.50
34.37	129.80	1.13	109.00	0.00	0.50
34.45	129.90	1.10	109.00	0.00	0.50
34.54	134.00	1.09	109.00	0.00	0.50
34.62	137.40	1.07	109.00	0.00	0.50
34.70	143.00	1.06	109.00	0.00	0.50
34.79	147.10	1.07	109.00	0.00	0.50
34.87	156.40	1.09	109.00	0.00	0.50
34.96	163.40	1.14	109.00	0.00	0.50
35.04	173.40	1.22	109.00	0.00	0.50
35.13	185.40	1.35	109.00	0.00	0.50
35.22	195.30	1.48	109.00	0.00	0.50
35.31	208.60	1.63	109.00	0.00	0.50
35.40	216.80	1.66	109.00	0.00	0.50
35.48	225.60	1.76	109.00	0.00	0.50
35.57	230.50	1.76	109.00	0.00	0.50
35.65	233.40	1.64	109.00	0.00	0.50
35.74	226.60	1.50	109.00	0.00	0.50
35.83	230.40	1.40	109.00	0.00	0.50
35.92	231.40	1.39	109.00	0.00	0.50
35.99	236.00	1.39	109.00	0.00	0.50
36.07	242.00	1.40	109.00	0.00	0.50
36.16	242.30	1.45	109.00	0.00	0.50
36.24	244.70	1.52	109.00	0.00	0.50
36.33	246.60	1.53	109.00	0.00	0.50
36.42	246.30	1.52	109.00	0.00	0.50
36.50	245.60	1.60	109.00	0.00	0.50
36.59	242.90	1.71	109.00	0.00	0.50
36.67	237.00	1.77	109.00	0.00	0.50
36.74	223.60	1.79	109.00	0.00	0.50
36.81	231.80	1.77	109.00	0.00	0.50
36.89	235.90	1.73	109.00	0.00	0.50
36.98	242.20	1.73	109.00	0.00	0.50
37.06	254.30	1.69	109.00	0.00	0.50
37.14	258.80	1.62	109.00	0.00	0.50
37.24	268.70	1.57	109.00	0.00	0.50

37.32	270.10	1.59	109.00	0.00	0.50
37.40	272.60	1.64	109.00	0.00	0.50
37.48	271.80	1.66	109.00	0.00	0.50
37.57	267.10	1.71	109.00	0.00	0.50
37.65	262.80	1.73	109.00	0.00	0.50
37.74	266.10	1.72	109.00	0.00	0.50
37.82	266.50	1.69	109.00	0.00	0.50
37.90	264.70	1.68	109.00	0.00	0.50
37.99	267.80	1.65	109.00	0.00	0.50
38.08	268.20	1.59	109.00	0.00	0.50
38.16	270.20	1.56	109.00	0.00	0.50
38.24	270.70	1.55	109.00	0.00	0.50
38.33	272.20	1.54	109.00	0.00	0.50
38.41	273.10	1.54	109.00	0.00	0.50
38.49	267.60	1.57	109.00	0.00	0.50
38.57	259.10	1.63	109.00	0.00	0.50
38.65	240.80	1.67	109.00	0.00	0.50
38.73	222.40	1.63	109.00	0.00	0.50
38.81	200.40	1.46	109.00	0.00	0.50
38.88	183.70	1.38	109.00	0.00	0.50
38.96	168.40	1.42	109.00	0.00	0.50
39.03	142.20	1.53	109.00	0.00	0.50
39.10	118.20	1.71	109.00	0.00	0.50
39.17	101.10	2.10	109.00	0.00	0.50
39.25	76.60	2.29	109.00	0.00	0.50
39.32	61.10	2.22	109.00	0.00	0.50
39.39	56.40	1.99	109.00	0.00	0.50
39.46	55.30	1.83	109.00	0.00	0.50
39.53	56.00	1.82	109.00	0.00	0.50
39.62	62.10	1.83	109.00	0.00	0.50
39.71	214.50	1.63	109.00	0.00	0.50
39.79	271.40	1.44	109.00	0.00	0.50
39.87	312.80	1.08	109.00	0.00	0.50
39.95	318.30	0.80	109.00	0.00	0.50
40.04	323.70	0.71	120.00	0.00	0.50
40.12	323.90	0.72	120.00	0.00	0.50
40.20	315.70	0.80	120.00	0.00	0.50
40.29	321.30	0.88	120.00	0.00	0.50
40.38	335.20	0.96	120.00	0.00	0.50
40.45	353.60	1.01	120.00	0.00	0.50
40.53	376.40	1.00	120.00	0.00	0.50
40.61	394.60	0.88	120.00	0.00	0.50
40.70	406.30	0.83	120.00	0.00	0.50
40.78	412.20	0.81	120.00	0.00	0.50
40.86	399.60	0.82	120.00	0.00	0.50
40.95	372.90	0.87	120.00	0.00	0.50
41.03	346.50	0.90	120.00	0.00	0.50
41.11	325.10	0.91	120.00	0.00	0.50
41.20	299.30	0.90	120.00	0.00	0.50
41.28	276.70	0.73	120.00	0.00	0.50
41.37	243.70	0.51	120.00	0.00	0.50
41.45	212.50	0.52	120.00	0.00	0.50
41.54	182.70	0.59	120.00	0.00	0.50
41.63	155.20	0.69	120.00	0.00	0.50
41.71	77.10	0.84	120.00	0.00	0.50
41.80	66.20	0.97	120.00	0.00	0.50
41.89	51.70	1.14	120.00	0.00	0.50
41.99	53.40	1.26	120.00	0.00	0.50
42.06	53.20	1.33	120.00	0.00	0.50
42.14	52.30	1.34	120.00	0.00	0.50
42.23	52.70	1.34	120.00	0.00	0.50
42.31	53.30	1.33	120.00	0.00	0.50
42.40	52.50	1.22	120.00	0.00	0.50
42.48	52.80	0.83	120.00	0.00	0.50
42.57	51.30	0.86	120.00	0.00	0.50
42.66	50.90	0.95	120.00	0.00	0.50
42.74	54.00	0.93	120.00	0.00	0.50
42.82	56.50	0.87	120.00	0.00	0.50
42.89	58.90	0.88	120.00	0.00	0.50
42.98	55.60	0.92	120.00	0.00	0.50
43.05	51.20	0.98	120.00	0.00	0.50
43.12	46.60	1.03	120.00	0.00	0.50
43.19	40.00	1.15	120.00	0.00	0.50
43.26	35.30	1.20	120.00	0.00	0.50
43.33	32.20	1.12	120.00	0.00	0.50
43.40	29.70	1.12	120.00	0.00	0.50
43.47	29.90	1.10	120.00	0.00	0.50
43.54	42.60	1.10	120.00	0.00	0.50
43.61	67.60	1.16	120.00	0.00	0.50
43.68	265.50	1.16	120.00	0.00	0.50
43.75	327.40	1.18	120.00	0.00	0.50
43.82	392.10	1.13	120.00	0.00	0.50
43.89	194.10	1.13	120.00	0.00	0.50
43.96	220.60	1.24	120.00	0.00	0.50
44.03	234.40	1.34	120.00	0.00	0.50
44.10	242.80	1.46	120.00	0.00	0.50
44.16	241.30	1.50	120.00	0.00	0.50
44.23	238.30	1.43	120.00	0.00	0.50
44.31	230.00	1.37	120.00	0.00	0.50
44.37	216.30	1.31	120.00	0.00	0.50
44.44	201.40	1.25	120.00	0.00	0.50
44.51	183.90	1.24	120.00	0.00	0.50
44.61	150.40	1.31	120.00	0.00	0.50
44.67	203.00	1.47	120.00	0.00	0.50
44.74	155.00	1.69	120.00	0.00	0.50
44.81	76.70	1.78	120.00	0.00	0.50
44.88	63.20	1.73	120.00	0.00	0.50
44.95	58.40	1.70	120.00	0.00	0.50
45.02	51.20	1.66	120.00	0.00	0.50
45.09	44.90	1.68	120.00	0.00	0.50
45.16	42.60	1.78	120.00	0.00	0.50
45.22	41.20	1.81	120.00	0.00	0.50
45.29	42.30	1.73	120.00	0.00	0.50
45.36	46.90	1.59	120.00	0.00	0.50
45.43	49.40	1.52	120.00	0.00	0.50
45.50	54.40	1.54	120.00	0.00	0.50
45.57	54.80	1.24	120.00	0.00	0.50
45.64	55.20	1.27	120.00	0.00	0.50
45.71	58.40	1.34	120.00	0.00	0.50
45.78	58.40	1.38	120.00	0.00	0.50
45.84	63.70	1.38	120.00	0.00	0.50
45.92	69.10	1.33	120.00	0.00	0.50
46.00	170.50	1.29	120.00	0.00	0.50
46.08	178.40	1.30	120.00	0.00	0.50
46.18	182.10	1.35	120.00	0.00	0.50
46.25	188.30	1.38	120.00	0.00	0.50
46.32	198.40	1.47	120.00	0.00	0.50
46.39	219.10	1.62	120.00	0.00	0.50
46.46	244.60	1.77	120.00	0.00	0.50
46.52	280.40	1.85	120.00	0.00	0.50

46.59	315.80	1.85	120.00	0.00	0.50
46.66	351.40	1.82	120.00	0.00	0.50
46.73	382.10	1.82	120.00	0.00	0.50
46.80	402.90	1.80	120.00	0.00	0.50
46.87	412.90	1.72	120.00	0.00	0.50
46.93	411.80	1.58	120.00	0.00	0.50
47.00	403.80	1.50	120.00	0.00	0.50
47.07	389.20	1.55	120.00	0.00	0.50
47.14	368.00	1.56	120.00	0.00	0.50
47.21	343.10	1.57	120.00	0.00	0.50
47.28	317.80	1.50	120.00	0.00	0.50
47.34	286.90	1.43	120.00	0.00	0.50
47.41	260.30	1.35	120.00	0.00	0.50
47.48	237.00	1.26	120.00	0.00	0.50
47.55	214.60	1.19	120.00	0.00	0.50
47.62	193.00	1.13	120.00	0.00	0.50
47.69	175.60	1.12	120.00	0.00	0.50
47.76	165.30	1.19	120.00	0.00	0.50
47.83	160.10	1.24	120.00	0.00	0.50
47.90	158.20	1.11	120.00	0.00	0.50
47.97	151.20	1.11	120.00	0.00	0.50
48.03	137.80	1.35	120.00	0.00	0.50
48.10	68.20	1.67	120.00	0.00	0.50
48.17	56.90	1.81	120.00	0.00	0.50
48.25	44.80	1.80	120.00	0.00	0.50
48.32	38.30	1.71	120.00	0.00	0.50
48.39	29.70	1.59	120.00	0.00	0.50
48.46	26.00	1.51	120.00	0.00	0.50
48.53	26.00	1.37	120.00	0.00	0.50
48.59	25.40	1.20	120.00	0.00	0.50
48.66	25.00	1.10	120.00	0.00	0.50
48.73	26.50	0.95	120.00	0.00	0.50
48.80	28.60	1.12	120.00	0.00	0.50
48.87	31.30	1.21	120.00	0.00	0.50
48.94	32.70	1.26	120.00	0.00	0.50
49.01	31.70	1.27	120.00	0.00	0.50
49.09	34.50	1.25	120.00	0.00	0.50
49.16	33.50	1.24	120.00	0.00	0.50
49.23	32.40	1.16	120.00	0.00	0.50
49.32	31.00	1.30	120.00	0.00	0.50
49.38	32.00	1.47	120.00	0.00	0.50
49.45	38.60	1.59	120.00	0.00	0.50
49.52	46.60	1.71	120.00	0.00	0.50
49.59	51.80	1.80	120.00	0.00	0.50
49.66	57.10	1.83	120.00	0.00	0.50
49.73	58.60	1.58	120.00	0.00	0.50
49.79	53.80	1.42	120.00	0.00	0.50
49.86	44.80	1.41	120.00	0.00	0.50
49.93	36.90	1.37	120.00	0.00	0.50
50.00	29.50	1.36	120.00	0.00	0.50
50.07	24.80	1.28	120.00	0.00	0.50
50.14	23.00	1.26	120.00	0.00	0.50
50.21	21.20	1.16	120.00	0.00	0.50
50.28	19.80	1.11	120.00	0.00	0.50
50.35	19.70	1.11	120.00	0.00	0.50
50.42	24.30	1.17	120.00	0.00	0.50
50.49	32.30	1.19	120.00	0.00	0.50
50.56	44.10	1.25	120.00	0.00	0.50
50.63	57.70	1.36	120.00	0.00	0.50
50.70	62.40	1.54	120.00	0.00	0.50
50.77	65.60	1.68	120.00	0.00	0.50
50.84	68.50	1.77	120.00	0.00	0.50
50.91	74.10	1.89	120.00	0.00	0.50
50.98	82.80	1.95	120.00	0.00	0.50
51.05	92.00	2.03	120.00	0.00	0.50
51.12	101.10	2.11	120.00	0.00	0.50
51.19	107.00	2.16	120.00	0.00	0.50
51.26	115.20	2.15	120.00	0.00	0.50
51.32	122.70	2.13	120.00	0.00	0.50
51.39	129.20	2.11	120.00	0.00	0.50
51.46	135.50	1.97	120.00	0.00	0.50
51.53	284.20	1.81	120.00	0.00	0.50
51.60	283.60	1.73	120.00	0.00	0.50
51.67	281.70	1.58	120.00	0.00	0.50
51.74	276.40	1.61	120.00	0.00	0.50
51.81	273.00	1.65	120.00	0.00	0.50
51.88	270.70	1.70	120.00	0.00	0.50
51.95	264.30	1.77	120.00	0.00	0.50
52.03	254.30	1.87	120.00	0.00	0.50
52.10	249.00	1.98	120.00	0.00	0.50
52.20	247.30	2.13	120.00	0.00	0.50
52.29	254.10	2.08	120.00	0.00	0.50
52.36	249.10	1.99	120.00	0.00	0.50
52.43	239.70	1.91	120.00	0.00	0.50
52.50	226.60	1.88	120.00	0.00	0.50
52.57	220.90	1.86	120.00	0.00	0.50
52.63	213.80	1.74	120.00	0.00	0.50
52.70	210.80	1.70	120.00	0.00	0.50
52.77	211.10	1.62	120.00	0.00	0.50
52.84	199.40	1.56	120.00	0.00	0.50
52.91	193.00	1.56	120.00	0.00	0.50
52.98	183.00	1.53	120.00	0.00	0.50
53.05	172.60	1.63	120.00	0.00	0.50
53.11	158.70	1.78	120.00	0.00	0.50
53.18	136.60	1.86	120.00	0.00	0.50
53.25	59.30	1.86	120.00	0.00	0.50
53.32	54.90	1.76	120.00	0.00	0.50
53.39	53.70	1.68	120.00	0.00	0.50
53.46	51.70	1.69	120.00	0.00	0.50
53.52	51.90	1.77	120.00	0.00	0.50
53.59	57.40	1.83	120.00	0.00	0.50
53.66	65.50	1.70	120.00	0.00	0.50
53.73	70.00	1.48	120.00	0.00	0.50
53.80	72.10	1.39	120.00	0.00	0.50
53.87	70.30	1.48	120.00	0.00	0.50
53.94	64.10	1.60	120.00	0.00	0.50
54.00	53.60	1.61	120.00	0.00	0.50
54.07	42.70	1.44	120.00	0.00	0.50
54.14	36.40	1.15	120.00	0.00	0.50
54.21	32.10	1.01	120.00	0.00	0.50
54.28	29.40	0.94	120.00	0.00	0.50
54.35	24.90	0.88	120.00	0.00	0.50
54.42	22.10	0.81	120.00	0.00	0.50
54.50	21.50	0.76	120.00	0.00	0.50
54.58	21.10	0.75	120.00	0.00	0.50
54.66	23.30	0.85	120.00	0.00	0.50
54.73	26.70	0.87	120.00	0.00	0.50
54.80	28.80	0.82	120.00	0.00	0.50
54.87	27.40	0.81	120.00	0.00	0.50
54.94	25.00	0.78	120.00	0.00	0.50

55.00	20.70	0.73	120.00	0.00	0.50
55.07	17.30	0.66	120.00	0.00	0.50
55.14	15.70	0.63	120.00	0.00	0.50
55.21	14.70	0.62	120.00	0.00	0.50
55.28	14.00	0.58	120.00	0.00	0.50
55.35	14.00	0.57	120.00	0.00	0.50
55.42	14.10	0.58	120.00	0.00	0.50
55.49	14.60	0.61	120.00	0.00	0.50
55.57	15.30	0.63	120.00	0.00	0.50
55.64	15.40	0.63	120.00	0.00	0.50
55.71	16.10	0.62	120.00	0.00	0.50
55.78	16.40	0.59	120.00	0.00	0.50
55.84	16.90	0.59	120.00	0.00	0.50
55.91	16.50	0.59	120.00	0.00	0.50
55.98	16.20	0.59	120.00	0.00	0.50
56.05	16.40	0.61	120.00	0.00	0.50
56.12	16.30	0.65	120.00	0.00	0.50
56.20	17.30	0.66	120.00	0.00	0.50
56.26	17.70	0.62	120.00	0.00	0.50
56.33	17.30	0.61	120.00	0.00	0.50
56.40	16.80	0.60	120.00	0.00	0.50
56.47	16.20	0.54	120.00	0.00	0.50
56.54	15.10	0.50	120.00	0.00	0.50
56.62	14.00	0.45	120.00	0.00	0.50
56.69	13.00	0.40	120.00	0.00	0.50
56.76	12.70	0.36	120.00	0.00	0.50
56.82	12.00	0.33	120.00	0.00	0.50
56.89	12.10	0.30	120.00	0.00	0.50
56.97	12.60	0.30	120.00	0.00	0.50
57.04	12.80	0.33	120.00	0.00	0.50
57.11	13.90	0.35	120.00	0.00	0.50
57.18	15.30	0.36	120.00	0.00	0.50
57.24	15.70	0.40	120.00	0.00	0.50
57.31	15.80	0.47	120.00	0.00	0.50
57.39	15.90	0.53	120.00	0.00	0.50
57.46	16.10	0.54	120.00	0.00	0.50
57.53	16.80	0.54	120.00	0.00	0.50
57.60	17.60	0.52	120.00	0.00	0.50
57.67	18.10	0.55	120.00	0.00	0.50
57.74	18.70	0.54	120.00	0.00	0.50
57.81	19.60	0.55	120.00	0.00	0.50
57.88	21.10	0.58	120.00	0.00	0.50
57.95	21.60	0.62	120.00	0.00	0.50
58.02	21.50	0.67	120.00	0.00	0.50
58.09	20.60	0.71	120.00	0.00	0.50
58.18	21.70	0.73	120.00	0.00	0.50
58.25	21.40	0.67	120.00	0.00	0.50
58.32	21.50	0.64	120.00	0.00	0.50
58.39	21.40	0.69	120.00	0.00	0.50
58.46	21.10	0.69	120.00	0.00	0.50
58.53	21.20	0.64	120.00	0.00	0.50
58.61	21.90	0.62	120.00	0.00	0.50
58.68	23.20	0.66	120.00	0.00	0.50
58.75	24.70	0.76	120.00	0.00	0.50
58.82	27.60	0.84	120.00	0.00	0.50
58.89	29.40	0.94	120.00	0.00	0.50
58.96	28.60	1.02	120.00	0.00	0.50
59.03	27.00	1.06	120.00	0.00	0.50
59.10	25.50	1.06	120.00	0.00	0.50
59.18	25.00	1.01	120.00	0.00	0.50
59.26	23.10	0.87	120.00	0.00	0.50
59.35	26.10	0.69	120.00	0.00	0.50
59.44	27.20	0.56	120.00	0.00	0.50
59.53	24.60	0.52	120.00	0.00	0.50
59.62	23.00	0.57	120.00	0.00	0.50
59.70	22.60	0.63	120.00	0.00	0.50
59.79	26.70	0.82	120.00	0.00	0.50
59.88	32.90	1.00	120.00	0.00	0.50
59.97	39.00	1.13	120.00	0.00	0.50
60.06	43.20	1.15	120.00	0.00	0.50
60.14	46.10	1.34	120.00	0.00	0.50
60.24	53.50	1.78	120.00	0.00	0.50
60.33	68.70	2.09	120.00	0.00	0.50
60.41	72.50	2.33	120.00	0.00	0.50
60.50	68.40	2.54	120.00	0.00	0.50
60.58	59.70	2.71	120.00	0.00	0.50
60.64	53.80	2.79	120.00	0.00	0.50
60.73	49.00	2.52	120.00	0.00	0.50
60.82	45.40	2.21	120.00	0.00	0.50
60.91	40.40	2.14	120.00	0.00	0.50
60.99	36.40	2.08	120.00	0.00	0.50
61.08	33.30	1.94	120.00	0.00	0.50
61.17	30.20	1.79	120.00	0.00	0.50
61.26	26.80	1.66	120.00	0.00	0.50
61.35	25.80	1.48	120.00	0.00	0.50
61.44	24.00	1.28	120.00	0.00	0.50
61.53	23.00	1.15	120.00	0.00	0.50
61.62	19.90	0.90	120.00	0.00	0.50
61.70	18.40	0.79	120.00	0.00	0.50
61.79	18.00	0.70	120.00	0.00	0.50
61.88	16.40	0.65	120.00	0.00	0.50
61.97	17.50	0.61	120.00	0.00	0.50
62.07	17.40	0.62	120.00	0.00	0.50
62.13	17.60	0.68	120.00	0.00	0.50
62.21	19.50	0.76	120.00	0.00	0.50
62.29	20.50	0.80	120.00	0.00	0.50
62.38	22.40	0.84	120.00	0.00	0.50
62.46	22.60	0.93	120.00	0.00	0.50
62.55	22.60	1.04	120.00	0.00	0.50
62.64	23.40	1.09	120.00	0.00	0.50
62.73	23.90	1.12	120.00	0.00	0.50
62.82	23.90	1.16	120.00	0.00	0.50
62.90	23.00	1.19	120.00	0.00	0.50
62.99	22.00	1.17	120.00	0.00	0.50
63.08	22.00	1.12	120.00	0.00	0.50
63.17	21.40	1.04	120.00	0.00	0.50
63.26	22.30	0.96	120.00	0.00	0.50
63.34	22.30	0.95	120.00	0.00	0.50
63.43	22.70	1.02	120.00	0.00	0.50
63.52	23.60	1.08	120.00	0.00	0.50
63.61	22.90	1.14	120.00	0.00	0.50
63.70	22.00	1.22	120.00	0.00	0.50
63.79	20.80	1.24	120.00	0.00	0.50
63.88	19.70	1.08	120.00	0.00	0.50
63.97	19.10	1.02	120.00	0.00	0.50
64.05	19.70	1.05	120.00	0.00	0.50
64.14	19.90	1.09	120.00	0.00	0.50
64.23	20.80	1.07	120.00	0.00	0.50
64.31	20.90	1.05	120.00	0.00	0.50
64.40	19.80	1.05	120.00	0.00	0.50

64.49	19.10	1.01	120.00	0.00	0.50
64.58	18.50	0.97	120.00	0.00	0.50
64.66	18.10	0.95	120.00	0.00	0.50
64.76	17.40	0.92	120.00	0.00	0.50
64.85	16.60	0.86	120.00	0.00	0.50
64.92	15.80	0.81	120.00	0.00	0.50
65.00	15.60	0.78	120.00	0.00	0.50
65.08	15.30	0.77	120.00	0.00	0.50
65.17	15.50	0.74	120.00	0.00	0.50
65.26	15.50	0.70	120.00	0.00	0.50
65.35	15.70	0.74	120.00	0.00	0.50
65.44	15.50	0.73	120.00	0.00	0.50
65.53	15.70	0.70	120.00	0.00	0.50
65.63	15.80	0.67	120.00	0.00	0.50
65.72	15.90	0.64	120.00	0.00	0.50
65.81	16.20	0.62	120.00	0.00	0.50
65.91	16.70	0.60	120.00	0.00	0.50
66.00	17.30	0.58	120.00	0.00	0.50
66.09	17.20	0.55	120.00	0.00	0.50
66.18	16.90	0.54	120.00	0.00	0.50
66.28	16.20	0.53	120.00	0.00	0.50
66.37	15.80	0.50	120.00	0.00	0.50
66.47	15.70	0.49	120.00	0.00	0.50
66.56	15.90	0.48	120.00	0.00	0.50
66.66	15.80	0.48	120.00	0.00	0.50
66.75	15.20	0.49	120.00	0.00	0.50
66.84	15.30	0.49	120.00	0.00	0.50
66.94	15.30	0.50	120.00	0.00	0.50
67.03	15.50	0.52	120.00	0.00	0.50
67.12	16.20	0.54	120.00	0.00	0.50
67.22	17.20	0.57	120.00	0.00	0.50
67.31	18.60	0.60	120.00	0.00	0.50
67.40	19.50	0.67	120.00	0.00	0.50
67.50	20.00	0.71	120.00	0.00	0.50
67.60	19.90	0.71	120.00	0.00	0.50
67.69	21.60	0.86	120.00	0.00	0.50
67.78	21.90	0.93	120.00	0.00	0.50
67.87	20.70	0.95	120.00	0.00	0.50
67.94	24.80	0.91	120.00	0.00	0.50
68.04	22.50	0.75	120.00	0.00	0.50
68.13	21.50	0.70	120.00	0.00	0.50
68.22	20.40	0.75	120.00	0.00	0.50
68.31	19.30	0.64	120.00	0.00	0.50
68.40	17.70	0.56	120.00	0.00	0.50
68.49	17.50	0.57	120.00	0.00	0.50
68.59	18.80	0.60	120.00	0.00	0.50
68.68	21.00	0.63	120.00	0.00	0.50
68.78	22.40	0.69	120.00	0.00	0.50
68.87	23.20	0.72	120.00	0.00	0.50
68.96	23.70	0.75	120.00	0.00	0.50
69.05	24.10	0.76	120.00	0.00	0.50
69.15	23.20	0.75	120.00	0.00	0.50
69.24	22.20	0.76	120.00	0.00	0.50
69.34	23.80	0.70	120.00	0.00	0.50
69.43	24.60	0.69	120.00	0.00	0.50
69.52	23.80	0.65	120.00	0.00	0.50
69.61	22.70	0.62	120.00	0.00	0.50
69.71	20.10	0.56	120.00	0.00	0.50
69.80	18.90	0.49	120.00	0.00	0.50
69.89	18.00	0.45	120.00	0.00	0.50
69.99	17.60	0.41	120.00	0.00	0.50
70.08	17.00	0.39	120.00	0.00	0.50
70.17	15.50	0.38	120.00	0.00	0.50
70.26	15.60	0.38	120.00	0.00	0.50
70.37	16.00	0.38	120.00	0.00	0.50
70.47	16.80	0.39	120.00	0.00	0.50
70.58	16.30	0.44	120.00	0.00	0.50
70.68	16.50	0.51	120.00	0.00	0.50
70.78	18.20	0.57	120.00	0.00	0.50
70.86	19.60	0.66	120.00	0.00	0.50
70.95	21.30	0.78	120.00	0.00	0.50
71.04	26.30	0.82	120.00	0.00	0.50
71.14	31.50	1.15	120.00	0.00	0.50
71.24	34.00	1.27	120.00	0.00	0.50
71.32	30.50	1.39	120.00	0.00	0.50
71.41	37.00	1.55	120.00	0.00	0.50
71.50	37.50	1.61	120.00	0.00	0.50
71.57	38.20	1.63	120.00	0.00	0.50
71.67	37.20	1.63	120.00	0.00	0.50
71.77	36.50	1.56	120.00	0.00	0.50
71.88	35.00	1.51	120.00	0.00	0.50
71.98	35.60	1.49	120.00	0.00	0.50
72.09	33.20	1.46	120.00	0.00	0.50
72.19	30.30	1.32	120.00	0.00	0.50
72.30	27.90	1.18	120.00	0.00	0.50
72.40	27.20	1.11	120.00	0.00	0.50
72.50	26.20	1.03	120.00	0.00	0.50
72.61	24.90	0.94	120.00	0.00	0.50
72.71	24.00	0.90	120.00	0.00	0.50
72.81	24.60	0.93	120.00	0.00	0.50
72.92	24.50	0.85	120.00	0.00	0.50
73.02	22.40	0.66	120.00	0.00	0.50
73.12	20.40	0.58	120.00	0.00	0.50
73.23	21.60	0.59	120.00	0.00	0.50
73.33	23.10	0.61	120.00	0.00	0.50
73.43	25.10	0.69	120.00	0.00	0.50
73.54	25.60	0.79	120.00	0.00	0.50
73.64	25.00	0.82	120.00	0.00	0.50
73.74	25.80	0.91	120.00	0.00	0.50
73.89	28.00	0.99	120.00	0.00	0.50
73.97	26.70	1.01	120.00	0.00	0.50
74.10	26.40	0.99	120.00	0.00	0.50
74.23	27.10	1.13	120.00	0.00	0.50
74.30	27.20	1.11	120.00	0.00	0.50
74.43	23.90	1.11	120.00	0.00	0.50
74.49	23.30	1.01	120.00	0.00	0.50
74.58	23.80	1.33	120.00	0.00	0.50
74.64	24.50	1.43	120.00	0.00	0.50
74.74	24.50	1.46	120.00	0.00	0.50
74.84	21.70	1.44	120.00	0.00	0.50
74.94	18.90	1.41	120.00	0.00	0.50
75.04	17.90	1.33	120.00	0.00	0.50
75.14	17.20	1.24	120.00	0.00	0.50
75.24	17.90	1.17	120.00	0.00	0.50
75.33	19.30	1.03	120.00	0.00	0.50
75.43	20.80	0.91	120.00	0.00	0.50
75.53	25.10	0.80	120.00	0.00	0.50
75.63	49.10	0.81	120.00	0.00	0.50
75.73	170.10	1.27	120.00	0.00	0.50
75.83	271.70	1.61	120.00	0.00	0.50

75.91	273.80	1.82	120.00	0.00	0.50
76.00	257.50	2.01	120.00	0.00	0.50
76.08	244.70	2.09	120.00	0.00	0.50
76.16	240.10	2.13	120.00	0.00	0.50
76.24	226.90	2.27	120.00	0.00	0.50
76.32	205.20	2.52	120.00	0.00	0.50
76.39	170.10	2.62	120.00	0.00	0.50
76.47	84.40	2.57	120.00	0.00	0.50
76.58	61.50	2.18	120.00	0.00	0.50
76.70	60.20	1.98	120.00	0.00	0.50
76.81	118.60	1.85	120.00	0.00	0.50
76.90	177.20	1.82	120.00	0.00	0.50
76.99	205.30	1.78	120.00	0.00	0.50
77.07	236.50	2.00	120.00	0.00	0.50
77.15	263.40	2.81	120.00	0.00	0.50
77.22	271.40	3.37	120.00	0.00	0.50
77.29	289.70	3.30	120.00	0.00	0.50
77.39	310.50	3.45	120.00	0.00	0.50
77.46	299.20	3.29	120.00	0.00	0.50
77.53	284.80	3.24	120.00	0.00	0.50
77.60	290.90	3.24	120.00	0.00	0.50
77.68	269.60	2.98	120.00	0.00	0.50
77.76	259.40	2.59	120.00	0.00	0.50
77.83	261.30	2.62	120.00	0.00	0.50
77.90	266.00	2.35	120.00	0.00	0.50
77.98	270.80	1.97	120.00	0.00	0.50
78.06	288.80	2.25	120.00	0.00	0.50
78.13	301.10	2.28	120.00	0.00	0.50
78.21	301.90	2.37	120.00	0.00	0.50
78.28	315.80	2.60	120.00	0.00	0.50
78.36	341.40	2.66	120.00	0.00	0.50
78.43	366.20	3.27	120.00	0.00	0.50
78.51	336.60	3.59	120.00	0.00	0.50
78.59	350.50	3.34	120.00	0.00	0.50
78.66	363.40	2.95	120.00	0.00	0.50
78.73	396.40	2.68	120.00	0.00	0.50
78.81	420.00	2.85	120.00	0.00	0.50
78.88	440.00	3.61	120.00	0.00	0.50
78.95	450.90	3.92	120.00	0.00	0.50
79.03	485.30	4.61	120.00	0.00	0.50
79.09	496.70	5.28	120.00	0.00	0.50
79.17	519.90	4.71	120.00	0.00	0.50
79.24	538.40	4.40	120.00	0.00	0.50
79.31	515.10	3.78	120.00	0.00	0.50
79.38	526.60	3.70	120.00	0.00	0.50
79.45	538.10	4.28	120.00	0.00	0.50
79.53	531.10	4.14	120.00	0.00	0.50
79.60	515.10	3.74	120.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.22 in.
Settlement of Unsaturated Sands=0.27 in.
Total Settlement of Saturated and Unsaturated Sands=0.49 in.
Differential Settlement=0.247 to 0.327 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.34	5.00	0.22	0.27	0.49
5.00	0.33	0.34	5.00	0.22	0.26	0.49
10.00	0.21	0.34	5.00	0.22	0.21	0.43
15.00	0.22	0.33	5.00	0.22	0.13	0.35
20.00	2.79	0.33	5.00	0.22	0.07	0.29
25.00	0.41	0.32	5.00	0.22	0.05	0.27
30.00	0.72	0.32	5.00	0.22	0.00	0.22
35.00	0.35	0.33	1.06	0.17	0.00	0.17
40.00	1.30	0.34	3.84	0.17	0.00	0.17
45.00	2.00	0.34	5.00	0.04	0.00	0.04
50.00	2.00	0.34	5.00	0.01	0.00	0.01
55.00	2.00	0.33	5.00	0.00	0.00	0.00
60.00	2.00	0.32	5.00	0.00	0.00	0.00
65.00	2.00	0.31	5.00	0.00	0.00	0.00
70.00	2.00	0.30	5.00	0.00	0.00	0.00
75.00	2.00	0.29	5.00	0.00	0.00	0.00
80.00	2.45	0.28	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Table 3 per MTD 3-1 – General Foundation Information

Foundation Design Data Sheet								
Support	Design Method	Pile Type	Finished Grade Elevation (feet)	Cut-off Elevation (feet)	Pile Cap Size (feet)		Permissible Settlement under Service Load (inches)	Number of Piles per Support
					B	L		
Abut 1	WSD	12-inch square precast concrete pile (Class 90)	203.1	189.8	6.0	23.58	1	11
Bent 2	LRFD	12-inch square precast concrete pile (Class 90)	174.0	163.8	6.0	33.00	1	22
Abut 3	WSD	HP 10x42 steel pile (Class 90)	202.5	189.8	6.0	23.58	1	11

Table 4 per MTD 3-1 – Design Loads

Foundation Design Load											
Support	Service Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Maximum Per Pile	Per Support	Per Support	Maximum Per Pile	Per Support	Maximum Per Pile	Per Support	Maximum Per Pile	Per Support	Maximum Per Pile
Abut 1	870	81	620	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	1610	95	1440	2030	124	-	-	1640	112	-	-
Abut 3	700	66	470	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5 per MTD 3-1 – Foundation Recommendations for Abutments 1 and 3

Abutment Foundation Design Recommendations									
Support	Pile Type	Cut-off Elevation (feet)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elevations (feet)	Specified Tip Elevation (feet)	Nominal Driving Resistance Required (kips)
			Total	Permanent					
Abut 1	12-inch square precast concrete pile (Class 90)	189.8	870	620	81	170	144 (a) 144 (c) 169 (d)	144	170
Abut 3	HP 10 by 42 Steel Pile (Class 90)	189.8	700	470	66	140	139 (a) 139 (c) 169 (d)	139	140
Design tip elevations are controlled by: (a) Compression, (c) Settlement, and (d) Lateral Load The specified tip elevation shall not be raised above the design tip elevations for tension, lateral, and tolerable settlement.									

Table 6 per MTD 3-1 – Foundation Recommendations for Bent 2

Bent Foundation Design Recommendations											
Support	Pile Type	Cut-off Elevation (feet)	Service-I Limit State Load (kips) per Support	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevation (feet)	Specified Tip Elevation (feet)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (ϕ=0.7)	Tension (ϕ=0.7)	Comp. (ϕ=1)	Tension (ϕ=1)			
Bent 2	12-inch square precast concrete pile (Class 90)	163.8	1610	1	124	-	112	-	132 (a-I) 140(a-II) 143 (c) 143 (d)	132	180
Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (c) Settlement, and (d) Lateral Load. The specified tip elevation shall not be raised above the design tip elevations for lateral, and tolerable settlement.											

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Douglass Abutment 1/ Existing 10-inch Square Concrete Pile

DESIGNER : AB

DATE : 05/04/2009

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 40.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.69 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 48.00 FT.
MODULUS OF ELASTICITY = 0.380E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 19.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	120.00	0.00	0.00
15.00	CLAY	0.00	120.00	0.00	0.00
15.00	SAND	1.00	110.00	33.00	8.00
55.00	SAND	1.00	110.00	33.00	8.00
55.00	SAND	1.00	47.60	32.00	8.00
75.00	SAND	1.00	47.60	32.00	8.00
75.00	CLAY	0.00	47.60	0.00	0.00
96.50	CLAY	0.00	47.60	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	1.30	0.00	0.00	0.00	0.00
9999.00	99999.00	1.30	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00

****
* COMPUTATION RESULT *
****

PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
1.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
2.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
3.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
4.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
5.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
6.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
7.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
8.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
9.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
10.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
11.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
12.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
13.0	0.0	9.7	9.7	0.0	10.4	10.4	0.0	8.2	8.2
14.0	0.0	22.2	22.2	0.0	29.4	29.4	0.0	9.3	9.3
15.0	0.0	34.7	34.7	0.0	48.4	48.4	0.0	10.6	10.6
16.0	0.0	34.7	34.7	0.0	48.4	48.4	0.0	11.3	11.3
17.0	0.0	34.7	34.7	0.0	48.4	48.4	0.0	11.9	11.9
18.0	0.0	34.7	34.7	3.9	48.4	52.3	0.0	12.5	12.5
19.0	1.9	34.7	36.7	7.8	48.4	56.2	0.0	13.1	13.1
20.0	5.9	34.7	40.6	11.6	48.4	60.0	13.8	13.7	27.5
21.0	10.1	34.7	44.8	15.5	48.4	63.9	15.3	14.3	29.6
22.0	14.5	34.7	49.2	19.4	48.4	67.8	17.8	14.9	32.7
23.0	19.0	34.7	53.7	23.3	48.4	71.7	20.6	15.5	36.2
24.0	23.8	34.7	58.5	27.1	48.4	75.6	23.6	16.1	39.7
25.0	28.7	34.7	63.4	31.0	48.4	79.4	26.6	16.8	43.4
26.0	33.8	34.7	68.5	34.9	48.4	83.3	29.8	17.4	47.2
27.0	39.1	34.7	73.9	38.8	48.4	87.2	33.1	18.0	51.1
28.0	44.6	34.7	79.4	42.7	48.4	91.1	36.5	18.6	55.1
29.0	50.3	34.7	85.1	46.5	48.4	94.9	40.0	19.2	59.2
30.0	56.2	34.7	91.0	50.4	48.4	98.8	43.6	19.8	63.5
31.0	62.3	34.7	97.0	54.3	48.4	102.7	47.4	20.4	67.8
32.0	68.6	34.7	103.3	58.2	48.4	106.6	51.3	21.0	72.3
33.0	75.0	34.7	109.8	62.1	48.4	110.5	55.3	21.6	76.9
34.0	81.7	34.7	116.4	65.9	48.4	114.3	59.4	22.3	81.7
35.0	88.5	34.7	123.3	69.8	48.4	118.2	63.6	22.9	86.5
36.0	95.6	34.7	130.3	73.7	48.4	122.1	68.0	23.5	91.5
37.0	102.8	34.7	137.5	77.6	48.4	126.0	72.4	24.1	96.5
38.0	110.2	34.7	144.9	81.4	48.4	129.9	77.0	24.7	101.7

39.0	117.8	34.7	152.5	85.3	48.4	133.7	81.7	25.3	107.0
40.0	125.6	34.7	160.3	89.2	48.4	137.6	86.6	25.9	112.5
41.0	133.6	34.7	168.3	93.1	48.4	141.5	91.5	26.5	118.0
42.0	141.8	34.7	176.5	97.0	48.4	145.4	96.6	27.1	123.7
43.0	150.2	34.7	184.9	100.8	48.4	149.2	101.7	27.8	129.5
44.0	158.7	34.7	193.4	104.7	48.4	153.1	107.0	28.4	135.4
45.0	167.5	34.7	202.2	108.6	48.4	157.0	112.4	29.0	141.4
46.0	176.4	34.7	211.1	112.5	48.4	160.9	118.0	29.6	147.6
47.0	185.5	34.7	220.3	116.3	48.4	164.8	123.6	30.2	153.8
48.0	194.9	34.7	229.6	120.2	48.4	168.6	129.4	30.8	160.2

****
* API RP-2A (1994) *
****

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	8.1	8.1
1.00	0.0	8.1	8.1
2.00	0.0	8.1	8.1
3.00	0.0	8.1	8.1
4.00	0.0	8.1	8.1
5.00	0.0	8.1	8.1
6.00	0.0	8.1	8.1
7.00	0.0	8.1	8.1
8.00	0.0	8.1	8.1
9.00	0.0	8.1	8.1
10.00	0.0	8.1	8.1
11.00	0.0	8.1	8.1
12.00	0.0	8.1	8.1
13.00	0.0	8.2	8.2
14.00	0.0	9.3	9.3
15.00	0.0	10.6	10.6
16.00	0.0	11.3	11.3
17.00	0.0	11.9	11.9
18.00	0.0	12.5	12.5
19.00	2.0	13.1	15.1
20.00	6.1	13.7	19.8
21.00	10.3	14.3	24.6
22.00	14.8	14.9	29.7
23.00	19.4	15.5	35.0
24.00	24.3	16.1	40.4
25.00	29.3	16.8	46.1
26.00	34.6	17.4	51.9
27.00	40.0	18.0	58.0
28.00	45.6	18.6	64.2
29.00	51.4	19.2	70.6
30.00	57.5	19.8	77.3
31.00	63.7	20.4	84.1
32.00	69.9	21.0	91.0
33.00	76.2	21.6	97.8
34.00	82.5	22.3	104.7
35.00	88.7	22.9	111.6
36.00	95.0	23.5	118.5
37.00	101.3	24.1	125.4
38.00	107.5	24.7	132.2
39.00	113.8	25.3	139.1
40.00	120.1	25.9	146.0
41.00	126.3	26.5	152.9
42.00	132.6	27.1	159.7
43.00	138.9	27.8	166.6
44.00	145.1	28.4	173.5
45.00	151.4	29.0	180.4
46.00	157.7	29.6	187.3
47.00	163.9	30.2	194.1
48.00	170.2	30.8	201.0

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2037E-01
			0.0000E+00	0.3947E-01
			0.0000E+00	0.7257E-01
			0.0000E+00	0.1019E+00
			0.0000E+00	0.1273E+00
			0.0000E+00	0.2546E+00
			0.0000E+00	0.3820E+00
			0.0000E+00	0.6366E+00
			0.0000E+00	0.2546E+01
2	10	0.7525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2037E-01
			0.0000E+00	0.3947E-01
			0.0000E+00	0.7257E-01
			0.0000E+00	0.1019E+00
			0.0000E+00	0.1273E+00
			0.0000E+00	0.2546E+00
			0.0000E+00	0.3820E+00
			0.0000E+00	0.6366E+00
			0.0000E+00	0.2546E+01
3	10	0.1496E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2037E-01
			0.0000E+00	0.3947E-01
			0.0000E+00	0.7257E-01
			0.0000E+00	0.1019E+00
			0.0000E+00	0.1273E+00
			0.0000E+00	0.2546E+00
			0.0000E+00	0.3820E+00
			0.0000E+00	0.6366E+00
			0.0000E+00	0.2546E+01
4	10	0.1500E+02		

		0.0000E+00	0.0000E+00	
		0.0000E+00	0.1000E-01	
		0.0000E+00	0.2000E-01	
		0.0000E+00	0.4000E-01	
		0.0000E+00	0.6000E-01	
		0.0000E+00	0.8000E-01	
		0.0000E+00	0.9000E-01	
		0.0000E+00	0.1000E+00	
		0.0000E+00	0.5000E+00	
		0.0000E+00	0.2000E+01	
5	10	0.3502E+02		
		0.0000E+00	0.0000E+00	
		0.1306E+01	0.1000E-01	
		0.2611E+01	0.2000E-01	
		0.5222E+01	0.4000E-01	
		0.7833E+01	0.6000E-01	
		0.1044E+02	0.8000E-01	
		0.1175E+02	0.9000E-01	
		0.1306E+02	0.1000E+00	
		0.1306E+02	0.5000E+00	
		0.1306E+02	0.2000E+01	
6	10	0.5496E+02		
		0.0000E+00	0.0000E+00	
		0.1306E+01	0.1000E-01	
		0.2611E+01	0.2000E-01	
		0.5222E+01	0.4000E-01	
		0.7833E+01	0.6000E-01	
		0.1044E+02	0.8000E-01	
		0.1175E+02	0.9000E-01	
		0.1306E+02	0.1000E+00	
		0.1306E+02	0.5000E+00	
		0.1306E+02	0.2000E+01	
7	10	0.5500E+02		
		0.0000E+00	0.0000E+00	
		0.1306E+01	0.1000E-01	
		0.2611E+01	0.2000E-01	
		0.5222E+01	0.4000E-01	
		0.7833E+01	0.6000E-01	
		0.1044E+02	0.8000E-01	
		0.1175E+02	0.9000E-01	
		0.1306E+02	0.1000E+00	
		0.1306E+02	0.5000E+00	
		0.1306E+02	0.2000E+01	
8	10	0.6503E+02		
		0.0000E+00	0.0000E+00	
		0.1306E+01	0.1000E-01	
		0.2611E+01	0.2000E-01	
		0.5222E+01	0.4000E-01	
		0.7833E+01	0.6000E-01	
		0.1044E+02	0.8000E-01	
		0.1175E+02	0.9000E-01	
		0.1306E+02	0.1000E+00	
		0.1306E+02	0.5000E+00	
		0.1306E+02	0.2000E+01	
9	10	0.7496E+02		
		0.0000E+00	0.0000E+00	
		0.1306E+01	0.1000E-01	
		0.2611E+01	0.2000E-01	
		0.5222E+01	0.4000E-01	
		0.7833E+01	0.6000E-01	

			0.1044E+02	0.8000E-01
			0.1175E+02	0.9000E-01
			0.1306E+02	0.1000E+00
			0.1306E+02	0.5000E+00
			0.1306E+02	0.2000E+01
10	10	0.7500E+02		
			0.0000E+00	0.0000E+00
			0.3917E+01	0.2037E-01
			0.6528E+01	0.3947E-01
			0.9792E+01	0.7257E-01
			0.1175E+02	0.1019E+00
			0.1306E+02	0.1273E+00
			0.1175E+02	0.2546E+00
			0.1175E+02	0.3820E+00
			0.1175E+02	0.6366E+00
			0.1175E+02	0.2546E+01
11	10	0.8578E+02		
			0.0000E+00	0.0000E+00
			0.3917E+01	0.2037E-01
			0.6528E+01	0.3947E-01
			0.9792E+01	0.7257E-01
			0.1175E+02	0.1019E+00
			0.1306E+02	0.1273E+00
			0.1175E+02	0.2546E+00
			0.1175E+02	0.3820E+00
			0.1175E+02	0.6366E+00
			0.1175E+02	0.2546E+01
12	10	0.9646E+02		
			0.0000E+00	0.0000E+00
			0.3917E+01	0.2037E-01
			0.6528E+01	0.3947E-01
			0.9792E+01	0.7257E-01
			0.1175E+02	0.1019E+00
			0.1306E+02	0.1273E+00
			0.1175E+02	0.2546E+00
			0.1175E+02	0.3820E+00
			0.1175E+02	0.6366E+00
			0.1175E+02	0.2546E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1926E+01	0.6366E-02
0.3852E+01	0.1273E-01
0.7704E+01	0.2546E-01
0.1541E+02	0.1655E+00
0.2311E+02	0.5348E+00
0.2773E+02	0.9295E+00
0.3082E+02	0.1273E+01
0.3082E+02	0.1910E+01
0.3082E+02	0.2546E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.2211E+00	0.3510E-03	0.3025E-01	0.1000E-03
0.2211E+01	0.3510E-02	0.3025E+00	0.1000E-02
0.1113E+02	0.1761E-01	0.1513E+01	0.5000E-02
0.2235E+02	0.3533E-01	0.3025E+01	0.1000E-01
0.1019E+03	0.1640E+00	0.9053E+01	0.5000E-01
0.1559E+03	0.2806E+00	0.1180E+02	0.1000E+00
0.1664E+03	0.6967E+00	0.2239E+02	0.5000E+00
0.1724E+03	0.1206E+01	0.2837E+02	0.1000E+01
0.1749E+03	0.2209E+01	0.3082E+02	0.2000E+01

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Douglass Bent 2/Existing 10-inch Square Concrete Pile

DESIGNER : AB

DATE : 05/04/2009

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 40.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.69 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 40.00 FT.
MODULUS OF ELASTICITY = 0.380E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 9.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

SOIL DEPTH FT.	EARTH TYPE	LATERAL PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	1.00	110.00	33.00	8.00
40.00	SAND	1.00	110.00	33.00	8.00
40.00	SAND	1.00	47.60	32.00	8.00
60.00	SAND	1.00	47.60	32.00	8.00
60.00	CLAY	0.00	47.60	0.00	0.00
81.50	CLAY	0.00	47.60	0.00	0.00

UNIT FRICTION KSF	UNIT BEARING KSF	MAXIMUM SHEAR STRENGTH KSF	MAXIMUM SHEAR STRENGTH KSF	UNDISTURB BLOW COUNT	REMOLDED UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00

****
* COMPUTATION RESULT *
****

PILE PENETR- ATION FT.	FED. HWY. METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP	ARMY CORPS METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP	LAMBDA 2 METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP
0.0	0.0	2.5	2.5	0.0	3.0	3.0	0.0	0.6	0.6
1.0	0.0	4.8	4.8	0.0	5.7	5.7	0.0	1.3	1.3
2.0	0.0	7.1	7.1	0.0	8.5	8.5	0.0	1.9	1.9
3.0	0.0	9.5	9.5	0.0	11.3	11.3	0.0	2.5	2.5
4.0	0.0	11.8	11.8	0.0	14.1	14.1	0.0	3.1	3.1
5.0	0.0	14.1	14.1	0.0	16.9	16.9	0.0	3.7	3.7
6.0	0.0	16.4	16.4	0.0	19.7	19.7	0.0	4.3	4.3
7.0	0.0	18.8	18.8	0.0	22.5	22.5	0.0	4.9	4.9
8.0	0.0	21.1	21.1	0.0	25.3	25.3	0.0	5.5	5.5
9.0	0.9	23.4	24.3	1.0	28.0	29.0	0.0	6.1	6.1
10.0	2.7	25.7	28.4	3.1	30.0	33.1	4.1	6.8	10.8
11.0	4.7	28.1	32.7	5.8	30.7	36.5	5.2	7.4	12.6
12.0	6.9	30.4	37.3	8.5	30.7	39.2	6.4	8.0	14.4
13.0	9.3	32.7	41.9	11.2	30.7	41.8	7.7	8.6	16.3
14.0	11.8	34.2	46.0	13.8	30.7	44.5	9.1	9.2	18.3
15.0	14.6	34.7	49.3	16.5	30.7	47.2	11.6	9.8	21.4
16.0	17.6	34.7	52.3	19.2	30.7	49.9	12.8	10.4	23.3
17.0	20.7	34.7	55.4	21.9	30.7	52.6	14.4	11.0	25.4
18.0	24.0	34.7	58.8	24.6	30.7	55.2	16.4	11.6	28.1
19.0	27.6	34.7	62.3	27.3	30.7	57.9	18.6	12.3	30.9
20.0	31.3	34.7	66.0	29.9	30.7	60.6	20.9	12.9	33.8
21.0	35.2	34.7	69.9	32.6	30.7	63.3	23.3	13.5	36.8
22.0	39.3	34.7	74.0	35.3	30.7	66.0	25.9	14.1	39.9
23.0	43.6	34.7	78.3	38.0	30.7	68.6	28.5	14.7	43.2
24.0	48.1	34.7	82.8	40.7	30.7	71.3	31.3	15.3	46.6
25.0	52.8	34.7	87.5	43.3	30.7	74.0	34.2	15.9	50.1
26.0	57.6	34.7	92.3	46.0	30.7	76.7	37.2	16.5	53.7
27.0	62.7	34.7	97.4	48.7	30.7	79.4	40.3	17.1	57.5
28.0	67.9	34.7	102.7	51.4	30.7	82.0	43.6	17.8	61.3
29.0	73.4	34.7	108.1	54.1	30.7	84.7	46.9	18.4	65.3
30.0	79.0	34.7	113.7	56.7	30.7	87.4	50.4	19.0	69.4
31.0	84.8	34.7	119.5	59.4	30.7	90.1	54.0	19.6	73.6
32.0	90.8	34.7	125.5	62.1	30.7	92.8	57.7	20.2	77.9
33.0	97.0	34.7	131.8	64.8	30.7	95.4	61.6	20.8	82.4
34.0	103.4	34.7	138.1	67.5	30.7	98.1	65.5	21.4	86.9
35.0	110.0	34.7	144.7	70.1	30.7	100.8	69.6	22.0	91.6
36.0	116.8	34.7	151.5	72.8	30.7	103.5	73.8	22.6	96.4
37.0	123.7	34.7	158.5	75.5	30.7	106.2	78.1	23.3	101.3
38.0	130.9	34.0	164.9	78.2	30.4	108.5	82.5	23.9	106.4
39.0	138.2	28.5	166.7	80.9	27.8	108.6	87.0	24.4	111.4
40.0	145.8	22.9	168.7	83.5	25.2	108.8	91.7	24.7	116.4

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*  API RP-2A (1994)  *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.6	0.6
1.00	0.0	1.3	1.3
2.00	0.0	1.9	1.9
3.00	0.0	2.5	2.5
4.00	0.0	3.1	3.1
5.00	0.0	3.7	3.7
6.00	0.0	4.3	4.3
7.00	0.0	4.9	4.9
8.00	0.0	5.5	5.5
9.00	0.9	6.1	7.0
10.00	2.7	6.8	9.5
11.00	4.8	7.4	12.1
12.00	7.0	8.0	15.0
13.00	9.5	8.6	18.0
14.00	12.1	9.2	21.3
15.00	14.9	9.8	24.7
16.00	17.9	10.4	28.4
17.00	21.2	11.0	32.2
18.00	24.6	11.6	36.2
19.00	28.2	12.3	40.4
20.00	32.0	12.9	44.8
21.00	36.0	13.5	49.5
22.00	40.2	14.1	54.3
23.00	44.5	14.7	59.3
24.00	49.1	15.3	64.4
25.00	53.9	15.9	69.8
26.00	58.9	16.5	75.4
27.00	64.0	17.1	81.2
28.00	69.4	17.8	87.2
29.00	75.0	18.4	93.3
30.00	80.7	19.0	99.7
31.00	86.7	19.6	106.3
32.00	92.8	20.2	113.0
33.00	99.1	20.8	119.9
34.00	105.3	21.4	126.8
35.00	111.6	22.0	133.6
36.00	117.9	22.6	140.5
37.00	124.1	23.3	147.4
38.00	130.4	23.9	154.3
39.00	136.7	24.4	161.0
40.00	142.8	24.7	167.6

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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**************************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
		0.0000E+00	0.0000E+00	
		0.0000E+00	0.1000E-01	
		0.0000E+00	0.2000E-01	
		0.0000E+00	0.4000E-01	
		0.0000E+00	0.6000E-01	
		0.0000E+00	0.8000E-01	
		0.0000E+00	0.9000E-01	
		0.0000E+00	0.1000E+00	
		0.0000E+00	0.5000E+00	
		0.0000E+00	0.2000E+01	
2	10	0.2002E+02		
		0.0000E+00	0.0000E+00	
		0.8326E+00	0.1000E-01	
		0.1665E+01	0.2000E-01	
		0.3331E+01	0.4000E-01	
		0.4996E+01	0.6000E-01	
		0.6661E+01	0.8000E-01	
		0.7494E+01	0.9000E-01	
		0.8326E+01	0.1000E+00	
		0.8326E+01	0.5000E+00	
		0.8326E+01	0.2000E+01	
3	10	0.3996E+02		
		0.0000E+00	0.0000E+00	
		0.1285E+01	0.1000E-01	
		0.2569E+01	0.2000E-01	
		0.5139E+01	0.4000E-01	
		0.7708E+01	0.6000E-01	
		0.1028E+02	0.8000E-01	
		0.1156E+02	0.9000E-01	
		0.1285E+02	0.1000E+00	
		0.1285E+02	0.5000E+00	
		0.1285E+02	0.2000E+01	
4	10	0.4000E+02		
		0.0000E+00	0.0000E+00	
		0.1285E+01	0.1000E-01	
		0.2569E+01	0.2000E-01	
		0.5139E+01	0.4000E-01	
		0.7708E+01	0.6000E-01	
		0.1028E+02	0.8000E-01	
		0.1156E+02	0.9000E-01	
		0.1285E+02	0.1000E+00	
		0.1285E+02	0.5000E+00	
		0.1285E+02	0.2000E+01	
5	10	0.5002E+02		
		0.0000E+00	0.0000E+00	
		0.1285E+01	0.1000E-01	
		0.2569E+01	0.2000E-01	
		0.5139E+01	0.4000E-01	
		0.7708E+01	0.6000E-01	
		0.1028E+02	0.8000E-01	
		0.1156E+02	0.9000E-01	
		0.1285E+02	0.1000E+00	
		0.1285E+02	0.5000E+00	

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 0.1285E+02      0.2000E+01
6         10      0.5996E+02
 0.0000E+00      0.0000E+00
 0.1285E+01      0.1000E-01
 0.2569E+01      0.2000E-01
 0.5139E+01      0.4000E-01
 0.7708E+01      0.6000E-01
 0.1028E+02      0.8000E-01
 0.1156E+02      0.9000E-01
 0.1285E+02      0.1000E+00
 0.1285E+02      0.5000E+00
 0.1285E+02      0.2000E+01
7         10      0.6000E+02
 0.0000E+00      0.0000E+00
 0.3854E+01      0.2037E-01
 0.6424E+01      0.3947E-01
 0.9635E+01      0.7257E-01
 0.1156E+02      0.1019E+00
 0.1285E+02      0.1273E+00
 0.1156E+02      0.2546E+00
 0.1156E+02      0.3820E+00
 0.1156E+02      0.6366E+00
 0.1156E+02      0.2546E+01
8         10      0.7078E+02
 0.0000E+00      0.0000E+00
 0.3854E+01      0.2037E-01
 0.6424E+01      0.3947E-01
 0.9635E+01      0.7257E-01
 0.1156E+02      0.1019E+00
 0.1285E+02      0.1273E+00
 0.1156E+02      0.2546E+00
 0.1156E+02      0.3820E+00
 0.1156E+02      0.6366E+00
 0.1156E+02      0.2546E+01
9         10      0.8146E+02
 0.0000E+00      0.0000E+00
 0.3854E+01      0.2037E-01
 0.6424E+01      0.3947E-01
 0.9635E+01      0.7257E-01
 0.1156E+02      0.1019E+00
 0.1285E+02      0.1273E+00
 0.1156E+02      0.2546E+00
 0.1156E+02      0.3820E+00
 0.1156E+02      0.6366E+00
 0.1156E+02      0.2546E+01
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TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1545E+01	0.6366E-02
0.3091E+01	0.1273E-01
0.6181E+01	0.2546E-01
0.1236E+02	0.1655E+00
0.1854E+02	0.5348E+00
0.2225E+02	0.9295E+00
0.2473E+02	0.1273E+01
0.2473E+02	0.1910E+01
0.2473E+02	0.2546E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.2177E+00	0.2732E-03	0.2427E-01	0.1000E-03
0.2177E+01	0.2732E-02	0.2427E+00	0.1000E-02
0.1095E+02	0.1369E-01	0.1214E+01	0.5000E-02
0.2199E+02	0.2745E-01	0.2427E+01	0.1000E-01
0.1010E+03	0.1291E+00	0.7264E+01	0.5000E-01
0.1510E+03	0.2274E+00	0.9471E+01	0.1000E+00
0.1595E+03	0.6381E+00	0.1796E+02	0.5000E+00
0.1643E+03	0.1144E+01	0.2276E+02	0.1000E+01
0.1663E+03	0.2147E+01	0.2473E+02	0.2000E+01

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Douglass Abutment 3/Existing HP 10*42 Pile

DESIGNER : AB

DATE : 05/05/2009

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 36.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.56 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 60.00 FT.
MODULUS OF ELASTICITY = 0.300E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 19.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	120.00	0.00	0.00
15.00	CLAY	0.00	120.00	0.00	0.00
15.00	SAND	1.00	110.00	33.00	8.00
55.00	SAND	1.00	110.00	33.00	8.00
55.00	SAND	1.00	47.60	32.00	8.00
75.00	SAND	1.00	47.60	32.00	8.00
75.00	CLAY	0.00	47.60	0.00	0.00
96.50	CLAY	0.00	47.60	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	1.30	0.00	0.00	0.00	0.00
9999.00	99999.00	1.30	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00

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* COMPUTATION RESULT *
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PILE PENETR-ATION FT.	FED. HWY. METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	ARMY CORPS METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	LAMBDA 2 METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
0.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
1.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
2.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
3.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
4.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
5.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
6.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
7.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
8.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
9.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
10.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
11.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
12.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
13.0	0.0	6.5	6.5	0.0	6.5	6.5	0.0	6.5	6.5
14.0	0.0	16.6	16.6	0.0	20.0	20.0	0.0	7.3	7.3
15.0	0.0	27.8	27.8	0.0	34.9	34.9	0.0	8.5	8.5
16.0	0.0	27.8	27.8	0.0	34.9	34.9	0.0	9.0	9.0
17.0	0.0	27.8	27.8	0.0	34.9	34.9	0.0	9.4	9.4
18.0	0.0	27.8	27.8	2.8	34.9	37.7	0.0	9.9	9.9
19.0	1.2	27.8	29.0	5.7	34.9	40.5	0.0	10.4	10.4
20.0	3.7	27.8	31.5	8.5	34.9	43.4	14.9	10.9	25.8
21.0	6.4	27.8	34.2	11.4	34.9	46.2	16.8	11.4	28.2
22.0	9.1	27.8	36.9	14.2	34.9	49.1	18.9	11.9	30.8
23.0	12.0	27.8	39.8	17.1	34.9	51.9	21.2	12.4	33.5
24.0	15.0	27.8	42.8	19.9	34.9	54.8	23.5	12.9	36.3
25.0	18.1	27.8	45.9	22.7	34.9	57.6	25.8	13.4	39.2
26.0	21.4	27.8	49.2	25.6	34.9	60.4	28.3	13.8	42.1
27.0	24.7	27.8	52.5	28.4	34.9	63.3	30.7	14.3	45.1
28.0	28.2	27.8	56.0	31.3	34.9	66.1	33.2	14.8	48.1
29.0	31.8	27.8	59.6	34.1	34.9	69.0	36.0	15.3	51.3
30.0	35.6	27.8	63.3	37.0	34.9	71.8	39.3	15.8	55.1
31.0	39.4	27.8	67.2	39.8	34.9	74.7	44.2	16.3	60.5
32.0	43.4	27.8	71.1	42.7	34.9	77.5	46.4	16.8	63.2
33.0	47.4	27.8	75.2	45.5	34.9	80.4	49.7	17.3	67.0
34.0	51.7	27.8	79.4	48.3	34.9	83.2	53.5	17.8	71.2
35.0	56.0	27.8	83.8	51.2	34.9	86.0	57.3	18.2	75.5
36.0	60.4	27.8	88.2	54.0	34.9	88.9	61.2	18.7	79.9
37.0	65.0	27.8	92.8	56.9	34.9	91.7	65.2	19.2	84.4
38.0	69.7	27.8	97.5	59.7	34.9	94.6	69.3	19.7	89.0

39.0	74.5	27.8	102.3	62.6	34.9	97.4	73.6	20.2	93.8
40.0	79.4	27.8	107.2	65.4	34.9	100.3	77.9	20.7	98.6
41.0	84.5	27.8	112.3	68.2	34.9	103.1	82.3	21.2	103.5
42.0	89.6	27.8	117.4	71.1	34.9	105.9	86.9	21.7	108.6
43.0	94.9	27.8	122.7	73.9	34.9	108.8	91.6	22.2	113.7
44.0	100.4	27.8	128.1	76.8	34.9	111.6	96.3	22.6	119.0
45.0	105.9	27.8	133.7	79.6	34.9	114.5	101.2	23.1	124.3
46.0	111.5	27.8	139.3	82.5	34.9	117.3	106.2	23.6	129.8
47.0	117.3	27.8	145.1	85.3	34.9	120.2	111.3	24.1	135.4
48.0	123.2	27.8	151.0	88.2	34.9	123.0	116.4	24.6	141.0
49.0	129.2	27.8	157.0	91.0	34.9	125.9	121.7	25.1	146.8
50.0	135.4	27.8	163.1	93.8	34.9	128.7	127.1	25.6	152.7
51.0	141.6	27.8	169.4	96.7	34.9	131.5	132.6	26.1	158.7
52.0	148.0	27.8	175.8	99.5	34.9	134.4	138.3	26.6	164.8
53.0	154.5	27.8	182.3	102.4	34.9	137.2	144.0	27.0	171.0
54.0	161.1	23.3	184.4	105.2	31.9	137.1	149.8	27.5	177.3
55.0	167.9	18.3	186.2	108.1	28.6	136.7	155.7	27.8	183.5
56.0	174.4	18.3	192.7	110.9	28.6	139.6	161.6	28.0	189.6
57.0	180.8	18.3	199.1	113.7	28.6	142.4	167.5	28.2	195.7
58.0	187.2	18.3	205.5	116.6	28.6	145.2	173.5	28.4	201.9
59.0	193.6	18.3	211.9	119.4	28.6	148.1	179.5	28.6	208.1
60.0	200.1	18.3	218.4	122.3	28.6	150.9	185.6	28.8	214.4

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*********************
*  API RP-2A (1994)  *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	6.5	6.5
1.00	0.0	6.5	6.5
2.00	0.0	6.5	6.5
3.00	0.0	6.5	6.5
4.00	0.0	6.5	6.5
5.00	0.0	6.5	6.5
6.00	0.0	6.5	6.5
7.00	0.0	6.5	6.5
8.00	0.0	6.5	6.5
9.00	0.0	6.5	6.5
10.00	0.0	6.5	6.5
11.00	0.0	6.5	6.5
12.00	0.0	6.5	6.5
13.00	0.0	6.5	6.5
14.00	0.0	7.3	7.3
15.00	0.0	8.5	8.5
16.00	0.0	9.0	9.0
17.00	0.0	9.4	9.4
18.00	0.0	9.9	9.9
19.00	1.8	10.4	12.2
20.00	5.4	10.9	16.4
21.00	9.3	11.4	20.7
22.00	13.3	11.9	25.2
23.00	17.5	12.4	29.9
24.00	21.8	12.9	34.7
25.00	26.4	13.4	39.7
26.00	31.1	13.8	44.9
27.00	36.0	14.3	50.3
28.00	41.1	14.8	55.9
29.00	46.3	15.3	61.6
30.00	51.7	15.8	67.5
31.00	57.3	16.3	73.6
32.00	62.9	16.8	79.7
33.00	68.6	17.3	85.8
34.00	74.2	17.8	92.0
35.00	79.9	18.2	98.1
36.00	85.5	18.7	104.2
37.00	91.1	19.2	110.4
38.00	96.8	19.7	116.5
39.00	102.4	20.2	122.6
40.00	108.1	20.7	128.7
41.00	113.7	21.2	134.9
42.00	119.3	21.7	141.0
43.00	125.0	22.2	147.1
44.00	130.6	22.6	153.3
45.00	136.3	23.1	159.4
46.00	141.9	23.6	165.5
47.00	147.5	24.1	171.6
48.00	153.2	24.6	177.8
49.00	158.8	25.1	183.9
50.00	164.5	25.6	190.0
51.00	170.1	26.1	196.2
52.00	175.7	26.6	202.3
53.00	181.4	27.0	208.4
54.00	187.0	27.5	214.5
55.00	192.6	27.8	220.3
56.00	198.0	28.0	226.0
57.00	203.5	28.2	231.7
58.00	208.9	28.4	237.3
59.00	214.4	28.6	243.0
60.00	219.9	28.8	248.7

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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************************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1833E-01
			0.0000E+00	0.3552E-01
			0.0000E+00	0.6532E-01
			0.0000E+00	0.9167E-01
			0.0000E+00	0.1146E+00
			0.0000E+00	0.2292E+00
			0.0000E+00	0.3438E+00
			0.0000E+00	0.5730E+00

			0.0000E+00	0.2292E+01				0.5056E+01	0.4000E-01
2	10	0.7525E+01						0.7583E+01	0.6000E-01
			0.0000E+00	0.0000E+00				0.1011E+02	0.8000E-01
			0.0000E+00	0.1833E-01				0.1137E+02	0.9000E-01
			0.0000E+00	0.3552E-01				0.1264E+02	0.1000E+00
			0.0000E+00	0.6532E-01				0.1264E+02	0.5000E+00
			0.0000E+00	0.9167E-01				0.1264E+02	0.2000E+01
			0.0000E+00	0.1146E+00	8	10	0.6503E+02		
			0.0000E+00	0.2292E+00				0.0000E+00	0.0000E+00
			0.0000E+00	0.3438E+00				0.1264E+01	0.1000E-01
			0.0000E+00	0.5730E+00				0.2528E+01	0.2000E-01
			0.0000E+00	0.2292E+01				0.5056E+01	0.4000E-01
3	10	0.1496E+02						0.7583E+01	0.6000E-01
			0.0000E+00	0.0000E+00				0.1011E+02	0.8000E-01
			0.0000E+00	0.1833E-01				0.1137E+02	0.9000E-01
			0.0000E+00	0.3552E-01				0.1264E+02	0.1000E+00
			0.0000E+00	0.6532E-01				0.1264E+02	0.5000E+00
			0.0000E+00	0.9167E-01				0.1264E+02	0.2000E+01
			0.0000E+00	0.1146E+00	9	10	0.7496E+02		
			0.0000E+00	0.2292E+00				0.0000E+00	0.0000E+00
			0.0000E+00	0.3438E+00				0.1264E+01	0.1000E-01
			0.0000E+00	0.5730E+00				0.2528E+01	0.2000E-01
			0.0000E+00	0.2292E+01				0.5056E+01	0.4000E-01
4	10	0.1500E+02						0.7583E+01	0.6000E-01
			0.0000E+00	0.0000E+00				0.1011E+02	0.8000E-01
			0.0000E+00	0.1000E-01				0.1137E+02	0.9000E-01
			0.0000E+00	0.2000E-01				0.1264E+02	0.1000E+00
			0.0000E+00	0.4000E-01				0.1264E+02	0.5000E+00
			0.0000E+00	0.6000E-01				0.1264E+02	0.2000E+01
			0.0000E+00	0.8000E-01	10	10	0.7500E+02		
			0.0000E+00	0.9000E-01				0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E+00				0.3792E+01	0.1833E-01
			0.0000E+00	0.5000E+00				0.6319E+01	0.3552E-01
			0.0000E+00	0.2000E+01				0.9479E+01	0.6532E-01
5	10	0.3502E+02						0.1137E+02	0.9167E-01
			0.0000E+00	0.0000E+00				0.1264E+02	0.1146E+00
			0.1306E+01	0.1000E-01				0.1137E+02	0.2292E+00
			0.2611E+01	0.2000E-01				0.1137E+02	0.3438E+00
			0.5222E+01	0.4000E-01				0.1137E+02	0.5730E+00
			0.7833E+01	0.6000E-01				0.1137E+02	0.2292E+01
			0.1044E+02	0.8000E-01	11	10	0.8578E+02		
			0.1175E+02	0.9000E-01				0.0000E+00	0.0000E+00
			0.1306E+02	0.1000E+00				0.3792E+01	0.1833E-01
			0.1306E+02	0.5000E+00				0.6319E+01	0.3552E-01
			0.1306E+02	0.2000E+01				0.9479E+01	0.6532E-01
6	10	0.5496E+02						0.1137E+02	0.9167E-01
			0.0000E+00	0.0000E+00				0.1264E+02	0.1146E+00
			0.1285E+01	0.1000E-01				0.1137E+02	0.2292E+00
			0.2569E+01	0.2000E-01				0.1137E+02	0.3438E+00
			0.5139E+01	0.4000E-01				0.1137E+02	0.5730E+00
			0.7708E+01	0.6000E-01				0.1137E+02	0.2292E+01
			0.1028E+02	0.8000E-01	12	10	0.9646E+02		
			0.1156E+02	0.9000E-01				0.0000E+00	0.0000E+00
			0.1285E+02	0.1000E+00				0.3792E+01	0.1833E-01
			0.1285E+02	0.5000E+00				0.6319E+01	0.3552E-01
			0.1285E+02	0.2000E+01				0.9479E+01	0.6532E-01
7	10	0.5500E+02						0.1137E+02	0.9167E-01
			0.0000E+00	0.0000E+00				0.1264E+02	0.1146E+00
			0.1264E+01	0.1000E-01				0.1137E+02	0.2292E+00
			0.2528E+01	0.2000E-01				0.1137E+02	0.3438E+00

0.1137E+02	0.5730E+00
0.1137E+02	0.2292E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1801E+01	0.5730E-02
0.3602E+01	0.1146E-01
0.7204E+01	0.2292E-01
0.1441E+02	0.1490E+00
0.2161E+02	0.4813E+00
0.2593E+02	0.8365E+00
0.2882E+02	0.1146E+01
0.2882E+02	0.1719E+01
0.2882E+02	0.2292E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.2442E+00	0.1532E-03	0.3143E-01	0.1000E-03
0.2442E+01	0.1532E-02	0.3143E+00	0.1000E-02
0.1221E+02	0.7662E-02	0.1572E+01	0.5000E-02
0.2442E+02	0.1532E-01	0.3143E+01	0.1000E-01
0.1142E+03	0.7436E-01	0.8752E+01	0.5000E-01
0.2072E+03	0.1445E+00	0.1161E+02	0.1000E+00
0.2174E+03	0.5475E+00	0.2184E+02	0.5000E+00
0.2230E+03	0.1049E+01	0.2746E+02	0.1000E+01
0.2244E+03	0.2050E+01	0.2882E+02	0.2000E+01

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AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Douglass Abutment 1/12-inch Square Concrete Pile/Ignore 19 ft of fill

DESIGNER : TK

DATE : 1/12/2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 48.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 1.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 70.00 FT.
MODULUS OF ELASTICITY = 0.380E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 19.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	120.00	0.00	0.00
22.00	CLAY	0.00	120.00	0.00	0.00
22.00	SAND	1.00	110.00	33.00	8.00
59.00	SAND	1.00	110.00	33.00	8.00
59.00	SAND	1.00	47.60	33.00	8.00
62.00	SAND	1.00	47.60	33.00	8.00
62.00	SAND	1.00	47.60	32.00	8.00
82.00	SAND	1.00	47.60	32.00	8.00
82.00	CLAY	0.00	47.60	0.00	0.00
98.00	CLAY	0.00	47.60	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	1.30	0.00	0.00	0.00	0.00
9999.00	99999.00	1.30	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00

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* COMPUTATION RESULT *
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PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
1.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
2.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
3.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
4.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
5.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
6.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
7.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
8.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
9.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
10.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
11.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
12.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
13.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
14.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
15.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
16.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
17.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
18.0	0.0	11.7	11.7	0.0	11.7	11.7	0.0	11.7	11.7
19.0	2.6	11.7	14.3	1.6	11.7	13.3	0.0	11.7	11.7
20.0	7.8	19.9	27.7	4.7	27.1	31.8	16.9	13.8	30.7
21.0	13.0	35.0	48.0	7.8	55.4	63.2	18.6	17.8	36.5
22.0	18.2	50.0	68.2	13.4	83.7	97.0	20.6	22.2	42.9
23.0	24.4	50.0	74.4	19.0	83.7	102.6	24.1	23.1	47.2
24.0	31.7	50.0	81.7	24.6	83.7	108.2	27.7	24.0	51.7
25.0	39.3	50.0	89.3	30.1	83.7	113.8	31.5	24.9	56.3
26.0	47.2	50.0	97.2	35.7	83.7	119.4	35.4	25.8	61.1
27.0	55.4	50.0	105.4	41.3	83.7	125.0	39.4	26.6	66.0
28.0	63.9	50.0	113.9	46.9	83.7	130.5	43.6	27.5	71.1
29.0	72.6	50.0	122.6	52.5	83.7	136.1	47.9	28.4	76.3
30.0	81.7	50.0	131.7	58.1	83.7	141.7	52.4	29.3	81.6
31.0	91.0	50.0	141.0	63.6	83.7	147.3	57.0	30.2	87.1
32.0	100.6	50.0	150.6	69.2	83.7	152.9	61.7	31.0	92.7
33.0	110.5	50.0	160.5	74.8	83.7	158.5	66.6	31.9	98.5
34.0	120.7	50.0	170.7	80.4	83.7	164.1	71.6	32.8	104.4

35.0	131.2	50.0	181.2	86.0	83.7	169.6	76.8	33.7	110.5
36.0	142.0	50.0	192.0	91.6	83.7	175.2	82.1	34.6	116.6
37.0	153.0	50.0	203.0	97.2	83.7	180.8	87.5	35.4	123.0
38.0	164.4	50.0	214.4	102.7	83.7	186.4	93.1	36.3	129.5
39.0	176.0	50.0	226.0	108.3	83.7	192.0	98.9	37.2	136.1
40.0	187.9	50.0	237.9	113.9	83.7	197.6	104.7	38.1	142.8
41.0	200.1	50.0	250.1	119.5	83.7	203.1	110.8	39.0	149.7
42.0	212.6	50.0	262.6	125.1	83.7	208.7	116.9	39.8	156.8
43.0	225.4	50.0	275.4	130.7	83.7	214.3	123.2	40.7	163.9
44.0	238.4	50.0	288.4	136.2	83.7	219.9	129.7	41.6	171.3
45.0	251.8	50.0	301.8	141.8	83.7	225.5	136.3	42.5	178.7
46.0	265.4	50.0	315.4	147.4	83.7	231.1	143.0	43.4	186.3
47.0	279.3	50.0	329.3	153.0	83.7	236.7	149.8	44.2	194.1
48.0	293.5	50.0	343.5	158.6	83.7	242.2	156.9	45.1	202.0
49.0	308.0	50.0	358.0	164.2	83.7	247.8	164.0	46.0	210.0
50.0	322.8	50.0	372.8	169.8	83.7	253.4	171.3	46.9	218.2
51.0	337.9	50.0	387.9	175.3	83.7	259.0	178.7	47.8	226.5
52.0	353.3	50.0	403.3	180.9	83.7	264.6	186.3	48.6	235.0
53.0	368.9	50.0	418.9	186.5	83.7	270.2	194.0	49.5	243.5
54.0	384.8	50.0	434.8	192.1	83.7	275.7	201.9	50.4	252.3
55.0	401.1	50.0	451.1	197.7	83.7	281.3	209.9	51.3	261.2
56.0	417.6	50.0	467.6	203.3	83.7	286.9	218.0	52.2	270.2
57.0	434.4	50.0	484.4	208.9	83.7	292.5	226.3	53.0	279.3
58.0	451.5	50.0	501.5	214.4	83.7	298.1	234.7	53.7	288.4
59.0	468.8	50.0	518.8	220.0	83.7	303.7	243.3	54.2	297.5
60.0	486.4	46.4	532.8	225.6	80.5	306.1	252.0	54.5	306.5
61.0	504.1	39.7	543.8	231.2	74.6	305.8	260.7	54.9	315.6
62.0	521.9	33.0	554.9	236.8	68.8	305.5	269.5	55.3	324.8
63.0	539.0	33.0	572.0	242.4	68.8	311.1	278.2	55.7	333.8
64.0	555.2	33.0	588.2	247.9	68.8	316.7	286.9	56.1	343.0
65.0	571.5	33.0	604.5	253.5	68.8	322.3	295.7	56.4	352.1
66.0	588.0	33.0	621.0	259.1	68.8	327.9	304.5	56.8	361.3
67.0	604.6	33.0	637.6	264.7	68.8	333.5	313.4	57.2	370.6
68.0	621.3	33.0	654.3	270.3	68.8	339.0	322.4	57.6	380.0
69.0	638.0	33.0	671.0	275.9	68.8	344.6	331.4	58.0	389.4
70.0	655.0	33.0	688.0	281.5	68.8	350.2	340.5	58.4	398.8

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* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	11.7	11.7
1.00	0.0	11.7	11.7
2.00	0.0	11.7	11.7
3.00	0.0	11.7	11.7
4.00	0.0	11.7	11.7
5.00	0.0	11.7	11.7
6.00	0.0	11.7	11.7
7.00	0.0	11.7	11.7
8.00	0.0	11.7	11.7
9.00	0.0	11.7	11.7
10.00	0.0	11.7	11.7
11.00	0.0	11.7	11.7
12.00	0.0	11.7	11.7
13.00	0.0	11.7	11.7
14.00	0.0	11.7	11.7
15.00	0.0	11.7	11.7
16.00	0.0	11.7	11.7
17.00	0.0	11.7	11.7
18.00	0.0	11.7	11.7
19.00	1.7	11.7	13.4
20.00	5.2	13.8	19.0
21.00	8.8	17.8	26.6
22.00	12.4	22.2	34.7
23.00	17.2	23.1	40.3
24.00	23.2	24.0	47.2
25.00	29.4	24.9	54.3
26.00	35.8	25.8	61.6
27.00	42.5	26.6	69.1
28.00	49.4	27.5	76.9
29.00	56.5	28.4	84.9
30.00	63.9	29.3	93.2
31.00	71.4	30.2	101.6
32.00	78.9	31.0	110.0
33.00	86.5	31.9	118.4
34.00	94.0	32.8	126.8
35.00	101.5	33.7	135.2
36.00	109.0	34.6	143.6
37.00	116.5	35.4	152.0
38.00	124.1	36.3	160.4
39.00	131.6	37.2	168.8
40.00	139.1	38.1	177.2
41.00	146.6	39.0	185.6
42.00	154.1	39.8	194.0
43.00	161.7	40.7	202.4
44.00	169.2	41.6	210.8
45.00	176.7	42.5	219.2
46.00	184.2	43.4	227.6
47.00	191.7	44.2	236.0
48.00	199.3	45.1	244.4
49.00	206.8	46.0	252.8
50.00	214.3	46.9	261.2
51.00	221.8	47.8	269.6
52.00	229.3	48.6	278.0
53.00	236.9	49.5	286.4
54.00	244.4	50.4	294.8
55.00	251.9	51.3	303.2
56.00	259.4	52.2	311.6
57.00	266.9	53.0	319.9
58.00	274.5	53.7	328.1
59.00	282.0	54.2	336.1
60.00	289.5	54.5	344.0
61.00	297.0	54.9	351.9
62.00	304.4	55.3	359.7
63.00	311.7	55.7	367.4
64.00	319.0	56.1	375.0
65.00	326.3	56.4	382.7
66.00	333.5	56.8	390.4
67.00	340.8	57.2	398.0
68.00	348.1	57.6	405.7
69.00	355.4	58.0	413.4
70.00	362.7	58.4	421.0

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN

IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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**************************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2445E-01
			0.0000E+00	0.4736E-01
			0.0000E+00	0.8709E-01
			0.0000E+00	0.1222E+00
			0.0000E+00	0.1528E+00
			0.0000E+00	0.3056E+00
			0.0000E+00	0.4584E+00
			0.0000E+00	0.7639E+00
			0.0000E+00	0.3056E+01
2	10	0.1103E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2445E-01
			0.0000E+00	0.4736E-01
			0.0000E+00	0.8709E-01
			0.0000E+00	0.1222E+00
			0.0000E+00	0.1528E+00
			0.0000E+00	0.3056E+00
			0.0000E+00	0.4584E+00
			0.0000E+00	0.7639E+00
			0.0000E+00	0.3056E+01
3	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.1908E+01	0.2445E-01
			0.3179E+01	0.4736E-01
			0.4769E+01	0.8709E-01
			0.5723E+01	0.1222E+00
			0.6359E+01	0.1528E+00
			0.5723E+01	0.3056E+00
			0.5723E+01	0.4584E+00
			0.5723E+01	0.7639E+00
			0.5723E+01	0.3056E+01
4	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.8293E+00	0.1000E-01
			0.1659E+01	0.2000E-01
			0.3317E+01	0.4000E-01
			0.4976E+01	0.6000E-01
			0.6635E+01	0.8000E-01
			0.7464E+01	0.9000E-01
			0.8293E+01	0.1000E+00
			0.8293E+01	0.5000E+00
			0.8293E+01	0.2000E+01
5	10	0.4052E+02		
			0.0000E+00	0.0000E+00
			0.1306E+01	0.1000E-01
			0.2611E+01	0.2000E-01
			0.5222E+01	0.4000E-01
			0.7833E+01	0.6000E-01
			0.1044E+02	0.8000E-01
			0.1175E+02	0.9000E-01
			0.1306E+02	0.1000E+00
			0.1306E+02	0.5000E+00
			0.1306E+02	0.2000E+01
6	10	0.5896E+02		
			0.0000E+00	0.0000E+00
			0.1306E+01	0.1000E-01
			0.2611E+01	0.2000E-01
			0.5222E+01	0.4000E-01
			0.7833E+01	0.6000E-01
			0.1044E+02	0.8000E-01
			0.1175E+02	0.9000E-01
			0.1306E+02	0.1000E+00
			0.1306E+02	0.5000E+00
			0.1306E+02	0.2000E+01
7	10	0.5900E+02		
			0.0000E+00	0.0000E+00
			0.1306E+01	0.1000E-01
			0.2611E+01	0.2000E-01
			0.5222E+01	0.4000E-01
			0.7833E+01	0.6000E-01
			0.1044E+02	0.8000E-01
			0.1175E+02	0.9000E-01
			0.1306E+02	0.1000E+00
			0.1306E+02	0.5000E+00
			0.1306E+02	0.2000E+01
8	10	0.6052E+02		
			0.0000E+00	0.0000E+00
			0.1306E+01	0.1000E-01
			0.2611E+01	0.2000E-01
			0.5222E+01	0.4000E-01
			0.7833E+01	0.6000E-01
			0.1044E+02	0.8000E-01
			0.1175E+02	0.9000E-01
			0.1306E+02	0.1000E+00
			0.1306E+02	0.5000E+00
			0.1306E+02	0.2000E+01
9	10	0.6196E+02		
			0.0000E+00	0.0000E+00
			0.1285E+01	0.1000E-01
			0.2569E+01	0.2000E-01
			0.5139E+01	0.4000E-01
			0.7708E+01	0.6000E-01
			0.1028E+02	0.8000E-01
			0.1156E+02	0.9000E-01
			0.1285E+02	0.1000E+00
			0.1285E+02	0.5000E+00
			0.1285E+02	0.2000E+01
10	10	0.6200E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01

			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
11	10	0.7203E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
12	10	0.8196E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
13	10	0.8200E+02		
			0.0000E+00	0.0000E+00
			0.3792E+01	0.2445E-01
			0.6319E+01	0.4736E-01
			0.9479E+01	0.8709E-01
			0.1137E+02	0.1222E+00
			0.1264E+02	0.1528E+00
			0.1137E+02	0.3056E+00
			0.1137E+02	0.4584E+00
			0.1137E+02	0.7639E+00
			0.1137E+02	0.3056E+01
14	10	0.9003E+02		
			0.0000E+00	0.0000E+00
			0.3792E+01	0.2445E-01
			0.6319E+01	0.4736E-01
			0.9479E+01	0.8709E-01
			0.1137E+02	0.1222E+00
			0.1264E+02	0.1528E+00
			0.1137E+02	0.3056E+00
			0.1137E+02	0.4584E+00
			0.1137E+02	0.7639E+00
			0.1137E+02	0.3056E+01
15	10	0.9796E+02		
			0.0000E+00	0.0000E+00
			0.3792E+01	0.2445E-01
			0.6319E+01	0.4736E-01
			0.9479E+01	0.8709E-01
			0.1137E+02	0.1222E+00
			0.1264E+02	0.1528E+00
			0.1137E+02	0.3056E+00
			0.1137E+02	0.4584E+00
			0.1137E+02	0.7639E+00
			0.1137E+02	0.3056E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.3647E+01	0.7639E-02
0.7294E+01	0.1528E-01
0.1459E+02	0.3056E-01
0.2918E+02	0.1986E+00
0.4377E+02	0.6417E+00
0.5252E+02	0.1115E+01
0.5835E+02	0.1528E+01
0.5835E+02	0.2292E+01
0.5835E+02	0.3056E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.8146E+00	0.8109E-03	0.4774E-01	0.1000E-03
0.8146E+01	0.8109E-02	0.4774E+00	0.1000E-02
0.4134E+02	0.4098E-01	0.2387E+01	0.5000E-02
0.8125E+02	0.8156E-01	0.4774E+01	0.1000E-01
0.3005E+03	0.3389E+00	0.1628E+02	0.5000E-01
0.3728E+03	0.4847E+00	0.2062E+02	0.1000E+00
0.3913E+03	0.9131E+00	0.3910E+02	0.5000E+00
0.4026E+03	0.1430E+01	0.5039E+02	0.1000E+01
0.4105E+03	0.2443E+01	0.5835E+02	0.2000E+01

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Douglass Bent 2/12-inch Square Concrete Pile/Cutoff @ 8 ft below grade

DESIGNER : TK

DATE : 1/12/2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 48.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 1.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 60.00 FT.
MODULUS OF ELASTICITY = 0.380E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 11.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	1.00	110.00	33.00	8.00
34.00	SAND	1.00	110.00	33.00	8.00
34.00	SAND	1.00	47.60	33.00	8.00
43.00	SAND	1.00	47.60	33.00	8.00
43.00	SAND	1.00	47.60	32.00	8.00
63.00	SAND	1.00	47.60	32.00	8.00
63.00	CLAY	0.00	47.60	0.00	0.00
79.00	CLAY	0.00	47.60	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00

****
* COMPUTATION RESULT *
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PILE PENETR-ATION FT.	FED. HWY. METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	ARMY CORPS METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	LAMBDA 2 METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
0.0	0.0	4.3	4.3	0.0	5.1	5.1	0.0	1.1	1.1
1.0	0.0	7.6	7.6	0.0	9.1	9.1	0.0	2.0	2.0
2.0	0.0	11.0	11.0	0.0	13.1	13.1	0.0	2.9	2.9
3.0	0.0	14.3	14.3	0.0	17.2	17.2	0.0	3.8	3.8
4.0	0.0	17.7	17.7	0.0	21.2	21.2	0.0	4.6	4.6
5.0	0.0	21.0	21.0	0.0	25.2	25.2	0.0	5.5	5.5
6.0	0.0	24.4	24.4	0.0	29.2	29.2	0.0	6.4	6.4
7.0	0.0	27.7	27.7	0.0	33.2	33.2	0.0	7.3	7.3
8.0	0.0	31.1	31.1	0.0	37.2	37.2	0.0	8.2	8.2
9.0	0.0	34.4	34.4	0.0	41.2	41.2	0.0	9.0	9.0
10.0	0.0	37.8	37.8	0.0	45.3	45.3	0.0	9.9	9.9
11.0	1.6	41.1	42.7	1.5	49.0	50.5	0.0	10.8	10.8
12.0	4.9	44.5	49.4	4.6	51.4	56.0	6.7	11.7	18.4
13.0	8.5	47.5	56.0	8.3	52.2	60.5	8.2	12.6	20.8
14.0	12.3	49.4	61.7	12.1	52.2	64.3	9.9	13.4	23.3
15.0	16.5	50.0	66.5	15.8	52.2	68.0	11.6	14.3	25.9
16.0	21.0	50.0	71.0	19.6	52.2	71.8	13.4	15.2	28.6
17.0	25.7	50.0	75.7	23.3	52.2	75.5	15.6	16.1	31.7
18.0	30.7	50.0	80.7	27.1	52.2	79.3	18.4	17.0	35.4
19.0	36.0	50.0	86.0	30.8	52.2	83.0	20.7	17.8	38.6
20.0	41.6	50.0	91.6	34.6	52.2	86.8	23.5	18.7	42.2
21.0	47.5	50.0	97.5	38.3	52.2	90.5	26.4	19.6	46.0
22.0	53.7	50.0	103.7	42.1	52.2	94.3	29.4	20.5	49.9
23.0	60.1	50.0	110.1	45.8	52.2	98.0	32.6	21.4	54.0
24.0	66.9	50.0	116.9	49.6	52.2	101.8	35.9	22.2	58.2
25.0	73.9	50.0	123.9	53.3	52.2	105.5	39.4	23.1	62.5
26.0	81.3	50.0	131.3	57.1	52.2	109.3	43.0	24.0	67.0
27.0	88.9	50.0	138.9	60.8	52.2	113.0	46.8	24.9	71.7
28.0	96.8	50.0	146.8	64.6	52.2	116.8	50.7	25.8	76.4
29.0	104.9	50.0	154.9	68.4	52.2	120.5	54.7	26.6	81.3
30.0	113.4	50.0	163.4	72.1	52.2	124.3	58.9	27.5	86.4
31.0	122.2	50.0	172.2	75.9	52.2	128.1	63.2	28.4	91.6
32.0	131.2	50.0	181.2	79.6	52.2	131.8	67.7	29.3	96.9
33.0	140.5	50.0	190.5	83.4	52.2	135.6	72.3	29.9	102.2
34.0	150.2	50.0	200.2	87.1	52.2	139.3	77.0	30.4	107.4
35.0	160.0	50.0	210.0	90.9	52.2	143.1	81.9	30.8	112.6
36.0	169.9	50.0	219.9	94.6	52.2	146.8	86.8	31.2	117.9
37.0	180.0	50.0	230.0	98.4	52.2	150.6	91.7	31.5	123.3
38.0	190.2	50.0	240.2	102.1	52.2	154.3	96.8	31.9	128.7

39.0	200.5	50.0	250.5	105.9	52.2	158.1	101.8	32.3	134.2
40.0	211.0	50.0	261.0	109.6	52.2	161.8	107.0	32.7	139.7
41.0	221.5	46.4	267.9	113.4	50.2	163.6	112.2	33.1	145.3
42.0	232.2	39.7	271.9	117.1	46.6	163.7	117.5	33.5	150.9
43.0	243.0	33.0	276.0	120.9	42.9	163.8	122.8	33.8	156.7
44.0	253.4	33.0	286.4	124.6	42.9	167.5	128.1	34.2	162.3
45.0	263.4	33.0	296.4	128.4	42.9	171.3	133.4	34.6	168.0
46.0	273.4	33.0	306.4	132.1	42.9	175.0	138.8	35.0	173.8
47.0	283.6	33.0	316.6	135.9	42.9	178.8	144.3	35.4	179.7
48.0	293.9	33.0	326.9	139.7	42.9	182.6	149.8	35.7	185.6
49.0	304.2	33.0	337.2	143.4	42.9	186.3	155.4	36.1	191.5
50.0	314.7	33.0	347.7	147.2	42.9	190.1	161.1	36.5	197.5
51.0	325.4	33.0	358.4	150.9	42.9	193.8	166.8	36.9	203.6
52.0	336.1	33.0	369.1	154.7	42.9	197.6	172.5	37.3	209.8
53.0	346.9	33.0	379.9	158.4	42.9	201.3	178.3	37.6	216.0
54.0	357.9	33.0	390.9	162.2	42.9	205.1	184.2	38.0	222.2
55.0	368.9	33.0	401.9	165.9	42.9	208.8	190.2	38.4	228.6
56.0	380.1	33.0	413.1	169.7	42.9	212.6	196.2	38.8	234.9
57.0	391.4	33.0	424.4	173.4	42.9	216.3	202.2	39.2	241.4
58.0	402.8	33.0	435.8	177.2	42.9	220.1	208.3	39.5	247.9
59.0	414.3	33.0	447.3	180.9	42.9	223.8	214.5	39.9	254.4
60.0	425.9	33.0	458.9	184.7	42.9	227.6	220.8	40.3	261.1

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* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.1	1.1
1.00	0.0	2.0	2.0
2.00	0.0	2.9	2.9
3.00	0.0	3.8	3.8
4.00	0.0	4.6	4.6
5.00	0.0	5.5	5.5
6.00	0.0	6.4	6.4
7.00	0.0	7.3	7.3
8.00	0.0	8.2	8.2
9.00	0.0	9.0	9.0
10.00	0.0	9.9	9.9
11.00	1.3	10.8	12.1
12.00	4.0	11.7	15.7
13.00	6.9	12.6	19.5
14.00	10.1	13.4	23.5
15.00	13.5	14.3	27.8
16.00	17.1	15.2	32.3
17.00	20.9	16.1	37.0
18.00	25.0	17.0	42.0
19.00	29.4	17.8	47.2
20.00	33.9	18.7	52.6
21.00	38.7	19.6	58.3
22.00	43.7	20.5	64.2
23.00	49.0	21.4	70.4
24.00	54.5	22.2	76.8
25.00	60.2	23.1	83.4
26.00	66.2	24.0	90.2
27.00	72.4	24.9	97.3
28.00	78.8	25.8	104.6
29.00	85.5	26.6	112.1
30.00	92.4	27.5	119.9
31.00	99.5	28.4	127.9
32.00	106.9	29.3	136.2
33.00	114.4	29.9	144.4
34.00	122.0	30.4	152.4
35.00	129.5	30.8	160.3
36.00	137.0	31.2	168.2
37.00	144.5	31.5	176.1
38.00	152.0	31.9	184.0
39.00	159.6	32.3	191.9
40.00	167.1	32.7	199.8
41.00	174.6	33.1	207.7
42.00	182.1	33.5	215.6
43.00	189.5	33.8	223.3
44.00	196.8	34.2	231.0
45.00	204.1	34.6	238.7
46.00	211.4	35.0	246.3
47.00	218.6	35.4	254.0
48.00	225.9	35.7	261.7
49.00	233.2	36.1	269.3
50.00	240.5	36.5	277.0
51.00	247.8	36.9	284.6
52.00	255.0	37.3	292.3
53.00	262.3	37.6	300.0
54.00	269.6	38.0	307.6
55.00	276.9	38.4	315.3
56.00	284.2	38.8	322.9
57.00	291.4	39.2	330.6
58.00	298.7	39.5	338.3
59.00	306.0	39.9	345.9
60.00	313.3	40.3	353.6

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

****
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING *
****

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00

			0.0000E+00	0.2000E+01
2	10	0.1702E+02		
			0.0000E+00	0.0000E+00
			0.7108E+00	0.1000E-01
			0.1422E+01	0.2000E-01
			0.2843E+01	0.4000E-01
			0.4265E+01	0.6000E-01
			0.5686E+01	0.8000E-01
			0.6397E+01	0.9000E-01
			0.7108E+01	0.1000E+00
			0.7108E+01	0.5000E+00
			0.7108E+01	0.2000E+01
3	10	0.3396E+02		
			0.0000E+00	0.0000E+00
			0.1306E+01	0.1000E-01
			0.2611E+01	0.2000E-01
			0.5222E+01	0.4000E-01
			0.7833E+01	0.6000E-01
			0.1044E+02	0.8000E-01
			0.1175E+02	0.9000E-01
			0.1306E+02	0.1000E+00
			0.1306E+02	0.5000E+00
			0.1306E+02	0.2000E+01
4	10	0.3400E+02		
			0.0000E+00	0.0000E+00
			0.1306E+01	0.1000E-01
			0.2611E+01	0.2000E-01
			0.5222E+01	0.4000E-01
			0.7833E+01	0.6000E-01
			0.1044E+02	0.8000E-01
			0.1175E+02	0.9000E-01
			0.1306E+02	0.1000E+00
			0.1306E+02	0.5000E+00
			0.1306E+02	0.2000E+01
5	10	0.3852E+02		
			0.0000E+00	0.0000E+00
			0.1306E+01	0.1000E-01
			0.2611E+01	0.2000E-01
			0.5222E+01	0.4000E-01
			0.7833E+01	0.6000E-01
			0.1044E+02	0.8000E-01
			0.1175E+02	0.9000E-01
			0.1306E+02	0.1000E+00
			0.1306E+02	0.5000E+00
			0.1306E+02	0.2000E+01
6	10	0.4296E+02		
			0.0000E+00	0.0000E+00
			0.1285E+01	0.1000E-01
			0.2569E+01	0.2000E-01
			0.5139E+01	0.4000E-01
			0.7708E+01	0.6000E-01
			0.1028E+02	0.8000E-01
			0.1156E+02	0.9000E-01
			0.1285E+02	0.1000E+00
			0.1285E+02	0.5000E+00
			0.1285E+02	0.2000E+01
7	10	0.4300E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01

			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
8	10	0.5302E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
9	10	0.6296E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
10	10	0.6300E+02		
			0.0000E+00	0.0000E+00
			0.3792E+01	0.2445E-01
			0.6319E+01	0.4736E-01
			0.9479E+01	0.8709E-01
			0.1137E+02	0.1222E+00
			0.1264E+02	0.1528E+00
			0.1137E+02	0.3056E+00
			0.1137E+02	0.4584E+00
			0.1137E+02	0.7639E+00
			0.1137E+02	0.3056E+01
11	10	0.7103E+02		
			0.0000E+00	0.0000E+00
			0.3792E+01	0.2445E-01
			0.6319E+01	0.4736E-01
			0.9479E+01	0.8709E-01
			0.1137E+02	0.1222E+00
			0.1264E+02	0.1528E+00
			0.1137E+02	0.3056E+00
			0.1137E+02	0.4584E+00
			0.1137E+02	0.7639E+00
			0.1137E+02	0.3056E+01
12	10	0.7896E+02		
			0.0000E+00	0.0000E+00
			0.3792E+01	0.2445E-01
			0.6319E+01	0.4736E-01
			0.9479E+01	0.8709E-01
			0.1137E+02	0.1222E+00
			0.1264E+02	0.1528E+00
			0.1137E+02	0.3056E+00
			0.1137E+02	0.4584E+00

0.1137E+02	0.7639E+00
0.1137E+02	0.3056E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2519E+01	0.7639E-02
0.5038E+01	0.1528E-01
0.1008E+02	0.3056E-01
0.2015E+02	0.1986E+00
0.3023E+02	0.6417E+00
0.3628E+02	0.1115E+01
0.4031E+02	0.1528E+01
0.4031E+02	0.2292E+01
0.4031E+02	0.3056E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.6465E+00	0.5505E-03	0.3298E-01	0.1000E-03
0.6465E+01	0.5505E-02	0.3298E+00	0.1000E-02
0.3277E+02	0.2774E-01	0.1649E+01	0.5000E-02
0.6577E+02	0.5566E-01	0.3298E+01	0.1000E-01
0.2636E+03	0.2500E+00	0.1124E+02	0.5000E-01
0.3390E+03	0.3811E+00	0.1424E+02	0.1000E+00
0.3517E+03	0.7979E+00	0.2701E+02	0.5000E+00
0.3595E+03	0.1308E+01	0.3480E+02	0.1000E+01
0.3650E+03	0.2315E+01	0.4031E+02	0.2000E+01

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AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Douglass Abutment 3/HP 10*42 Steel Pile/Ignore 19 ft of fill

DESIGNER : TK

DATE : 1/12/2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 40.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.69 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 70.00 FT.
MODULUS OF ELASTICITY = 0.300E+08 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 19.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	120.00	0.00	0.00
22.00	CLAY	0.00	120.00	0.00	0.00
22.00	SAND	0.80	110.00	33.00	8.00
59.00	SAND	0.80	110.00	33.00	8.00
59.00	SAND	0.80	47.60	32.00	8.00
62.00	SAND	0.80	47.60	32.00	8.00
62.00	SAND	0.80	47.60	32.00	8.00
82.00	SAND	0.80	47.60	32.00	8.00
82.00	CLAY	0.00	47.60	0.00	0.00
98.00	CLAY	0.00	47.60	0.00	0.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	1.30	0.00	0.00	0.00	0.00
9999.00	99999.00	1.30	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00

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****
* COMPUTATION RESULT *
****

PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
1.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
2.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
3.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
4.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
5.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
6.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
7.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
8.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
9.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
10.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
11.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
12.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
13.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
14.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
15.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
16.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
17.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
18.0	0.0	8.1	8.1	0.0	8.1	8.1	0.0	8.1	8.1
19.0	2.2	8.1	10.3	1.3	8.1	9.4	0.0	8.1	8.1
20.0	6.5	9.7	16.2	3.9	10.4	14.3	16.8	8.5	25.3
21.0	10.8	22.2	33.0	6.5	29.4	35.9	18.7	11.8	30.5
22.0	15.2	34.7	49.9	9.3	48.4	57.7	20.9	15.3	36.2
23.0	19.0	34.7	53.7	12.1	48.4	60.5	23.2	15.9	39.1
24.0	22.4	34.7	57.1	14.9	48.4	63.3	25.6	16.5	42.1
25.0	26.0	34.7	60.7	17.7	48.4	66.1	28.1	17.1	45.2
26.0	29.7	34.7	64.4	20.5	48.4	69.0	30.6	17.8	48.3
27.0	33.5	34.7	68.2	23.4	48.4	71.8	33.2	18.4	51.5
28.0	37.4	34.7	72.2	26.2	48.4	74.6	35.8	19.0	54.8
29.0	41.5	34.7	76.3	29.0	48.4	77.4	38.4	19.6	58.0
30.0	45.8	34.7	80.5	31.8	48.4	80.2	41.2	20.2	61.4
31.0	50.1	34.7	84.8	34.6	48.4	83.0	44.0	20.8	64.9
32.0	54.6	34.7	89.3	37.4	48.4	85.8	47.5	21.4	69.0
33.0	59.2	34.7	93.9	40.2	48.4	88.6	51.2	22.0	73.2
34.0	64.0	34.7	98.7	43.0	48.4	91.4	54.9	22.6	77.5

35.0	68.9	34.7	103.6	45.8	48.4	94.2	58.7	23.3	82.0
36.0	73.9	34.7	108.6	48.6	48.4	97.0	62.6	23.9	86.5
37.0	79.1	34.7	113.8	51.4	48.4	99.8	66.6	24.5	91.1
38.0	84.4	34.7	119.1	54.2	48.4	102.7	70.8	25.1	95.9
39.0	89.8	34.7	124.5	57.1	48.4	105.5	75.0	25.7	100.7
40.0	95.4	34.7	130.1	59.9	48.4	108.3	79.4	26.3	105.7
41.0	101.0	34.7	135.8	62.7	48.4	111.1	83.8	26.9	110.7
42.0	106.9	34.7	141.6	65.5	48.4	113.9	88.4	27.5	115.9
43.0	112.8	34.7	147.6	68.3	48.4	116.7	93.0	28.1	121.2
44.0	118.9	34.7	153.7	71.1	48.4	119.5	97.8	28.8	126.5
45.0	125.2	34.7	159.9	73.9	48.4	122.3	102.7	29.4	132.0
46.0	131.5	34.7	166.3	76.7	48.4	125.1	107.6	30.0	137.6
47.0	138.0	34.7	172.8	79.5	48.4	127.9	112.7	30.6	143.3
48.0	144.7	34.7	179.4	82.3	48.4	130.7	117.9	31.2	149.1
49.0	151.5	34.7	186.2	85.1	48.4	133.5	123.2	31.8	155.0
50.0	158.4	34.7	193.1	87.9	48.4	136.4	128.6	32.4	161.0
51.0	165.4	34.7	200.1	90.8	48.4	139.2	134.1	33.0	167.1
52.0	172.6	34.7	207.3	93.6	48.4	142.0	139.7	33.6	173.3
53.0	179.9	34.7	214.6	96.4	48.4	144.8	145.4	34.3	179.6
54.0	187.3	34.7	222.0	99.2	48.4	147.6	151.2	34.9	186.0
55.0	194.9	34.7	229.6	102.0	48.4	150.4	157.1	35.5	192.6
56.0	202.6	34.7	237.3	104.8	48.4	153.2	163.1	36.1	199.2
57.0	210.4	34.0	244.5	107.6	47.9	155.5	169.2	36.7	205.9
58.0	218.4	28.5	246.9	110.4	43.9	154.3	175.5	37.2	212.7
59.0	226.5	22.9	249.4	113.2	39.8	153.0	181.8	37.6	219.3
60.0	234.4	22.9	257.3	116.0	39.8	155.8	188.1	37.8	225.9
61.0	242.0	22.9	265.0	118.8	39.8	158.6	194.4	38.1	232.5
62.0	249.7	22.9	272.6	121.7	39.8	161.4	200.8	38.4	239.1
63.0	257.5	22.9	280.4	124.5	39.8	164.2	207.2	38.6	245.8
64.0	265.2	22.9	288.2	127.3	39.8	167.1	213.7	38.9	252.5
65.0	273.1	22.9	296.0	130.1	39.8	169.9	220.2	39.1	259.3
66.0	281.0	22.9	303.9	132.9	39.8	172.7	226.7	39.4	266.1
67.0	288.9	22.9	311.8	135.7	39.8	175.5	233.3	39.7	273.0
68.0	296.9	22.9	319.8	138.5	39.8	178.3	239.9	39.9	279.9
69.0	305.0	22.9	327.9	141.3	39.8	181.1	246.6	40.2	286.8
70.0	313.1	22.9	336.0	144.1	39.8	183.9	253.4	40.5	293.8

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**********************
*  API RP-2A (1994)  *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	8.1	8.1
1.00	0.0	8.1	8.1
2.00	0.0	8.1	8.1
3.00	0.0	8.1	8.1
4.00	0.0	8.1	8.1
5.00	0.0	8.1	8.1
6.00	0.0	8.1	8.1
7.00	0.0	8.1	8.1
8.00	0.0	8.1	8.1
9.00	0.0	8.1	8.1
10.00	0.0	8.1	8.1
11.00	0.0	8.1	8.1
12.00	0.0	8.1	8.1
13.00	0.0	8.1	8.1
14.00	0.0	8.1	8.1
15.00	0.0	8.1	8.1
16.00	0.0	8.1	8.1
17.00	0.0	8.1	8.1
18.00	0.0	8.1	8.1
19.00	1.4	8.1	9.6
20.00	4.3	8.5	12.8
21.00	7.3	11.8	19.1
22.00	10.4	15.3	25.7
23.00	13.9	15.9	29.8
24.00	17.8	16.5	34.4
25.00	22.0	17.1	39.1
26.00	26.3	17.8	44.0
27.00	30.7	18.4	49.1
28.00	35.3	19.0	54.3
29.00	40.1	19.6	59.7
30.00	45.0	20.2	65.2
31.00	50.1	20.8	70.9
32.00	55.3	21.4	76.7
33.00	60.7	22.0	82.7
34.00	66.2	22.6	88.8
35.00	71.9	23.3	95.1
36.00	77.7	23.9	101.6
37.00	83.7	24.5	108.2
38.00	89.9	25.1	115.0
39.00	96.2	25.7	121.9
40.00	102.4	26.3	128.7
41.00	108.7	26.9	135.6
42.00	115.0	27.5	142.5
43.00	121.2	28.1	149.4
44.00	127.5	28.8	156.3
45.00	133.8	29.4	163.1
46.00	140.0	30.0	170.0
47.00	146.3	30.6	176.9
48.00	152.6	31.2	183.8
49.00	158.8	31.8	190.6
50.00	165.1	32.4	197.5
51.00	171.4	33.0	204.4
52.00	177.6	33.6	211.3
53.00	183.9	34.3	218.2
54.00	190.2	34.9	225.0
55.00	196.4	35.5	231.9
56.00	202.7	36.1	238.8
57.00	209.0	36.7	245.7
58.00	215.2	37.2	252.4
59.00	221.4	37.6	259.0
60.00	227.5	37.8	265.3
61.00	233.5	38.1	271.6
62.00	239.6	38.4	278.0
63.00	245.7	38.6	284.3
64.00	251.7	38.9	290.6
65.00	257.8	39.1	296.9
66.00	263.9	39.4	303.3
67.00	269.9	39.7	309.6
68.00	276.0	39.9	315.9
69.00	282.1	40.2	322.3
70.00	288.1	40.5	328.6

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN

IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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**************************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2037E-01
			0.0000E+00	0.3947E-01
			0.0000E+00	0.7257E-01
			0.0000E+00	0.1019E+00
			0.0000E+00	0.1273E+00
			0.0000E+00	0.2546E+00
			0.0000E+00	0.3820E+00
			0.0000E+00	0.6366E+00
			0.0000E+00	0.2546E+01
2	10	0.1103E+02		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2037E-01
			0.0000E+00	0.3947E-01
			0.0000E+00	0.7257E-01
			0.0000E+00	0.1019E+00
			0.0000E+00	0.1273E+00
			0.0000E+00	0.2546E+00
			0.0000E+00	0.3820E+00
			0.0000E+00	0.6366E+00
			0.0000E+00	0.2546E+01
3	10	0.2196E+02		
			0.0000E+00	0.0000E+00
			0.1908E+01	0.2037E-01
			0.3179E+01	0.3947E-01
			0.4769E+01	0.7257E-01
			0.5723E+01	0.1019E+00
			0.6359E+01	0.1273E+00
			0.5723E+01	0.2546E+00
			0.5723E+01	0.3820E+00
			0.5723E+01	0.6366E+00
			0.5723E+01	0.2546E+01
4	10	0.2200E+02		
			0.0000E+00	0.0000E+00
			0.7278E+00	0.1000E-01
			0.1456E+01	0.2000E-01
			0.2911E+01	0.4000E-01
			0.4367E+01	0.6000E-01
			0.5822E+01	0.8000E-01
			0.6550E+01	0.9000E-01
			0.7278E+01	0.1000E+00
			0.7278E+01	0.5000E+00
			0.7278E+01	0.2000E+01
5	10	0.4052E+02		
			0.0000E+00	0.0000E+00
			0.1306E+01	0.1000E-01
			0.2611E+01	0.2000E-01
			0.5222E+01	0.4000E-01
			0.7833E+01	0.6000E-01
			0.1044E+02	0.8000E-01
			0.1175E+02	0.9000E-01
			0.1306E+02	0.1000E+00
			0.1306E+02	0.5000E+00
			0.1306E+02	0.2000E+01
6	10	0.5896E+02		
			0.0000E+00	0.0000E+00
			0.1285E+01	0.1000E-01
			0.2569E+01	0.2000E-01
			0.5139E+01	0.4000E-01
			0.7708E+01	0.6000E-01
			0.1028E+02	0.8000E-01
			0.1156E+02	0.9000E-01
			0.1285E+02	0.1000E+00
			0.1285E+02	0.5000E+00
			0.1285E+02	0.2000E+01
7	10	0.5900E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
8	10	0.6052E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
9	10	0.6196E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
10	10	0.6200E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01

			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
11	10	0.7203E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
12	10	0.8196E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
13	10	0.8200E+02		
			0.0000E+00	0.0000E+00
			0.3792E+01	0.2037E-01
			0.6319E+01	0.3947E-01
			0.9479E+01	0.7257E-01
			0.1137E+02	0.1019E+00
			0.1264E+02	0.1273E+00
			0.1137E+02	0.2546E+00
			0.1137E+02	0.3820E+00
			0.1137E+02	0.6366E+00
			0.1137E+02	0.2546E+01
14	10	0.9003E+02		
			0.0000E+00	0.0000E+00
			0.3792E+01	0.2037E-01
			0.6319E+01	0.3947E-01
			0.9479E+01	0.7257E-01
			0.1137E+02	0.1019E+00
			0.1264E+02	0.1273E+00
			0.1137E+02	0.2546E+00
			0.1137E+02	0.3820E+00
			0.1137E+02	0.6366E+00
			0.1137E+02	0.2546E+01
15	10	0.9796E+02		
			0.0000E+00	0.0000E+00
			0.3792E+01	0.2037E-01
			0.6319E+01	0.3947E-01
			0.9479E+01	0.7257E-01
			0.1137E+02	0.1019E+00
			0.1264E+02	0.1273E+00
			0.1137E+02	0.2546E+00
			0.1137E+02	0.3820E+00
			0.1137E+02	0.6366E+00
			0.1137E+02	0.2546E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.2529E+01	0.6366E-02
0.5058E+01	0.1273E-01
0.1012E+02	0.2546E-01
0.2023E+02	0.1655E+00
0.3035E+02	0.5348E+00
0.3642E+02	0.9295E+00
0.4047E+02	0.1273E+01
0.4047E+02	0.1910E+01
0.4047E+02	0.2546E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.3787E+00	0.1701E-03	0.3973E-01	0.1000E-03
0.3787E+01	0.1701E-02	0.3973E+00	0.1000E-02
0.1893E+02	0.8503E-02	0.1986E+01	0.5000E-02
0.3787E+02	0.1701E-01	0.3973E+01	0.1000E-01
0.1747E+03	0.8218E-01	0.1189E+02	0.5000E-01
0.3044E+03	0.1573E+00	0.1550E+02	0.1000E+00
0.3168E+03	0.5611E+00	0.2940E+02	0.5000E+00
0.3246E+03	0.1063E+01	0.3725E+02	0.1000E+01
0.3278E+03	0.2064E+01	0.4047E+02	0.2000E+01

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\DOUA1.DVN
Project Name: SR 57/Douglass Rd/Abut 1 Project Date: 01/14/2010
Project Client: HDR
Computed By: TK
Project Manager: DJC

PILE INFORMATION

Pile Type: Concrete Pile
Top of Pile: 19.00 ft
Length of Square Side: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	59.00 ft
	- Driving/Restrike	59.00 ft
	- Ultimate:	59.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	22.00 ft	0.00%	120.00 pcf	1300.00 psf	T-79 Concrete
2	Cohesionless	40.00 ft	0.00%	110.00 pcf	33.0/0.0	Nordlund
3	Cohesionless	20.00 ft	0.00%	110.00 pcf	32.0/0.0	Nordlund
4	Cohesive	16.00 ft	0.00%	110.00 pcf	1500.00 psf	T-79 Concrete

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	1130.00 psf	0.00 Kips
21.99 ft	Cohesive	N/A	N/A	1130.00 psf	13.51 Kips
22.01 ft	Cohesionless	2640.55 psf	25.31	N/A	13.62 Kips
31.01 ft	Cohesionless	3135.55 psf	25.31	N/A	79.33 Kips
40.01 ft	Cohesionless	3630.55 psf	25.31	N/A	165.77 Kips
49.01 ft	Cohesionless	4125.55 psf	25.31	N/A	272.96 Kips
58.01 ft	Cohesionless	4620.55 psf	25.31	N/A	400.89 Kips
58.99 ft	Cohesionless	4674.45 psf	25.31	N/A	416.07 Kips
59.01 ft	Cohesionless	6710.24 psf	25.31	N/A	416.38 Kips
61.99 ft	Cohesionless	6781.16 psf	25.31	N/A	463.43 Kips
62.01 ft	Cohesionless	6853.04 psf	24.54	N/A	463.73 Kips
71.01 ft	Cohesionless	7067.24 psf	24.54	N/A	597.08 Kips
80.01 ft	Cohesionless	7281.44 psf	24.54	N/A	738.51 Kips
81.99 ft	Cohesionless	7328.56 psf	24.54	N/A	770.72 Kips
82.01 ft	Cohesive	N/A	N/A	1500.00 psf	770.94 Kips
91.01 ft	Cohesive	N/A	N/A	1500.00 psf	824.94 Kips
97.99 ft	Cohesive	N/A	N/A	1500.00 psf	866.82 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	N/A	11.70 Kips
21.99 ft	Cohesive	N/A	N/A	N/A	11.70 Kips
22.01 ft	Cohesionless	2641.10 psf	4.80	13.32 Kips	4.35 Kips
31.01 ft	Cohesionless	3631.10 psf	4.80	13.32 Kips	4.37 Kips
40.01 ft	Cohesionless	4621.10 psf	4.80	13.32 Kips	4.51 Kips
49.01 ft	Cohesionless	5611.10 psf	4.80	13.32 Kips	4.77 Kips
58.01 ft	Cohesionless	6601.10 psf	4.80	13.32 Kips	5.61 Kips
58.99 ft	Cohesionless	6708.90 psf	4.80	13.32 Kips	5.70 Kips
59.01 ft	Cohesionless	6710.48 psf	4.80	13.32 Kips	5.70 Kips
61.99 ft	Cohesionless	6852.32 psf	4.80	13.32 Kips	5.82 Kips
62.01 ft	Cohesionless	6853.28 psf	4.80	13.32 Kips	5.82 Kips
71.01 ft	Cohesionless	7281.68 psf	4.80	13.32 Kips	6.19 Kips
80.01 ft	Cohesionless	7710.08 psf	4.80	13.32 Kips	6.55 Kips
81.99 ft	Cohesionless	7804.32 psf	4.80	13.32 Kips	6.63 Kips
82.01 ft	Cohesive	N/A	N/A	N/A	13.50 Kips
91.01 ft	Cohesive	N/A	N/A	N/A	13.50 Kips
97.99 ft	Cohesive	N/A	N/A	N/A	13.50 Kips

ULTIMATE - SUMMARY OF CAPACITIES

	Depth	Skin Friction	End Bearing	Total Capacity
cutoff →	0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
elev. 189.8'	9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	18.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
elev. 171' →	19.00 ft	0.00 Kips	11.70 Kips	11.70 Kips
	21.99 ft	13.51 Kips	11.70 Kips	25.21 Kips
	22.01 ft	13.62 Kips	4.35 Kips	17.97 Kips
	31.01 ft	79.33 Kips	4.37 Kips	83.70 Kips
	40.01 ft	165.77 Kips	4.51 Kips	170.28 Kips
	49.01 ft	272.96 Kips	4.77 Kips	277.73 Kips
	58.01 ft	400.89 Kips	5.61 Kips	406.50 Kips
	58.99 ft	416.07 Kips	5.70 Kips	421.77 Kips
	59.01 ft	416.38 Kips	5.70 Kips	422.09 Kips
	61.99 ft	463.43 Kips	5.82 Kips	469.25 Kips
	62.01 ft	463.73 Kips	5.82 Kips	469.55 Kips
	71.01 ft	597.08 Kips	6.19 Kips	603.27 Kips
	80.01 ft	738.51 Kips	6.55 Kips	745.07 Kips
	81.99 ft	770.72 Kips	6.63 Kips	777.35 Kips
	82.01 ft	770.94 Kips	13.50 Kips	784.44 Kips
	91.01 ft	824.94 Kips	13.50 Kips	838.44 Kips
	97.99 ft	866.82 Kips	13.50 Kips	880.32 Kips

40.01 ft 165.77 kips
49.01 ft 272.96 kips

pile capacity per foot: (272.96 - 165.77) / (49.01 - 40.01) = 11.91 Kips / ft.

170 - 165.77 = 4.23 kips ∴ pile length = 41.01' ≈ 42'

⇒ Need a foot

pile tip elev = 189.8' - 42' = 147.8' ≈ 147' use pile tip from Apile output (144')

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\DOUB2.DVN
Project Name: SR 57/Douglass Rd/Bent 2 Project Date: 01/14/2010
Project Client: HDR
Computed By: TK
Project Manager: DJC

PILE INFORMATION

Pile Type: Concrete Pile
Top of Pile: 11.00 ft
Length of Square Side: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	34.00 ft
	- Driving/Restrike	34.00 ft
	- Ultimate:	34.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	43.00 ft	0.00%	110.00 pcf	33.0/0.0	Nordlund
2	Cohesionless	20.00 ft	0.00%	110.00 pcf	32.0/0.0	Nordlund
3	Cohesive	16.00 ft	0.00%	110.00 pcf	1500.00 psf	T-79 Concrete

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
10.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
11.00 ft	Cohesionless	1210.00 psf	25.31	N/A	0.00 Kips
18.01 ft	Cohesionless	1595.55 psf	25.31	N/A	26.04 Kips
27.01 ft	Cohesionless	2090.55 psf	25.31	N/A	77.91 Kips
33.99 ft	Cohesionless	2474.45 psf	25.31	N/A	132.43 Kips
34.01 ft	Cohesionless	3740.24 psf	25.31	N/A	132.60 Kips
42.99 ft	Cohesionless	3953.96 psf	25.31	N/A	215.26 Kips
43.01 ft	Cohesionless	4168.64 psf	24.54	N/A	215.45 Kips
52.01 ft	Cohesionless	4382.84 psf	24.54	N/A	298.15 Kips
61.01 ft	Cohesionless	4597.04 psf	24.54	N/A	388.93 Kips
62.99 ft	Cohesionless	4644.16 psf	24.54	N/A	409.99 Kips
63.01 ft	Cohesive	N/A	N/A	1500.00 psf	410.16 Kips
72.01 ft	Cohesive	N/A	N/A	1500.00 psf	464.16 Kips
78.99 ft	Cohesive	N/A	N/A	1500.00 psf	506.04 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	4.80	13.32 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	4.80	13.32 Kips	0.00 Kips
10.99 ft	Cohesionless	0.00 psf	4.80	13.32 Kips	0.00 Kips
11.00 ft	Cohesionless	1210.00 psf	4.80	13.32 Kips	2.12 Kips
18.01 ft	Cohesionless	1981.10 psf	4.80	13.32 Kips	3.47 Kips
27.01 ft	Cohesionless	2971.10 psf	4.80	13.32 Kips	5.21 Kips
33.99 ft	Cohesionless	3738.90 psf	4.80	13.32 Kips	5.97 Kips
34.01 ft	Cohesionless	3740.48 psf	4.80	13.32 Kips	4.22 Kips
42.99 ft	Cohesionless	4167.92 psf	4.80	13.32 Kips	3.75 Kips
43.01 ft	Cohesionless	4168.88 psf	4.80	13.32 Kips	3.75 Kips
52.01 ft	Cohesionless	4597.28 psf	4.80	13.32 Kips	3.91 Kips
61.01 ft	Cohesionless	5025.68 psf	4.80	13.32 Kips	4.27 Kips
62.99 ft	Cohesionless	5119.92 psf	4.80	13.32 Kips	4.35 Kips
63.01 ft	Cohesive	N/A	N/A	N/A	13.50 Kips
72.01 ft	Cohesive	N/A	N/A	N/A	13.50 Kips
78.99 ft	Cohesive	N/A	N/A	N/A	13.50 Kips

ULTIMATE - SUMMARY OF CAPACITIES

	Depth	Skin Friction	End Bearing	Total Capacity
FG@elev. 174' →	0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
pile cutoff @ →	11.00 ft	0.00 Kips	2.12 Kips	2.12 Kips
elev. 163.8'	18.01 ft	26.04 Kips	3.47 Kips	29.51 Kips
a-II	27.01 ft	77.91 Kips	5.21 Kips	83.12 Kips
	33.99 ft	132.43 Kips	5.97 Kips	138.39 Kips
a-I	34.01 ft	132.60 Kips	4.22 Kips	136.82 Kips
	42.99 ft	215.26 Kips	3.75 Kips	219.02 Kips
	43.01 ft	215.45 Kips	3.75 Kips	219.20 Kips
	52.01 ft	298.15 Kips	3.91 Kips	302.05 Kips
	61.01 ft	388.93 Kips	4.27 Kips	393.20 Kips
	62.99 ft	409.99 Kips	4.35 Kips	414.34 Kips
	63.01 ft	410.16 Kips	13.50 Kips	423.66 Kips
	72.01 ft	464.16 Kips	13.50 Kips	477.66 Kips
	78.99 ft	506.04 Kips	13.50 Kips	519.54 Kips

a-II

27.01' 77.91 Kips
33.99' 132.43 Kips

pile capacity : $\frac{(132.43-77.91)}{(33.99-27.01)} = 7.81$ Kips/ft

120 Kips − 77.91 Kips = 42.09 Kips

Depth = (42.09/7.81) + 27.01 = 33.4' ≃ 34'

pile tip elev : 174' − 34' = 140'. for a-II. Same as one from Apile output

a-I

34.01' 132.60 Kips
42.99' 215.26 Kips

pile capacity : $\frac{(215.26-132.60)}{(42.99-34.01)} = 9.2$ Kips/ft

180 Kips − 132.60 Kips = 47.4 Kips

Depth = 34.01 + (47.4/9.2) = 39.2' ≃ 40'

pile tip elev : 174' − 40' = 134' use one from Apile output (132')

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\DOUA3.DVN
Project Name: SR 57/Douglass Rd/Abut 3 Project Date: 01/14/2010
Project Client: HDR
Computed By: TK
Project Manager: DJC

PILE INFORMATION

Pile Type: H Pile - HP10X42
Top of Pile: 19.00 ft
Perimeter Analysis: Box
Tip Analysis: Pile Area

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	59.00 ft
	- Driving/Restrike	59.00 ft
	- Ultimate:	59.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	22.00 ft	0.00%	120.00 pcf	1300.00 psf	T-79 Steel
2	Cohesionless	37.00 ft	0.00%	110.00 pcf	33.0/0.0	Nordlund
3	Cohesive	23.00 ft	0.00%	110.00 pcf	1500.00 psf	T-79 Steel

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	956.00 psf	0.00 Kips
21.99 ft	Cohesive	N/A	N/A	956.00 psf	9.42 Kips
22.01 ft	Cohesionless	2640.55 psf	24.19	N/A	9.48 Kips
31.01 ft	Cohesionless	3135.55 psf	24.19	N/A	43.93 Kips
40.01 ft	Cohesionless	3630.55 psf	24.19	N/A	89.26 Kips
49.01 ft	Cohesionless	4125.55 psf	24.19	N/A	145.46 Kips
58.01 ft	Cohesionless	4620.55 psf	24.19	N/A	212.53 Kips
58.99 ft	Cohesionless	4674.45 psf	24.19	N/A	220.49 Kips
59.01 ft	Cohesive	N/A	N/A	1295.00 psf	220.62 Kips
68.01 ft	Cohesive	N/A	N/A	1295.00 psf	259.03 Kips
77.01 ft	Cohesive	N/A	N/A	1295.00 psf	297.44 Kips
81.99 ft	Cohesive	N/A	N/A	1295.00 psf	318.70 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
18.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.00 ft	Cohesive	N/A	N/A	N/A	1.01 Kips
21.99 ft	Cohesive	N/A	N/A	N/A	1.01 Kips
22.01 ft	Cohesionless	2641.10 psf	4.80	1.15 Kips	0.32 Kips
31.01 ft	Cohesionless	3631.10 psf	4.80	1.15 Kips	0.33 Kips
40.01 ft	Cohesionless	4621.10 psf	4.80	1.15 Kips	0.34 Kips
49.01 ft	Cohesionless	5611.10 psf	4.80	1.15 Kips	0.41 Kips
58.01 ft	Cohesionless	6601.10 psf	4.80	1.15 Kips	0.48 Kips
58.99 ft	Cohesionless	6708.90 psf	4.80	1.15 Kips	0.49 Kips
59.01 ft	Cohesive	N/A	N/A	N/A	1.16 Kips
68.01 ft	Cohesive	N/A	N/A	N/A	1.16 Kips
77.01 ft	Cohesive	N/A	N/A	N/A	1.16 Kips
81.99 ft	Cohesive	N/A	N/A	N/A	1.16 Kips

ULTIMATE - SUMMARY OF CAPACITIES

	Depth	Skin Friction	End Bearing	Total Capacity
pile cut-off @	0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
Elev. 189.5'	9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	18.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	18.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
Elev. 171' →	19.00 ft	0.00 Kips	1.01 Kips	1.01 Kips
	21.99 ft	9.42 Kips	1.01 Kips	10.43 Kips
	22.01 ft	9.48 Kips	0.32 Kips	9.81 Kips
	31.01 ft	43.93 Kips	0.33 Kips	44.26 Kips
	40.01 ft	89.26 Kips	0.34 Kips	89.60 Kips
pile length →	49.01 ft	145.46 Kips	0.41 Kips	145.87 Kips
=50'	58.01 ft	212.53 Kips	0.48 Kips	213.01 Kips
	58.99 ft	220.49 Kips	0.49 Kips	220.98 Kips
pile Tip	59.01 ft	220.62 Kips	1.16 Kips	221.78 Kips
	68.01 ft	259.03 Kips	1.16 Kips	260.19 Kips
189.5-50	77.01 ft	297.44 Kips	1.16 Kips	298.61 Kips
=139'	81.99 ft	318.70 Kips	1.16 Kips	319.86 Kips

```
==============================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.25)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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==============================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Douglas\
Name of input data file:     Douglas 12 inch Abutment _3D(0.75)Row1.lpd
Name of output file:         Douglas 12 inch Abutment _3D(0.75)Row1.lpo
Name of plot output file:    Douglas 12 inch Abutment _3D(0.75)Row1.lpp
Name of runtime file:        Douglas 12 inch Abutment _3D(0.75)Row1.lpr


------------------------------------------------------------------------------
                           Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  May 11, 2009     Time:  13:51:14


------------------------------------------------------------------------------
                                 Problem Title
------------------------------------------------------------------------------

Douglas Road Abutments1&3 /12-inch Square Concrete Pile/3D(0.75)Row1


------------------------------------------------------------------------------
                                 Program Options
------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Pile Length                                =     468.00 in
Depth of ground surface below top of pile =        .00 in
Slope angle of ground surface              =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
           in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   12.00000000    1728.0000     144.0000      3800000.
  2     468.0000   12.00000000    1728.0000     144.0000      3800000.


------------------------------------------------------------------------------
                         Soil and Rock Layering Information
------------------------------------------------------------------------------

The soil profile is modelled using  4 layers

Layer  1 is stiff clay without free water
Distance from top of pile to top of layer    =         .000 in
Distance from top of pile to bottom of layer =      180.000 in

Layer  2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      180.000 in
Distance from top of pile to bottom of layer =      660.000 in
p-y subgrade modulus k for top of soil layer =       75.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       75.000 lbs/in**3

Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      660.000 in
Distance from top of pile to bottom of layer =      840.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      840.000 in
Distance from top of pile to bottom of layer =     1158.000 in


(Depth of lowest layer extends  690.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	.00	.06333
2	180.00	.06366
3	180.00	.06366
4	660.00	.06366
5	660.00	.02755
6	840.00	.02755
7	840.00	.02755
8	1158.00	.02755

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	.000	9.03000	.00	.00600	.0
2	180.000	9.03000	.00	.00600	.0
3	180.000	.00000	33.00	------	------
4	660.000	.00000	33.00	------	------
5	660.000	.00000	32.00	------	------
6	840.000	.00000	32.00	------	------
7	840.000	10.42000	.00	.00600	.0
8	1158.000	10.42000	.00	.00600	.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.7500	1.0000
2	468.000	.7500	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	9971.9000	-.0040271	0.0000	-132.3392
4.680	.231153	45219.2195	9335.5001	-.0040109	157.0112	-139.6266
9.360	.212458	87380.2808	8666.2832	-.0039637	303.4038	-146.3635
14.040	.194053	126336.	7966.8968	-.0038875	438.6654	-152.5195
18.720	.176070	161950.	7240.1309	-.0037848	562.3279	-158.0642
23.400	.158627	194103.	6488.9196	-.0036579	673.9696	-162.9663
28.080	.141832	222687.	5716.3441	-.0035094	773.2178	-167.1942
32.760	.125779	247608.	4925.6369	-.0033418	859.7508	-170.7149
37.440	.110553	268791.	4120.1878	-.0031578	933.3010	-173.4941
42.120	.096223	286173.	3303.5523	-.0029600	993.6569	-175.4954
46.800	.082847	299712.	2479.4627	-.0027512	1040.6664	-176.6796
51.480	.070471	309381.	1651.8433	-.0025342	1074.2395	-177.0039
56.160	.059127	315173.	824.8318	-.0023116	1094.3513	-176.4199
60.840	.048835	317101.	2.8091	-.0020863	1101.0465	-174.8719
65.520	.039600	315199.	-809.5572	-.0018610	1094.4426	-172.2932
70.200	.031416	309524.	-1607.2472	-.0016383	1074.7359	-168.6000
74.880	.024265	300156.	-2384.7867	-.0014211	1042.2071	-163.6818
79.560	.018115	287202.	-3136.0762	-.0012118	997.2303	-157.3821
84.240	.012923	270802.	-3854.0872	-.0010129	940.2846	-149.4602
88.920	.008634	251128.	-4530.2613	-.0008269	871.9725	-139.5031
93.600	.005183	228399.	-5153.1368	-.0006560	793.0511	-126.6830
98.280	.002494	202895.	-5704.2888	-.0005023	704.4955	-108.8520
102.960	.000481	175007.	-6134.8447	-.0003677	607.6617	-75.1462
107.640	-.000948	145473.	-6101.1112	-.0002535	505.1131	89.5623
112.320	-.001891	117900.	-5634.5933	-.0001596	409.3756	109.8044
117.000	-.002441	92732.7748	-5096.1352	-8.4539E-05	321.9888	120.3059
121.680	-.002682	70200.3566	-4518.7310	-2.6476E-05	243.7512	126.4480
126.360	-.002689	50437.4528	-3924.2184	1.6515E-05	175.1300	127.6172
131.040	-.002528	33469.6722	-3331.5304	4.6416E-05	116.2141	125.6683
135.720	-.002255	19254.3287	-2751.6812	6.5205E-05	66.8553	122.1305
140.400	-.001917	7713.9363	-2191.4624	7.4815E-05	26.7845	117.2793
145.080	-.001554	-1257.7590	-1656.6404	7.7116E-05	4.3672	111.2772
149.760	-.001196	-7792.2175	-1152.4247	7.3891E-05	27.0563	104.1996
154.440	-.000863	-12044.4541	-683.9017	6.6822E-05	41.8210	96.0239
159.120	-.000570	-14193.5377	-256.6630	5.7471E-05	49.2831	86.5568
163.800	-.000325	-14446.8197	121.7812	4.7265E-05	50.1626	75.1715
168.480	-.000128	-13053.6661	413.7829	3.7465E-05	45.3252	49.6156
173.160	2.58E-05	-10573.8115	506.4702	2.9045E-05	36.7146	-10.0057
177.840	.000144	-8313.1046	352.1718	2.2315E-05	28.8649	-55.9338
182.520	.000235	-7277.4832	217.0443	1.6759E-05	25.2690	-1.8130
187.200	.000301	-6281.5698	207.1757	1.1927E-05	21.8110	-2.4044
191.880	.000346	-5338.3185	194.8621	7.7861E-06	18.5358	-2.8578
196.560	.000374	-4457.6608	180.7253	4.2952E-06	15.4780	-3.1835
201.240	.000386	-3646.7293	165.3361	1.4071E-06	12.6623	-3.3931
205.920	.000387	-2910.1153	149.2075	-9.2946E-07	10.1046	-3.4994
210.600	.000378	-2250.1467	132.7923	-2.7684E-06	7.8130	-3.5156
215.280	.000361	-1667.1791	116.4806	-4.1643E-06	5.7888	-3.4552
219.960	.000339	-1159.8886	100.6002	-5.1718E-06	4.0274	-3.3313
224.640	.000313	-725.5611	85.4186	-5.8437E-06	2.5193	-3.1566
229.320	.000284	-360.3702	71.1455	-6.2307E-06	1.2513	-2.9430
234.000	.000254	-59.6390	57.9368	-6.3804E-06	.2070800	-2.7017
238.680	.000224	181.9182	45.8993	-6.3368E-06	.6316606	-2.4425
243.360	.000195	369.9782	35.0958	-6.1401E-06	1.2846	-2.1744
248.040	.000167	510.4145	25.5505	-5.8264E-06	1.7723	-1.9048
252.720	.000140	609.1312	17.2549	-5.4274E-06	2.1150	-1.6403
257.400	.000116	671.9208	10.1729	-4.9709E-06	2.3331	-1.3862
262.080	9.40E-05	704.3495	4.2462	-4.4804E-06	2.4457	-1.1466
266.760	7.42E-05	711.6656	-.6002456	-3.9758E-06	2.4711	-.9245753
271.440	5.68E-05	698.7312	-4.4541	-3.4732E-06	2.4262	-.7223732
276.120	4.17E-05	669.9752	-7.4110	-2.9855E-06	2.3263	-.5412782
280.800	2.88E-05	629.3638	-9.5712	-2.5224E-06	2.1853	-.3818595
285.480	1.81E-05	580.3888	-11.0358	-2.0913E-06	2.0152	-.2440509
290.160	9.23E-06	526.0685	-11.9047	-1.6970E-06	1.8266	-.1272589
294.840	2.17E-06	468.9609	-12.2738	-1.3424E-06	1.6283	-.0304678
299.520	-3.33E-06	411.1861	-12.2335	-1.0288E-06	1.4277	.0476621
304.200	-7.46E-06	354.4551	-11.8676	-7.5596E-07	1.2307	.1087035
308.880	-1.04E-05	300.1050	-11.2520	-5.2270E-07	1.0420	.1543801
313.560	-1.24E-05	249.1362	-10.4544	-3.2697E-07	.8650561	.1864954
318.240	-1.35E-05	202.2521	-9.5339	-1.6611E-07	.7022641	.2068703
322.920	-1.39E-05	159.8989	-8.5414	-3.7057E-08	.5552045	.2172917
327.600	-1.38E-05	122.3049	-7.5193	6.3509E-08	.4246700	.2194714
332.280	-1.33E-05	89.5180	-6.5026	1.3899E-07	.3108262	.2150133
336.960	-1.25E-05	61.4403	-5.5189	1.9279E-07	.2133342	.2053903
341.640	-1.15E-05	37.8611	-4.5892	2.2818E-07	.1314622	.1919286
346.320	-1.04E-05	18.4857	-3.7287	2.4826E-07	.0641863	.1757984
351.000	-9.18E-06	2.9606	-2.9476	2.5590E-07	.0102799	.1580121
355.680	-7.98E-06	-9.1036	-2.2516	2.5371E-07	.0316097	.1394253
360.360	-6.81E-06	-18.1140	-1.6428	2.4401E-07	.0628960	.1207437
365.040	-5.70E-06	-24.4799	-1.1203	2.2883E-07	.0849997	.1025322
369.720	-4.67E-06	-28.6001	-.6809507	2.0992E-07	.0993059	.0852260
374.400	-3.73E-06	-30.8536	-.3197245	1.8873E-07	.1071306	.0691442
379.080	-2.90E-06	-31.5927	-.0303895	1.6648E-07	.1096969	.0545033
383.760	-2.18E-06	-31.1381	.1940978	1.4412E-07	.1081183	.0414315
388.440	-1.55E-06	-29.7760	.3612072	1.2241E-07	.1033887	.0299828
393.120	-1.03E-06	-27.7572	.4785186	1.0191E-07	.0963790	.0201503
397.800	-5.99E-07	-25.2970	.5534666	8.3005E-08	.0878369	.0118788
402.480	-2.53E-07	-22.5767	.5931419	6.5945E-08	.0783914	.0050765
407.160	1.84E-08	-19.7452	.6041442	5.0863E-08	.0685598	-.0003747
411.840	2.24E-07	-16.9219	.5924799	3.7797E-08	.0587567	-.0046101
416.520	3.72E-07	-14.1996	.5635002	2.6706E-08	.0493042	-.0077744
421.200	4.73E-07	-11.6476	.5218725	1.7495E-08	.0404429	-.0100152
425.880	5.36E-07	-9.3149	.4715801	1.0025E-08	.0323433	-.0114773
430.560	5.67E-07	-7.2336	.4159443	4.1278E-09	.0251166	-.0122987
435.240	5.75E-07	-5.4216	.3576645	-3.8197E-10	.0188251	-.0126072
439.920	5.64E-07	-3.8858	.2988715	-3.6988E-09	.0134925	-.0125180
444.600	5.40E-07	-2.6242	.2411908	-6.0187E-09	.0091118	-.0121319
449.280	5.07E-07	-1.6283	.1858122	-7.5341E-09	.0056538	-.0115342
453.960	4.69E-07	-.8849958	.1335630	-8.4297E-09	.0030729	-.0107945
458.640	4.29E-07	-.3781344	.0849828	-8.8799E-09	.0013130	-.0099662
463.320	3.86E-07	-.0895571	.0403990	-9.0465E-09	.0003110	-.0090867
468.000	3.44E-07	0.0000	0.0000	-9.0784E-09	0.0000	-.0081778

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.25000000	in
Computed slope at pile head	=	-.00402706	
Maximum bending moment	=	317101.38943	lbs-in
Maximum shear force	=	9971.90004	lbs
Depth of maximum bending moment	=	60.84000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	18	
Number of zero deflection points	=	4	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	13877.5105	-.0071555	0.0000	-157.3787
4.680	.466512	63223.2637	13119.8192	-.0071330	219.5252	-166.4210
9.360	.433235	122802.	12321.1241	-.0070667	426.3941	-174.9017
14.040	.400368	178549.	11484.1207	-.0069593	619.9618	-182.7921
18.720	.368097	230293.	10611.6393	-.0068136	799.6280	-190.0632
23.400	.336593	277874.	9706.6460	-.0066325	964.8400	-196.6861
28.080	.306017	321147.	8772.2442	-.0064190	1115.0940	-202.6309
32.760	.276511	359982.	7811.6779	-.0061763	1249.9380	-207.8675
37.440	.248206	394264.	6828.3350	-.0059075	1368.9736	-212.3645
42.120	.221217	423895.	5825.7530	-.0056160	1471.8589	-216.0894
46.800	.195641	448793.	4807.6255	-.0053050	1558.3105	-219.0079
51.480	.171562	468895.	3777.8115	-.0049779	1628.1067	-221.0836
56.160	.149047	484154.	2740.3474	-.0046383	1681.0894	-222.2771
60.840	.128148	494544.	1699.4636	-.0042895	1717.1680	-222.5451
65.520	.108897	500061.	659.6058	-.0039351	1736.3220	-221.8386
70.200	.091315	500718.	-374.5336	-.0035785	1738.6052	-220.1013
74.880	.075403	496555.	-1397.9725	-.0032231	1724.1496	-217.2658
79.560	.061147	487633.	-2405.3753	-.0028724	1693.1711	-213.2483
84.240	.048518	474041.	-3390.9555	-.0025297	1645.9749	-207.9399
88.920	.037469	455894.	-4348.3212	-.0021983	1582.9650	-201.1908
93.600	.027942	433340.	-5270.2124	-.0018814	1504.6545	-192.7798
98.280	.019860	406565.	-6148.0208	-.0015821	1411.6831	-182.3520
102.960	.013134	375795.	-6970.8090	-.0013033	1304.8438	-169.2669
107.640	.007661	341318.	-7722.9341	-.0010477	1185.1318	-152.1541
112.320	.003327	303508.	-8376.1128	-.0008179	1053.8485	-126.9821
117.000	5.40E-06	262918.	-8677.9884	-.0006161	912.9081	-2.0246
121.680	-.002439	222282.	-8393.4471	-.0004432	771.8138	123.6234
126.360	-.004143	184355.	-7771.0324	-.0002983	640.1211	142.3658
131.040	-.005231	149546.	-7084.7173	-.0001793	519.2553	150.9313
135.720	-.005821	118042.	-6368.7888	-8.3913E-05	409.8678	155.0211
140.400	-.006016	89933.6608	-5640.2739	-9.7993E-06	312.2697	156.3101
145.080	-.005912	65248.9617	-4910.3394	4.5502E-05	226.5589	155.6278
149.760	-.005591	43972.8841	-4187.0687	8.4424E-05	152.6836	153.4623
154.440	-.005122	26057.9985	-3476.6478	.0001094	90.4792	150.1364
159.120	-.004567	11431.4606	-2783.9604	.0001227	39.6926	145.8839
163.800	-.003973	.1294052	-2112.9177	.0001268	.0004493	140.8865
168.480	-.003380	-8345.4490	-1466.6565	.0001238	28.9773	135.2935
173.160	-.002814	-13727.7751	-847.6754	.0001160	47.6659	129.2283
177.840	-.002294	-16279.6909	-257.9658	.0001053	56.5267	122.7843
182.520	-.001829	-16142.3350	62.4138	9.3726E-05	56.0498	14.1300
187.200	-.001417	-15695.4979	121.9712	8.2380E-05	54.4983	11.3219
191.880	-.001058	-15000.6847	168.8903	7.1442E-05	52.0857	8.7290
196.560	-.000748	-14114.6848	204.2293	6.1066E-05	49.0093	6.3731
201.240	-.000486	-13089.0988	229.1286	5.1372E-05	45.4483	4.2677
205.920	-.000267	-11970.0409	244.7752	4.2442E-05	41.5626	2.4189
210.600	-8.88E-05	-10798.0026	252.3700	3.4328E-05	37.4931	.8266884
215.280	5.38E-05	-9607.8578	253.0994	2.7056E-05	33.3606	-.5149644
219.960	.000164	-8428.9919	248.1115	2.0629E-05	29.2673	-1.6166
224.640	.000247	-7285.5337	238.4959	1.5029E-05	25.2970	-2.4926
229.320	.000305	-6196.6705	225.2678	1.0224E-05	21.5162	-3.1604
234.000	.000343	-5177.0268	209.3569	6.1709E-06	17.9758	-3.6392
238.680	.000363	-4237.0896	191.5989	2.8161E-06	14.7121	-3.9497
243.360	.000369	-3383.6613	172.7311	1.0040E-07	11.7488	-4.1134
248.040	.000364	-2620.3267	153.3912	-2.0392E-06	9.0984	-4.1515
252.720	.000350	-1947.9199	134.1182	-3.6671E-06	6.7636	-4.0848
257.400	.000329	-1364.9807	115.3559	-4.8477E-06	4.7395	-3.9333
262.080	.000304	-868.1890	97.4581	-5.6435E-06	3.0145	-3.7154
266.760	.000277	-452.7730	80.6952	-6.1143E-06	1.5721	-3.4483
271.440	.000247	-112.8822	65.2617	-6.3158E-06	.3919522	-3.1473
276.120	.000218	158.0761	51.2845	-6.2997E-06	.5488755	-2.8259
280.800	.000188	367.1407	38.8316	-6.1126E-06	1.2748	-2.4959
285.480	.000160	521.5398	27.9205	-5.7959E-06	1.8109	-2.1670
290.160	.000134	628.4766	18.5269	-5.3860E-06	2.1822	-1.8474
294.840	.000110	694.9516	10.5926	-4.9144E-06	2.4130	-1.5434
299.520	8.80E-05	727.6232	4.0332	-4.4075E-06	2.5265	-1.2598
304.200	6.86E-05	732.7023	-1.2550	-3.8871E-06	2.5441	-1.0001
308.880	5.17E-05	715.8768	-5.3886	-3.3709E-06	2.4857	-.7664345
313.560	3.71E-05	682.2646	-8.4922	-2.8726E-06	2.3690	-.5598860
318.240	2.48E-05	636.3895	-10.6930	-2.4027E-06	2.2097	-.3806171
322.920	1.46E-05	582.1780	-12.1173	-1.9685E-06	2.0215	-.2280342
327.600	6.35E-06	522.9720	-12.8871	-1.5746E-06	1.8159	-.1009411
332.280	-1.44E-07	461.5552	-13.1178	-1.2238E-06	1.6026	.0023183
336.960	-5.10E-06	400.1891	-12.9165	-9.1670E-07	1.3895	.0837288
341.640	-8.72E-06	340.6569	-12.3801	-6.5269E-07	1.1828	.1454881
346.320	-1.12E-05	284.3112	-11.5953	-4.2997E-07	.9871918	.1899059
351.000	-1.27E-05	232.1250	-10.6377	-2.4594E-07	.8059894	.2193182
355.680	-1.35E-05	184.7423	-9.5722	-9.7383E-08	.6414662	.2360164
360.360	-1.37E-05	142.5289	-8.4532	1.9243E-08	.4948920	.2421913
365.040	-1.33E-05	105.6201	-7.3252	1.0767E-07	.3667365	.2398898
369.720	-1.27E-05	73.9655	-6.2233	1.7167E-07	.2568246	.2309838
374.400	-1.17E-05	47.3700	-5.1747	2.1491E-07	.1644791	.2171507
379.080	-1.06E-05	25.5306	-4.1989	2.4089E-07	.0886478	.1998619
383.760	-9.47E-06	8.0686	-3.3091	2.5286E-07	.0280160	.1803800
388.440	-8.27E-06	-5.4426	-2.5132	2.5380E-07	.0188978	.1597624
393.120	-7.10E-06	-15.4546	-1.8144	2.4635E-07	.0536618	.1388700
397.800	-5.97E-06	-22.4250	-1.2124	2.3285E-07	.0778646	.1183796
402.480	-4.92E-06	-26.8026	-.7042010	2.1531E-07	.0930647	.0987991
407.160	-3.95E-06	-29.0163	-.2846760	1.9542E-07	.1007512	.0804850
411.840	-3.09E-06	-29.4672	.0526238	1.7458E-07	.1023167	.0636602

416.520	-2.32E-06	-28.5238	.3149209	1.5391E-07	.0990409	.0484325
421.200	-1.65E-06	-26.5196	.5097156	1.3430E-07	.0920818	.0348130
425.880	-1.06E-06	-23.7528	.6443750	1.1638E-07	.0824751	.0227337
430.560	-5.57E-07	-20.4882	.7258025	1.0061E-07	.0711396	.0120643
435.240	-1.20E-07	-16.9593	.7601839	8.7270E-08	.0588866	.0026286
439.920	2.60E-07	-13.3729	.7528072	7.6461E-08	.0464336	-.0057810
444.600	5.96E-07	-9.9131	.7079504	6.8163E-08	.0344203	-.0133885
449.280	8.98E-07	-6.7465	.6288360	6.2226E-08	.0234252	-.0204211
453.960	1.18E-06	-4.0271	.5176476	5.8386E-08	.0139832	-.0270954
458.640	1.44E-06	-1.9013	.3756095	5.6274E-08	.0066017	-.0336047
463.320	1.71E-06	-.5114429	.2031286	5.5414E-08	.0017758	-.0401051
468.000	1.96E-06	0.0000	0.0000	5.5232E-08	0.0000	-.0467020

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      .50000000 in
Computed slope at pile head      =     -.00715549
Maximum bending moment           =   500718.28736 lbs-in
Maximum shear force              =    13877.51050 lbs
Depth of maximum bending moment  =    70.20000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             15
Number of zero deflection points =              4
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	19328.3563	-.0127215	0.0000	-187.1558
4.680	.940463	88407.1263	18426.3843	-.0126900	306.9692	-198.3023
9.360	.881221	172471.	17473.5923	-.0125971	598.8575	-208.8738
14.040	.822555	251960.	16472.7346	-.0124458	874.8609	-218.8432
18.720	.764729	326656.	15426.6928	-.0122396	1134.2214	-228.1832
23.400	.707992	396354.	14338.4768	-.0119820	1376.2285	-236.8663
28.080	.652578	460864.	13211.2262	-.0116765	1600.2219	-244.8647
32.760	.598700	520011.	12048.2116	-.0113269	1805.5933	-252.1501
37.440	.546557	573635.	10852.8376	-.0109372	1991.7887	-258.6935
42.120	.496328	621593.	9628.6463	-.0105113	2158.3105	-264.4652
46.800	.448172	663759.	8379.3217	-.0100532	2304.7197	-269.4342
51.480	.402230	700024.	7108.6956	-.0095672	2430.6385	-273.5684
56.160	.358623	730297.	5820.7553	-.0090575	2535.7523	-276.8334
60.840	.317451	754506.	4519.6538	-.0085284	2619.8130	-279.1929
65.520	.278797	772601.	3209.7222	-.0079842	2682.6411	-280.6070
70.200	.242719	784549.	1895.4873	-.0074293	2724.1290	-281.0319
74.880	.209259	790342.	581.6941	-.0068681	2744.2444	-280.4182
79.560	.178434	789994.	-726.6626	-.0063049	2743.0341	-278.7086
84.240	.150245	783541.	-2024.2947	-.0057442	2720.6279	-275.8350
88.920	.124669	771046.	-3305.5586	-.0051902	2677.2445	-271.7136
93.600	.101665	752601.	-4564.3630	-.0046472	2613.1972	-266.2369
98.280	.081171	728324.	-5794.0271	-.0041195	2528.9027	-259.2606
102.960	.063107	698369.	-6987.0537	-.0036110	2424.8914	-250.5798
107.640	.047372	662925.	-8134.7390	-.0031259	2301.8234	-239.8840
112.320	.033848	622228.	-9226.4517	-.0026679	2160.5123	-226.6599
117.000	.022400	576566.	-10248.1280	-.0022407	2001.9638	-209.9539
121.680	.012875	526305.	-11178.4864	-.0018477	1827.4482	-187.6351
126.360	.005105	471935.	-11969.1320	-.0014920	1638.6630	-150.2476
131.040	-.001090	414274.	-12083.1637	-.0011762	1438.4514	101.5161
135.720	-.005904	358837.	-11481.7535	-.0009007	1245.9601	155.4968
140.400	-.009521	306805.	-10707.7089	-.0006635	1065.2944	175.2915
145.080	-.012114	258612.	-9861.8237	-.0004620	897.9596	186.1979
149.760	-.013845	214498.	-8975.5941	-.0002934	744.7851	192.5327
154.440	-.014860	174601.	-8066.4796	-.0001547	606.2528	195.9778
159.120	-.015293	138996.	-7145.9862	-4.2973E-05	482.6245	197.3955
163.800	-.015262	107714.	-6222.3978	4.4944E-05	374.0082	197.3004
168.480	-.014873	80754.2263	-5302.0022	.0001121	280.3966	196.0310
173.160	-.014213	58087.6309	-4389.7417	.0001616	201.6932	193.8239
177.840	-.013360	39666.2436	-3489.6052	.0001964	137.7300	190.8499
182.520	-.012375	25424.9264	-2819.2790	.0002196	88.2810	95.6143
187.200	-.011304	13277.7920	-2384.1901	.0002334	46.1034	90.3211
191.880	-.010190	3108.9075	-1976.0469	.0002392	10.7948	84.0990
196.560	-.009065	-5218.0069	-1598.6031	.0002385	18.1181	77.2018
201.240	-.007958	-11854.0174	-1254.4666	.0002324	41.1598	69.8651
205.920	-.006890	-16959.8146	-945.1935	.0002221	58.8882	62.3029
210.600	-.005878	-20701.0288	-671.3953	.0002087	71.8786	54.7049
215.280	-.004936	-23244.0747	-432.8556	.0001931	80.7086	47.2352
219.960	-.004071	-24752.5573	-228.6513	.0001760	85.9464	40.0316
224.640	-.003289	-25384.2510	-57.2744	.0001581	88.1398	33.2064
229.320	-.002592	-25288.6459	83.2489	.0001400	87.8078	26.8464
234.000	-.001978	-24605.0412	195.2447	.0001223	85.4342	21.0151
238.680	-.001447	-23461.1554	281.2853	.0001051	81.4623	15.7544
243.360	-.000994	-21972.2106	344.0931	8.8935E-05	76.2924	11.0865
248.040	-.000615	-20240.4444	386.4543	7.3892E-05	70.2793	7.0166
252.720	-.000303	-18354.9981	411.1452	6.0138E-05	63.7326	3.5351
257.400	-5.19E-05	-16392.1257	420.8683	4.7756E-05	56.9171	.6201395
262.080	.000144	-14415.6707	418.2018	3.6777E-05	50.0544	-1.7597
266.760	.000292	-12477.7570	405.5585	2.7193E-05	43.3255	-3.6434
271.440	.000399	-10619.6428	385.1566	1.8962E-05	36.8738	-5.0754
276.120	.000470	-8872.6910	358.9989	1.2016E-05	30.8080	-6.1031
280.800	.000511	-7259.4127	328.8616	6.2672E-06	25.2063	-6.7761
285.480	.000528	-5794.5464	296.2899	1.6153E-06	20.1200	-7.1435
290.160	.000526	-4486.1393	262.6008	-2.0483E-06	15.5769	-7.2536
294.840	.000509	-3336.6028	228.8908	-4.8361E-06	11.5854	-7.1524
299.520	.000481	-2343.7216	196.0478	-6.8603E-06	8.1379	-6.8830
304.200	.000445	-1501.5953	164.7668	-8.2306E-06	5.2139	-6.4849
308.880	.000404	-801.5040	135.5674	-9.0513E-06	2.7830	-5.9935
313.560	.000360	-232.6848	108.8126	-9.4199E-06	.8079332	-5.4401
318.240	.000316	216.9823	84.7294	-9.4255E-06	.7534106	-4.8519
322.920	.000272	560.3820	63.4276	-9.1485E-06	1.9458	-4.2515
327.600	.000230	810.6646	44.9201	-8.6599E-06	2.8148	-3.6577
332.280	.000191	980.8342	29.1407	-8.0215E-06	3.4057	-3.0856
336.960	.000155	1083.4215	15.9614	-7.2858E-06	3.7619	-2.5466
341.640	.000123	1130.2326	5.2079	-6.4970E-06	3.9244	-2.0489

346.320	9.43E-05	1132.1679	-3.3260	-5.6908E-06	3.9311	-1.5981
351.000	6.96E-05	1099.1012	-9.8670	-4.8956E-06	3.8163	-1.1972
355.680	4.85E-05	1039.8123	-14.6514	-4.1334E-06	3.6105	-.8473728
360.360	3.09E-05	961.9640	-17.9164	-3.4200E-06	3.3402	-.5479144
365.040	1.65E-05	872.1150	-19.8933	-2.7664E-06	3.0282	-.2969188
369.720	5.01E-06	775.7628	-20.8021	-2.1792E-06	2.6936	-.0914487
374.400	-3.90E-06	677.4076	-20.8472	-1.6614E-06	2.3521	.0721507
379.080	-1.05E-05	580.6327	-20.2151	-1.2130E-06	2.0161	.1979979
383.760	-1.52E-05	488.1944	-19.0721	-8.3216E-07	1.6951	.2904565
388.440	-1.83E-05	402.1179	-17.5642	-5.1489E-07	1.3962	.3539508
393.120	-2.01E-05	323.7937	-15.8168	-2.5620E-07	1.1243	.3928142
397.800	-2.07E-05	254.0730	-13.9354	-5.0274E-08	.8821981	.4111698
402.480	-2.05E-05	193.3580	-12.0073	1.0917E-07	.6713820	.4128389
407.160	-1.97E-05	141.6852	-10.1022	2.2857E-07	.4919624	.4012758
411.840	-1.84E-05	98.8012	-8.2751	3.1427E-07	.3430598	.3795262
416.520	-1.68E-05	64.2298	-6.5676	3.7237E-07	.2230201	.3502050
421.200	-1.49E-05	37.3287	-5.0098	4.0856E-07	.1296136	.3154910
425.880	-1.29E-05	17.3376	-3.6231	4.2804E-07	.0602001	.2771365
430.560	-1.09E-05	3.4165	-2.4212	4.3543E-07	.0118629	.2364890
435.240	-8.87E-06	-5.3249	-1.4127	4.3475E-07	.0184893	.1945214
439.920	-6.84E-06	-9.8059	-.6020889	4.2936E-07	.0340482	.1518723
444.600	-4.85E-06	-10.9605	.0080987	4.2196E-07	.0380572	.1088916
449.280	-2.89E-06	-9.7301	.4166256	4.1459E-07	.0337850	.0656926
453.960	-9.66E-07	-7.0609	.6223170	4.0860E-07	.0245169	.0222097
458.640	9.35E-07	-3.9052	.6234201	4.0470E-07	.0135597	-.0217383
463.320	2.82E-06	-1.2257	.4172219	4.0287E-07	.0042557	-.0663806
468.000	4.71E-06	0.0000	0.0000	4.0243E-07	0.0000	-.1119194

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.01272153
Maximum bending moment           =   790342.39734 lbs-in
Maximum shear force              =    19328.35628 lbs
Depth of maximum bending moment  =    74.88000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             23
Number of zero deflection points =              4
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	-810704.	20001.1396	0.0000	2814.9458	-132.3392
4.680	.248648	-718656.	19335.6192	-.0005450	2495.3343	-142.1963
9.360	.244899	-629723.	18648.0466	-.0010255	2186.5368	-151.6559
14.040	.239049	-544111.	17917.1788	-.0014438	1889.2728	-160.6808
18.720	.231385	-462018.	17145.1751	-.0018024	1604.2285	-169.2353
23.400	.222179	-383632.	16334.3165	-.0021037	1332.0546	-177.2854
28.080	.211694	-309129.	15487.0415	-.0023506	1073.3632	-184.7979
32.760	.200178	-238673.	14605.9425	-.0025458	828.7257	-191.7402
37.440	.187865	-172417.	13693.7622	-.0026923	598.6701	-198.0805
42.120	.174978	-110499.	12753.3922	-.0027931	383.6785	-203.7871
46.800	.161722	-53045.2361	11787.8720	-.0028514	184.1848	-208.8284
51.480	.148289	-164.9171	10800.3891	-.0028704	.5726287	-213.1728
56.160	.134855	48046.4061	9794.2809	-.0028533	166.8278	-216.7880
60.840	.121582	91509.5522	8773.0371	-.0028036	317.7415	-219.6410
65.520	.108614	130162.	7740.3044	-.0027246	451.9515	-221.6978
70.200	.096080	163959.	6699.8930	-.0026198	569.3014	-222.9225
74.880	.084093	192873.	5655.7857	-.0024926	669.6980	-223.2772
79.560	.072749	216897.	4612.1507	-.0023466	753.1144	-222.7207
84.240	.062129	236043.	3573.3590	-.0021852	819.5929	-221.2074
88.920	.052296	250344.	2544.0096	-.0020118	869.2486	-218.6855
93.600	.043298	259855.	1528.9652	-.0018300	902.2732	-215.0941
98.280	.035167	264655.	533.4053	-.0016431	918.9400	-210.3588
102.960	.027919	264847.	-437.0926	-.0014544	919.6089	-204.3839
107.640	.021554	260564.	-1376.4220	-.0012672	904.7345	-197.0389
112.320	.016058	251964.	-2277.7247	-.0010845	874.8752	-188.1332
117.000	.011402	239244.	-3132.9819	-.0009095	830.7084	-177.3613
121.680	.007545	222639.	-3932.1777	-.0007449	773.0533	-164.1753
126.360	.004430	202439.	-4655.5338	-.0005934	702.9126	-144.9512
131.040	.001991	179064.	-5272.5568	-.0004575	621.7484	-118.7338
135.720	.000148	153088.	-5685.1977	-.0003391	531.5545	-57.6085
140.400	-.001183	125850.	-5576.5317	-.0002397	436.9795	104.0470
145.080	-.002095	100891.	-5052.0290	-.0001589	350.3173	120.0995
149.760	-.002670	78563.1061	-4472.3162	-9.4938E-05	272.7886	127.6411
154.440	-.002984	59030.4892	-3866.5093	-4.5905E-05	204.9670	131.2508
159.120	-.003100	42372.5791	-3249.2643	-9.7693E-06	147.1270	132.5291
163.800	-.003075	28617.3750	-2629.6184	1.5529E-05	99.3659	132.2769
168.480	-.002955	17759.3513	-2013.6045	3.2055E-05	61.6644	130.9769
173.160	-.002775	9770.0368	-1405.3693	4.1866E-05	33.9237	128.9526
177.840	-.002563	4605.0947	-807.7837	4.6989E-05	15.9899	126.4258
182.520	-.002335	2209.1816	-469.7240	4.9417E-05	7.6708	18.0441
187.200	-.002100	208.4785	-388.2316	5.0278E-05	.7238838	16.7817
191.880	-.001865	-1424.6660	-312.9506	4.9845E-05	4.9468	15.3897
196.560	-.001634	-2720.7386	-244.3794	4.8368E-05	9.4470	13.9142
201.240	-.001412	-3712.0570	-182.8117	4.6075E-05	12.8891	12.3968
205.920	-.001203	-4431.8564	-128.3569	4.3173E-05	15.3884	10.8745
210.600	-.001008	-4913.4777	-80.9623	3.9843E-05	17.0607	9.3796
215.280	-.000830	-5189.6638	-40.4370	3.6243E-05	18.0197	7.9390
219.960	-.000669	-5291.9676	-6.4750	3.2507E-05	18.3749	6.5747
224.640	-.000525	-5250.2697	21.3210	2.8751E-05	18.2301	5.3039
229.320	-.000400	-5092.4035	43.4175	2.5065E-05	17.6820	4.1391
234.000	-.000291	-4843.8819	60.3298	2.1524E-05	16.8190	3.0884
238.680	-.000198	-4527.7165	72.6026	1.8184E-05	15.7212	2.1564
243.360	-.000121	-4164.3212	80.7933	1.5087E-05	14.4594	1.3439
248.040	-5.69E-05	-3771.4911	85.4571	1.2259E-05	13.0955	.6491392
252.720	-5.80E-06	-3364.4432	87.1345	9.7158E-06	11.6821	.0677229
257.400	3.41E-05	-2955.9121	86.3415	7.4635E-06	10.2636	-.4066103
262.080	6.41E-05	-2556.2867	83.5610	5.4992E-06	8.8760	-.7816246
266.760	8.55E-05	-2173.7807	79.2373	3.8136E-06	7.5478	-1.0661
271.440	9.98E-05	-1814.6260	73.7714	2.3923E-06	6.3008	-1.2697

276.120	.000108	-1483.2805	67.5194	1.2170E-06	5.1503	-1.4021
280.800	.000111	-1182.6440	60.7913	2.6699E-07	4.1064	-1.4732
285.480	.000110	-914.2741	53.8511	-4.8027E-07	3.1746	-1.4927
290.160	.000107	-678.5975	46.9190	-1.0479E-06	2.3562	-1.4698
294.840	.000101	-475.1124	40.1732	-1.4590E-06	1.6497	-1.4131
299.520	9.30E-05	-302.5768	33.7532	-1.7362E-06	1.0506	-1.3305
304.200	8.44E-05	-159.1827	27.7633	-1.9007E-06	.5527176	-1.2292
308.880	7.52E-05	-42.7121	22.2765	-1.9727E-06	.1483059	-1.1156
313.560	6.59E-05	49.3250	17.3380	-1.9703E-06	.1712674	-.9949000
318.240	5.68E-05	119.5714	12.9697	-1.9101E-06	.4151784	-.8718671
322.920	4.80E-05	170.7218	9.1740	-1.8067E-06	.5927840	-.7502540
327.600	3.98E-05	205.4399	5.9370	-1.6726E-06	.7133328	-.6330863
332.280	3.24E-05	226.2918	3.2325	-1.5188E-06	.7857354	-.5226840
336.960	2.56E-05	235.6957	1.0249	-1.3542E-06	.8183878	-.4207300
341.640	1.97E-05	235.8846	-.7279586	-1.1861E-06	.8190438	-.3283433
346.320	1.45E-05	228.8820	-2.0723	-1.0205E-06	.7947292	-.2461556
351.000	1.01E-05	216.4880	-3.0564	-8.6176E-07	.7516945	-.1743865
355.680	6.46E-06	200.2745	-3.7286	-7.1325E-07	.6953976	-.1129166
360.360	3.46E-06	181.5879	-4.1364	-5.7716E-07	.6305135	-.0613576
365.040	1.06E-06	161.5574	-4.3248	-4.5488E-07	.5609632	-.0191154
369.720	-7.97E-07	141.1082	-4.3354	-3.4702E-07	.4899591	.0145514
374.400	-2.19E-06	120.9777	-4.2067	-2.5363E-07	.4200616	.0404804
379.080	-3.17E-06	101.7339	-3.9726	-1.7426E-07	.3532427	.0595612
383.760	-3.82E-06	83.7946	-3.6631	-1.0815E-07	.2909534	.0726975
388.440	-4.18E-06	67.4475	-3.3039	-5.4250E-08	.2341927	.0807769
393.120	-4.32E-06	52.8696	-2.9169	-1.1374E-08	.1835752	.0846458
397.800	-4.29E-06	40.1457	-2.5197	2.1773E-08	.1393949	.0850911
402.480	-4.12E-06	29.2855	-2.1267	4.6516E-08	.1016858	.0828265
407.160	-3.85E-06	20.2394	-1.7493	6.4164E-08	.0702757	.0784840
411.840	-3.52E-06	12.9123	-1.3957	7.5978E-08	.0448343	.0726087
416.520	-3.14E-06	7.1754	-1.0722	8.3137E-08	.0249147	.0656579
421.200	-2.74E-06	2.8767	-.7828124	8.6719E-08	.0099885	.0580023
425.880	-2.33E-06	-.1516775	-.5302510	8.7690E-08	.0005267	.0499300
430.560	-1.92E-06	-2.0865	-.3159480	8.6892E-08	.0072446	.0416525
435.240	-1.52E-06	-3.1090	-.1405318	8.5041E-08	.0107950	.0333117
439.920	-1.13E-06	-3.4018	-.0041082	8.2721E-08	.0118119	.0249890
444.600	-7.44E-07	-3.1474	.0934775	8.0387E-08	.0109285	.0167144
449.280	-3.73E-07	-2.5269	.1524265	7.8365E-08	.0087739	.0084775
453.960	-1.04E-08	-1.7207	.1728238	7.6851E-08	.0059746	.0002392
458.640	3.46E-07	-.9092564	.1545315	7.5914E-08	.0031571	-.0080565
463.320	7.00E-07	-.2742767	.0971428	7.5492E-08	.0009523	-.0164687
468.000	1.05E-06	0.0000	0.0000	7.5394E-08	0.0000	-.0250454

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =      .25000000 in
Computed slope at pile head      =     -.00003280
Maximum bending moment           =  -810704.38984 lbs-in
Maximum shear force              =    20001.13961 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             13
Number of zero deflection points =              4
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .500000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-1283324.	28001.2346	0.0000	4455.9856	-157.3787
4.680	.497860	-1154130.	27209.5270	-.0008686	4007.3974	-169.1488
9.360	.491870	-1028642.	26391.3453	-.0016465	3571.6730	-180.5406
14.040	.482449	-907107.	25520.7337	-.0023363	3149.6787	-191.5156
18.720	.470002	-789768.	24599.8202	-.0029410	2742.2492	-202.0372
23.400	.454921	-676853.	23630.8090	-.0034636	2350.1846	-212.0702
28.080	.437583	-568583.	22616.0654	-.0039075	1974.2479	-221.5809
32.760	.418347	-465167.	21558.1100	-.0042758	1615.1624	-230.5367
37.440	.397561	-366799.	20459.6149	-.0045723	1273.6093	-238.9056
42.120	.375551	-273665.	19323.3998	-.0048006	950.2249	-246.6563
46.800	.352628	-185932.	18152.4308	-.0049643	645.5988	-253.7578
51.480	.329084	-103758.	16949.8181	-.0050676	360.2709	-260.1793
56.160	.305195	-27282.1582	15718.8162	-.0051143	94.7297	-265.8899
60.840	.281215	43370.0880	14462.8246	-.0051085	150.5906	-270.8586
65.520	.257379	108090.	13185.3895	-.0050546	375.3121	-275.0538
70.200	.233904	166785.	11890.2068	-.0049566	579.1157	-278.4431
74.880	.210985	219382.	10581.1266	-.0048190	761.7438	-280.9929
79.560	.188798	265825.	9262.1602	-.0046461	923.0024	-282.6680
84.240	.167498	306076.	7937.4887	-.0044423	1062.7640	-283.4309
88.920	.147219	340120.	6611.4758	-.0042120	1180.9707	-283.2412
93.600	.128074	367959.	5288.6846	-.0039597	1277.6370	-282.0541
98.280	.110156	389622.	3973.9016	-.0036897	1352.8530	-279.8189
102.960	.093538	405155.	2672.1699	-.0034065	1406.7888	-276.4766
107.640	.078272	414633.	1388.8375	-.0031143	1439.6985	-271.9560
112.320	.064388	418155.	129.6286	-.0028176	1451.9260	-266.1675
117.000	.051899	415846.	-1099.2470	-.0025204	1443.9114	-258.9931
121.680	.040798	407866.	-2290.9192	-.0022268	1416.2005	-250.2685
126.360	.031056	394403.	-3428.1949	-.0019409	1369.4566	-235.7467
131.040	.022631	375778.	-4489.5592	-.0016665	1304.7841	-217.8278
135.720	.015458	352381.	-5462.7203	-.0014070	1223.5459	-198.0530
140.400	.009461	324647.	-6336.1764	-.0011657	1127.2457	-175.2188
145.080	.004547	293075.	-7087.7923	-.0009456	1017.6202	-145.9845
149.760	.000611	258305.	-7637.8204	-.0007491	896.8925	-89.0702
154.440	-.002464	221585.	-7554.1450	-.0005781	769.3910	124.8289
159.120	-.004800	187598.	-6916.5835	-.0004323	651.3828	147.6333
163.800	-.006510	156845.	-6198.1927	-.0003095	544.6020	159.3714
168.480	-.007697	129583.	-5436.3280	-.0002074	449.9415	166.2118
173.160	-.008452	105961.	-4649.2171	-.0001235	367.9214	170.1603
177.840	-.008853	86066.4788	-3848.1965	-5.5072E-05	298.8419	172.1562
182.520	-.008967	69942.2357	-3283.2180	5.2298E-07	242.8550	69.2877
187.200	-.008848	55335.5587	-2955.6544	4.5167E-05	192.1374	70.6968
191.880	-.008545	42277.3110	-2625.2073	7.9952E-05	146.7962	70.5199
196.560	-.008100	30763.6181	-2298.7725	.0001060	106.8181	68.9822
201.240	-.007553	20760.8004	-1982.1902	.0001243	72.0861	66.3094

205.920	-.006936	12210.3181	-1680.2559	.0001361	42.3969	62.7223
210.600	-.006279	5033.6052	-1396.7558	.0001422	17.4778	58.4316
215.280	-.005605	-863.3159	-1134.5220	.0001437	2.9976	53.6341
219.960	-.004934	-5585.5208	-895.5045	.0001414	19.3942	48.5101
224.640	-.004281	-9245.2382	-680.8543	.0001361	32.1015	43.2208
229.320	-.003659	-11958.3170	-491.0145	.0001286	41.5219	37.9073
234.000	-.003077	-13841.1342	-325.8162	.0001194	48.0595	32.6903
238.680	-.002542	-15007.9563	-184.5745	.0001091	52.1110	27.6694
243.360	-.002056	-15568.7519	-66.1844	9.8213E-05	54.0582	22.9246
248.040	-.001623	-15627.4427	30.7886	8.7096E-05	54.2620	18.5168
252.720	-.001241	-15280.5702	108.0230	7.6081E-05	53.0575	14.4893
257.400	-.000910	-14616.3474	167.3623	6.5427E-05	50.7512	10.8694
262.080	-.000629	-13714.0594	210.7450	5.5332E-05	47.6183	7.6703
266.760	-.000393	-12643.7742	240.1430	4.5939E-05	43.9020	4.8930
271.440	-.000199	-11466.3210	257.5086	3.7347E-05	39.8136	2.5282
276.120	-4.30E-05	-10233.4941	264.7308	2.9614E-05	35.5330	.5582155
280.800	7.86E-05	-8988.4409	263.6004	2.2764E-05	31.2099	-1.0413
285.480	.000170	-7766.1943	255.7830	1.6793E-05	26.9660	-2.2995
290.160	.000236	-6594.3119	242.7998	1.1676E-05	22.8969	-3.2489
294.840	.000279	-5493.5877	226.0155	7.3682E-06	19.0750	-3.9239
299.520	.000305	-4478.8067	206.6317	3.8144E-06	15.5514	-4.3598
304.200	.000315	-3559.5148	185.6864	9.4989E-07	12.3594	-4.5912
308.880	.000314	-2740.7821	164.0570	-1.2953E-06	9.5166	-4.6521
313.560	.000303	-2023.9411	142.4678	-2.9932E-06	7.0276	-4.5741
318.240	.000286	-1407.2839	121.4992	-4.2160E-06	4.8864	-4.3868
322.920	.000264	-886.7087	101.6001	-5.0335E-06	3.0788	-4.1171
327.600	.000238	-456.3069	83.1007	-5.5121E-06	1.5844	-3.7887
332.280	.000212	-108.8864	66.2264	-5.7135E-06	.3780777	-3.4225
336.960	.000185	163.5724	51.1124	-5.6940E-06	.5679597	-3.0365
341.640	.000159	369.5256	37.8171	-5.5040E-06	1.2831	-2.6453
346.320	.000133	517.5407	26.3361	-5.1879E-06	1.7970	-2.2611
351.000	.000110	616.0318	16.6145	-4.7839E-06	2.1390	-1.8934
355.680	8.87E-05	673.0526	8.5586	-4.3246E-06	2.3370	-1.5493
360.360	6.96E-05	696.1406	2.0465	-3.8366E-06	2.4172	-1.2337
365.040	5.28E-05	692.2081	-3.0628	-3.3419E-06	2.4035	-.9498083
369.720	3.83E-05	667.4726	-6.9216	-2.8574E-06	2.3176	-.6992458
374.400	2.60E-05	627.4218	-9.6864	-2.3959E-06	2.1785	-.4822888
379.080	1.59E-05	576.8078	-11.5127	-1.9668E-06	2.0028	-.2981862
383.760	7.63E-06	519.6628	-12.5507	-1.5760E-06	1.8044	-.1453754
388.440	1.12E-06	459.3337	-12.9416	-1.2272E-06	1.5949	-.0216952
393.120	-3.85E-06	398.5294	-12.8159	-9.2145E-07	1.3838	.0754241
397.800	-7.50E-06	339.3771	-12.2912	-6.5849E-07	1.1784	.1487956
402.480	-1.00E-05	283.4838	-11.4719	-4.3653E-07	.9843188	.2013351
407.160	-1.16E-05	232.0002	-10.4487	-2.5283E-07	.8055563	.2359449
411.840	-1.24E-05	185.6844	-9.2989	-1.0399E-07	.6447374	.2554203
416.520	-1.26E-05	144.9629	-8.0872	1.3844E-08	.5033433	.2623771
421.200	-1.23E-05	109.9880	-6.8667	1.0470E-07	.3819029	.2591994
425.880	-1.16E-05	80.6903	-5.6799	1.7265E-07	.2801747	.2480035
430.560	-1.06E-05	56.8244	-4.5599	2.2165E-07	.1973071	.2306184
435.240	-9.51E-06	38.0097	-3.5322	2.5545E-07	.1319780	.2085780
439.920	-8.25E-06	23.7633	-2.6156	2.7746E-07	.0825113	.1831264
444.600	-6.91E-06	13.5278	-1.8238	2.9075E-07	.0469714	.1552311
449.280	-5.53E-06	6.6922	-1.1667	2.9796E-07	.0232368	.1256055
453.960	-4.12E-06	2.6077	-.6510698	3.0127E-07	.0090545	.0947383
458.640	-2.71E-06	.5981832	-.2821287	3.0241E-07	.0020770	.0629288
463.320	-1.29E-06	-.0330334	-.0639085	3.0261E-07	.0001147	.0303277
468.000	1.27E-07	0.0000	0.0000	3.0260E-07	0.0000	-.0030164

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

```
Pile-head deflection             =      .50000000 in
Computed slope at pile head      =     -.00004604
Maximum bending moment           =      -1283324. lbs-in
Maximum shear force              =    28001.23463 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             19
Number of zero deflection points =              4
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = 1.000000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-2036707.	39345.7530	0.0000	7071.8995	-187.1558
4.680	.996603	-1854772.	38404.1428	-.0013868	6440.1815	-201.1975
9.360	.987020	-1677244.	37430.5297	-.0026454	5823.7647	-214.8789
14.040	.971842	-1504423.	36393.8176	-.0037793	5223.6893	-228.1604
18.720	.951646	-1336598.	35295.9719	-.0047917	4640.9656	-241.0044
23.400	.926992	-1174052.	34139.1233	-.0056864	4076.5702	-253.3753
28.080	.898422	-1017056.	32925.5660	-.0064672	3531.4441	-265.2389
32.760	.866459	-865869.	31657.7521	-.0071382	3006.4893	-276.5620
37.440	.831608	-720739.	30338.2857	-.0077036	2502.5671	-287.3126
42.120	.794353	-581903.	28969.9190	-.0081678	2020.4951	-297.4595
46.800	.755157	-449581.	27555.5494	-.0085354	1561.0448	-306.9720
51.480	.714462	-323983.	26098.2166	-.0088111	1124.9397	-315.8198
56.160	.672686	-205302.	24601.1012	-.0089997	712.8527	-323.9731
60.840	.630225	-93716.3270	23067.5239	-.0091062	325.4039	-331.4019
65.520	.587452	10610.4369	21500.9451	-.0091358	36.8418	-338.0763
70.200	.544714	107533.	19904.9659	-.0090937	373.3768	-343.9661
74.880	.502334	196921.	18283.3297	-.0089852	683.7532	-349.0408
79.560	.460612	278664.	16639.9249	-.0088158	967.5850	-353.2690
84.240	.419819	352671.	14978.7888	-.0085908	1224.5507	-356.6183
88.920	.380202	418866.	13304.1133	-.0083158	1454.3957	-359.0550
93.600	.341983	477197.	11620.2526	-.0079965	1656.9344	-360.5436
98.280	.305355	527632.	9931.7328	-.0076384	1832.0539	-361.0461
102.960	.270487	570158.	8243.2659	-.0072472	1979.7157	-360.5210
107.640	.237521	604788.	6559.7677	-.0068285	2099.9600	-358.9227
112.320	.206572	631558.	4886.3827	-.0063879	2192.9082	-356.1991
117.000	.177730	650525.	3228.5185	-.0059311	2258.7674	-352.2899
121.680	.151057	661776.	1591.8934	-.0054634	2297.8350	-347.1225
126.360	.126592	665425.	-4.0858	-.0049904	2310.5040	-334.9199
131.040	.104347	661738.	-1534.5509	-.0045175	2297.7023	-319.1250

135.720	.084308	651062.	-2989.2935	-.0040497	2260.6311	-302.5598
140.400	.066442	633758.	-4364.3551	-.0035918	2200.5502	-285.0734
145.080	.050689	610211.	-5654.8661	-.0031485	2118.7895	-266.4271
149.760	.036972	580829.	-6854.4582	-.0027241	2016.7671	-246.2191
154.440	.025192	546054.	-7954.0809	-.0023225	1896.0196	-223.7051
159.120	.015233	506379.	-8939.1731	-.0019475	1758.2594	-197.2745
163.800	.006964	462383.	-9780.3999	-.0016022	1605.4965	-162.2241
168.480	.000236	414834.	-10374.6378	-.0012896	1440.3964	-91.7237
173.160	-.005107	365276.	-10238.0903	-.0010116	1268.3208	150.0774
177.840	-.009233	319006.	-9479.6691	-.0007678	1107.6585	174.0342
182.520	-.012294	276547.	-8850.1565	-.0005555	960.2315	94.9882
187.200	-.014432	236168.	-8358.0529	-.0003728	820.0284	115.3125
191.880	-.015783	198315.	-7783.4099	-.0002180	688.5948	130.2614
196.560	-.016473	163315.	-7150.3239	-8.9124E-05	567.0676	140.2882
201.240	-.016618	131388.	-6480.6545	1.5896E-05	456.2093	145.8953
205.920	-.016324	102657.	-5793.8388	9.9300E-05	356.4463	147.6156
210.600	-.015688	77157.9471	-5106.7902	.0001634	267.9095	145.9949
215.280	-.014795	54856.9878	-4433.8733	.0002104	190.4757	141.5765
219.960	-.013718	35656.8934	-3786.9448	.0002427	123.8087	134.8887
224.640	-.012523	19411.1843	-3175.4512	.0002623	67.3999	126.4334
229.320	-.011263	5934.6704	-2606.5701	.0002713	20.6065	116.6782
234.000	-.009984	-4986.3114	-2085.3877	.0002717	17.3136	106.0493
238.680	-.008720	-13584.5588	-1615.1015	.0002651	47.1686	94.9277
243.360	-.007503	-20103.6619	-1197.2386	.0002531	69.8044	83.6462
248.040	-.006352	-24790.7117	-831.8825	.0002371	86.0789	72.4888
252.720	-.005284	-27890.0818	-517.9016	.0002183	96.8406	61.6910
257.400	-.004309	-29638.2704	-253.1714	.0001978	102.9107	51.4415
262.080	-.003433	-30259.7665	-34.7877	.0001764	105.0686	41.8849
266.760	-.002657	-29963.8830	140.7358	.0001550	104.0413	33.1251
271.440	-.001982	-28942.4799	277.2851	.0001340	100.4947	25.2293
276.120	-.001403	-27368.4944	378.9849	.0001139	95.0295	18.2322
280.800	-.000916	-25395.1810	450.0565	9.5110E-05	88.1777	12.1403
285.480	-.000513	-23155.9659	494.6970	7.7808E-05	80.4027	6.9369
290.160	-.000188	-20764.8168	516.9801	6.2156E-05	72.1001	2.5858
294.840	6.86E-05	-18317.0323	520.7754	4.8229E-05	63.6008	-.9638795
299.520	.000264	-15890.3590	509.6880	3.6039E-05	55.1749	-3.7743
304.200	.000406	-13546.3525	487.0145	2.5549E-05	47.0359	-5.9152
308.880	.000503	-11331.9033	455.7149	1.6683E-05	39.3469	-7.4607
313.560	.000562	-9280.8607	418.3985	9.3378E-06	32.2252	-8.4865
318.240	.000590	-7415.6933	377.3209	3.3878E-06	25.7489	-9.0680
322.920	.000594	-5749.1375	334.3914	-1.3036E-06	19.9623	-9.2779
327.600	.000578	-4285.7901	291.1882	-4.8797E-06	14.8812	-9.1850
332.280	.000548	-3023.6157	248.9796	-7.4845E-06	10.4987	-8.8529
336.960	.000508	-1955.3411	208.7494	-9.2588E-06	6.7894	-8.3395
341.640	.000461	-1069.7214	171.2258	-1.0337E-05	3.7143	-7.6962
346.320	.000411	-352.6675	136.9116	-1.0844E-05	1.2245	-6.9680
351.000	.000360	211.7709	106.1147	-1.0894E-05	.7353157	-6.1931
355.680	.000309	640.5658	78.9786	-1.0590E-05	2.2242	-5.4035
360.360	.000261	951.0110	55.5116	-1.0023E-05	3.3021	-4.6252
365.040	.000216	1160.1542	35.6134	-9.2706E-06	4.0283	-3.8783
369.720	.000174	1284.3525	19.1008	-8.3995E-06	4.4596	-3.1783
374.400	.000137	1338.9380	5.7298	-7.4647E-06	4.6491	-2.5358
379.080	.000104	1337.9833	-4.7848	-6.5107E-06	4.6458	-1.9576
383.760	7.60E-05	1294.1522	-12.7521	-5.5727E-06	4.4936	-1.4472
388.440	5.21E-05	1218.6238	-18.4909	-4.6773E-06	4.2313	-1.0053
393.120	3.22E-05	1121.0772	-22.3182	-3.8435E-06	3.8926	-.6303261
397.800	1.61E-05	1009.7250	-24.5399	-3.0842E-06	3.5060	-.3190880
402.480	3.34E-06	891.3840	-25.4435	-2.4067E-06	3.0951	-.0670578
407.160	-6.44E-06	771.5743	-25.2935	-1.8141E-06	2.6791	.1311424
411.840	-1.36E-05	654.6369	-24.3281	-1.3058E-06	2.2730	.2814071
416.520	-1.87E-05	543.8630	-22.7574	-8.7873E-07	1.8884	.3898516
421.200	-2.19E-05	441.6278	-20.7627	-5.2754E-07	1.5334	.4625671
425.880	-2.36E-05	349.5239	-18.4976	-2.4561E-07	1.2136	.5054237
430.560	-2.42E-05	268.4900	-16.0890	-2.5373E-08	.9322571	.5239181
435.240	-2.38E-05	198.9312	-13.6390	1.4120E-07	.6907333	.5230605
439.920	-2.28E-05	140.8287	-11.2280	2.6227E-07	.4889884	.5072955
444.600	-2.14E-05	93.8371	-8.9167	3.4590E-07	.3258232	.4804535
449.280	-1.96E-05	57.3686	-6.7494	3.9978E-07	.1991966	.4457266
453.960	-1.76E-05	30.6626	-4.7572	4.3115E-07	.1064674	.4056648
458.640	-1.56E-05	12.8417	-2.9604	4.4666E-07	.0445891	.3621888
463.320	-1.35E-05	2.9535	-1.3720	4.5229E-07	.0102552	.3166160
468.000	-1.13E-05	0.0000	0.0000	4.5334E-07	0.0000	.2696970

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.00006483
Maximum bending moment           =      -2036707. lbs-in
Maximum shear force              =    39345.75296 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             15
Number of zero deflection points =              3
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	317101.	9971.9000
4	y= .500000	M= 0.000	0.0000	.5000000	500718.	13877.5105
4	y= 1.000000	M= 0.000	0.0000	1.0000000	790342.	19328.3563
5	y= .250000	S= 0.000	0.0000	.2500000	-810704.	20001.1396
5	y= .500000	S= 0.000	0.0000	.5000000	-1283324.	28001.2346
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-2036707.	39345.7530

The analysis ended normally.

```
==============================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.25)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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==============================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Douglas\
Name of input data file:     Douglas 12 inch Abutment _3D(0.55)Row2.lpd
Name of output file:         Douglas 12 inch Abutment _3D(0.55)Row2.lpo
Name of plot output file:    Douglas 12 inch Abutment _3D(0.55)Row2.lpp
Name of runtime file:        Douglas 12 inch Abutment _3D(0.55)Row2.lpr


------------------------------------------------------------------------------
                           Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  May 11, 2009     Time:  14: 6:21


------------------------------------------------------------------------------
                                Problem Title
------------------------------------------------------------------------------

Douglas Road Abutments1&3 /12-inch Square Concrete Pile/3D(0.55)Row2


------------------------------------------------------------------------------
                                Program Options
------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Pile Length                                =     468.00 in
Depth of ground surface below top of pile =        .00 in
Slope angle of ground surface              =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
           in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   12.00000000    1728.0000     144.0000      3800000.
  2     468.0000   12.00000000    1728.0000     144.0000      3800000.


------------------------------------------------------------------------------
                         Soil and Rock Layering Information
------------------------------------------------------------------------------

The soil profile is modelled using  4 layers

Layer  1 is stiff clay without free water
Distance from top of pile to top of layer    =         .000 in
Distance from top of pile to bottom of layer =      180.000 in

Layer  2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      180.000 in
Distance from top of pile to bottom of layer =      660.000 in
p-y subgrade modulus k for top of soil layer =       75.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       75.000 lbs/in**3

Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      660.000 in
Distance from top of pile to bottom of layer =      840.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      840.000 in
Distance from top of pile to bottom of layer =     1158.000 in


(Depth of lowest layer extends  690.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	.00	.06333
2	180.00	.06366
3	180.00	.06366
4	660.00	.06366
5	660.00	.02755
6	840.00	.02755
7	840.00	.02755
8	1158.00	.02755

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	.000	9.03000	.00	.00600	.0
2	180.000	9.03000	.00	.00600	.0
3	180.000	.00000	33.00	------	------
4	660.000	.00000	33.00	------	------
5	660.000	.00000	32.00	------	------
6	840.000	.00000	32.00	------	------
7	840.000	10.42000	.00	.00600	.0
8	1158.000	10.42000	.00	.00600	.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.5500	1.0000
2	468.000	.5500	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	8032.7232	-.0037520	0.0000	-97.0487
4.680	.232441	36530.3446	7565.6973	-.0037389	126.8415	-102.5350
9.360	.215004	70814.9272	7073.8575	-.0037007	245.8852	-107.6530
14.040	.197802	102742.	6558.9723	-.0036388	356.7418	-112.3834
18.720	.180944	132207.	6022.9015	-.0035551	459.0518	-116.7067
23.400	.164527	159116.	5467.5964	-.0034513	552.4861	-120.6031
28.080	.148640	183384.	4895.1019	-.0033292	636.7486	-124.0526
32.760	.133365	204934.	4307.5578	-.0031909	711.5770	-127.0346
37.440	.118773	223702.	3707.2026	-.0030381	776.7443	-129.5275
42.120	.104928	239634.	3096.3768	-.0028730	832.0610	-131.5091
46.800	.091882	252684.	2477.5288	-.0026976	877.3765	-132.9558
51.480	.079679	262823.	1853.2216	-.0025139	912.5807	-133.8421
56.160	.068352	270031.	1226.1429	-.0023240	937.6062	-134.1402
60.840	.057927	274300.	599.1178	-.0021300	952.4304	-133.8192
65.520	.048416	275638.	-24.8728	-.0019340	957.0776	-132.8434
70.200	.039824	274067.	-642.6664	-.0017381	951.6220	-131.1709
74.880	.032147	269623.	-1250.8809	-.0015444	936.1909	-128.7498
79.560	.025369	262359.	-1845.8573	-.0013548	910.9684	-125.5135
84.240	.019466	252346.	-2423.5668	-.0011714	876.2005	-121.3709
88.920	.014405	239674.	-2979.4549	-.0009960	832.2025	-116.1882
93.600	.010143	224458.	-3508.1536	-.0008306	779.3683	-109.7514
98.280	.006630	206838.	-4002.8901	-.0006769	718.1875	-101.6744
102.960	.003807	186991.	-4454.0420	-.0005366	649.2743	-91.1256
107.640	.001608	165148.	-4844.2323	-.0004111	573.4311	-75.6224
112.320	-4.09E-05	141649.	-4986.2061	-.0003018	491.8368	14.9499
117.000	-.001217	118477.	-4777.7524	-.0002091	411.3794	74.1329
121.680	-.001998	96929.2299	-4402.6051	-.0001323	336.5598	86.1864
126.360	-.002455	77268.8829	-3986.7482	-7.0240E-05	268.2947	91.5302
131.040	-.002655	59613.2663	-3554.1466	-2.1461E-05	206.9905	93.3423
135.720	-.002656	44002.0705	-3117.2923	1.5463E-05	152.7850	93.3476
140.400	-.002511	30435.4102	-2683.5060	4.1990E-05	105.6785	92.0312
145.080	-.002263	18884.4547	-2258.3397	5.9565E-05	65.5710	89.6638
149.760	-.001953	9297.3509	-1846.3440	6.9608E-05	32.2825	86.4028
154.440	-.001612	1602.6753	-1451.5045	7.3493E-05	5.5648	82.3320
159.120	-.001265	-4288.7315	-1077.5667	7.2535E-05	14.8914	77.4705
163.800	-.000933	-8483.3489	-728.3793	6.7984E-05	29.4561	71.7549
168.480	-.000629	-11106.3619	-408.4426	6.1003E-05	38.5638	64.9702
173.160	-.000362	-12306.3720	-124.1935	5.2660E-05	42.7305	56.5038
177.840	-.000136	-12268.8130	131.5569	4.3902E-05	42.6000	52.7912
182.520	4.90E-05	-11074.9993	254.4384	3.5583E-05	38.4549	-.2777873
187.200	.000197	-9887.2698	251.0862	2.8113E-05	34.3308	-1.1548
191.880	.000312	-8724.8324	243.9631	2.1480E-05	30.2946	-1.8893
196.560	.000398	-7603.7752	233.7236	1.5662E-05	26.4020	-2.4865
201.240	.000459	-6537.1790	220.9936	1.0622E-05	22.6985	-2.9537
205.920	.000498	-5535.2748	206.3611	6.3202E-06	19.2197	-3.2996
210.600	.000518	-4605.6394	190.3693	2.7064E-06	15.9918	-3.5345
215.280	.000523	-3753.4179	173.5121	-2.7243E-07	13.0327	-3.6695
219.960	.000515	-2981.5664	156.2299	-2.6725E-06	10.3527	-3.7161
224.640	.000498	-2291.1058	138.9087	-4.5515E-06	7.9552	-3.6862
229.320	.000473	-1681.3808	121.8792	-5.9671E-06	5.8381	-3.5914
234.000	.000442	-1150.3166	105.4179	-6.9762E-06	3.9942	-3.4433
238.680	.000407	-694.6693	89.7492	-7.6337E-06	2.4120	-3.2527
243.360	.000371	-310.2639	75.0481	-7.9918E-06	1.0773	-3.0298
248.040	.000333	7.7814	61.4438	-8.0996E-06	.0270188	-2.7840
252.720	.000295	264.8503	49.0236	-8.0024E-06	.9196191	-2.5238
257.400	.000258	466.6421	37.8373	-7.7418E-06	1.6203	-2.2567
262.080	.000222	619.0074	27.9020	-7.3549E-06	2.1493	-1.9892
266.760	.000189	727.8045	19.2063	-6.8749E-06	2.5271	-1.7269
271.440	.000158	798.7781	11.7152	-6.3309E-06	2.7735	-1.4744
276.120	.000130	837.4592	5.3746	-5.7478E-06	2.9078	-1.2353
280.800	.000104	849.0844	.1149484	-5.1468E-06	2.9482	-1.0124
285.480	8.15E-05	838.5351	-4.1444	-4.5454E-06	2.9116	-.8077887
290.160	6.16E-05	810.2933	-7.4916	-3.9578E-06	2.8135	-.6226654
294.840	4.44E-05	768.4136	-10.0197	-3.3953E-06	2.6681	-.4577054
299.520	2.98E-05	716.5090	-11.8232	-2.8661E-06	2.4879	-.3130084
304.200	1.76E-05	657.7489	-12.9960	-2.3764E-06	2.2839	-.1882088
308.880	7.59E-06	594.8665	-13.6296	-1.9300E-06	2.0655	-.0825585
313.560	-4.51E-07	530.1758	-13.8111	-1.5291E-06	1.8409	.0049941
318.240	-6.72E-06	465.5946	-13.6222	-1.1742E-06	1.6166	.0757304
322.920	-1.14E-05	402.6720	-13.1382	-8.6479E-07	1.3982	.1310945
327.600	-1.48E-05	342.6207	-12.4275	-5.9920E-07	1.1897	.1726321
332.280	-1.71E-05	286.3505	-11.5510	-3.7506E-07	.9942726	.2019377
336.960	-1.83E-05	234.5032	-10.5623	-1.8945E-07	.8142472	.2206087
341.640	-1.88E-05	187.4877	-9.5074	-3.9065E-08	.6509991	.2302068
346.320	-1.87E-05	145.5144	-8.4253	7.9604E-08	.5052583	.2322274
351.000	-1.81E-05	108.6273	-7.3481	1.7017E-07	.3771783	.2280744
355.680	-1.71E-05	76.7357	-6.3019	2.3623E-07	.2664434	.2190429
360.360	-1.59E-05	49.6416	-5.3066	2.8126E-07	.1723667	.2063059
365.040	-1.45E-05	27.0661	-4.3771	3.0860E-07	.0939796	.1909078
369.720	-1.30E-05	8.6720	-3.5238	3.2133E-07	.0301110	.1737609
374.400	-1.15E-05	-5.9164	-2.7530	3.2231E-07	.0205431	.1556460
379.080	-9.96E-06	-17.0958	-2.0677	3.1411E-07	.0593603	.1372168
383.760	-8.52E-06	-25.2697	-1.4681	2.9902E-07	.0877422	.1190054
388.440	-7.16E-06	-30.8372	-.9522820	2.7902E-07	.1070737	.1014310
393.120	-5.91E-06	-34.1831	-.5164804	2.5585E-07	.1186913	.0848090
397.800	-4.77E-06	-35.6715	-.1557223	2.3096E-07	.1238593	.0693612
402.480	-3.75E-06	-35.6407	.1358136	2.0555E-07	.1237523	.0552268
407.160	-2.84E-06	-34.4003	.3644318	1.8059E-07	.1194453	.0424733
411.840	-2.06E-06	-32.2296	.5366093	1.5684E-07	.1119083	.0311069
416.520	-1.38E-06	-29.3776	.6587338	1.3489E-07	.1020055	.0210831
421.200	-7.94E-07	-26.0638	.7368891	1.1513E-07	.0904994	.0123166
425.880	-2.99E-07	-22.4803	.7766863	9.7831E-08	.0780566	.0046907
430.560	1.22E-07	-18.7941	.7831359	8.3123E-08	.0652571	-.0019344
435.240	4.79E-07	-15.1502	.7605607	7.1026E-08	.0526047	-.0077131
439.920	7.86E-07	-11.6752	.7125435	6.1467E-08	.0405389	-.0128070
444.600	1.05E-06	-8.4808	.6419108	5.4284E-08	.0294471	-.0173779
449.280	1.29E-06	-5.6669	.5507477	4.9242E-08	.0196768	-.0215807
453.960	1.52E-06	-3.3258	.4404444	4.6038E-08	.0115478	-.0255574
458.640	1.73E-06	-1.5444	.3117733	4.4302E-08	.0053624	-.0294303
463.320	1.93E-06	-.4075559	.1649955	4.3607E-08	.0014151	-.0332953
468.000	2.13E-06	0.0000	0.0000	4.3461E-08	0.0000	-.0372156

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.25000000	in
Computed slope at pile head	=	-.00375196	
Maximum bending moment	=	275638.33640	lbs-in
Maximum shear force	=	8032.72320	lbs
Depth of maximum bending moment	=	65.52000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	17	
Number of zero deflection points	=	4	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	11172.0007	-.0066677	0.0000	-115.4110
4.680	.468795	51021.0741	10616.0117	-.0066495	177.1565	-122.1911
9.360	.437761	99365.8695	10029.1724	-.0065959	345.0204	-128.5949
14.040	.407058	144894.	9413.2870	-.0065088	503.1046	-134.6040
18.720	.376838	187474.	8770.2458	-.0063904	650.9522	-140.2000
23.400	.347244	226984.	8102.0257	-.0062427	788.1376	-145.3642
28.080	.318406	263309.	7410.6913	-.0060680	914.2680	-150.0779
32.760	.290447	296348.	6698.3963	-.0058685	1028.9851	-154.3217
37.440	.263477	326006.	5967.3855	-.0056468	1131.9659	-158.0761
42.120	.237594	352202.	5219.9975	-.0054051	1222.9251	-161.3205
46.800	.212885	374865.	4458.6684	-.0051460	1301.6158	-164.0338
51.480	.189427	393936.	3685.9364	-.0048720	1367.8318	-166.1935
56.160	.167283	409366.	2904.4480	-.0045857	1421.4088	-167.7759
60.840	.146505	421121.	2116.9660	-.0042898	1462.2264	-168.7549
65.520	.127131	429181.	1326.3802	-.0039868	1490.2102	-169.1022
70.200	.109188	433536.	535.7222	-.0036793	1505.3337	-168.7858
74.880	.092692	434195.	-251.8153	-.0033701	1507.6211	-167.7687
79.560	.077644	431179.	-1032.8503	-.0030617	1497.1497	-166.0069
84.240	.064034	424527.	-1803.7711	-.0027568	1474.0535	-163.4464
88.920	.051840	414296.	-2560.6773	-.0024579	1438.5272	-160.0177
93.600	.041028	400559.	-3299.2856	-.0021675	1390.8315	-155.6269
98.280	.031553	383415.	-4014.7794	-.0018881	1331.3004	-150.1397
102.960	.023356	362981.	-4701.5436	-.0016221	1260.3512	-143.3493
107.640	.016369	339408.	-5352.6626	-.0013718	1178.5002	-134.9067
112.320	.010515	312880.	-5958.8348	-.0011394	1086.3896	-124.1412
117.000	.005705	283633.	-6505.4622	-.0009268	984.8381	-109.4603
121.680	.001840	251989.	-6960.1141	-.0007359	874.9621	-84.8354
126.360	-.001183	218487.	-6980.7724	-.0005683	758.6344	76.0071
131.040	-.003479	186649.	-6569.2961	-.0004239	648.0870	99.8375
135.720	-.005151	156998.	-6077.8233	-.0003014	545.1323	110.1936
140.400	-.006300	129761.	-5548.7464	-.0001992	450.5577	115.9076
145.080	-.007016	105062.	-4998.8677	-.0001156	364.7980	119.0833
149.760	-.007382	82971.2299	-4437.9768	-4.8558E-05	288.0945	120.6137
154.440	-.007471	63522.3627	-3872.6464	3.6464E-06	220.5638	120.9805
159.120	-.007348	46723.2593	-3307.6215	4.2933E-05	162.2335	120.4831
163.800	-.007069	32563.0254	-2746.4683	7.1188E-05	113.0661	119.3260
168.480	-.006681	21016.3165	-2191.9257	9.0281E-05	72.9733	117.6580
173.160	-.006224	12046.6006	-1646.1224	.0001021	41.8285	115.5913
177.840	-.005726	5608.6106	-1110.7304	.0001084	19.4743	113.2088
182.520	-.005209	1650.1643	-776.7506	.0001109	5.7297	29.5176
187.200	-.004687	-1661.7747	-643.4111	.0001109	5.7701	27.4650
191.880	-.004171	-4372.1635	-520.0709	.0001088	15.1811	25.2444
196.560	-.003669	-6529.6383	-407.3765	.0001049	22.6724	22.9155
201.240	-.003189	-8185.2076	-305.7066	9.9659E-05	28.4209	20.5331
205.920	-.002736	-9391.0524	-215.1966	9.3395E-05	32.6078	18.1464
210.600	-.002315	-10199.4478	-135.7653	8.6414E-05	35.4147	15.7986
215.280	-.001928	-10661.8156	-67.1436	7.8980E-05	37.0202	13.5269
219.960	-.001576	-10827.9121	-8.9037	7.1322E-05	37.5969	11.3620
224.640	-.001260	-10745.1538	39.5124	6.3634E-05	37.3096	9.3286
229.320	-.000980	-10458.0757	78.7644	5.6078E-05	36.3128	7.4457
234.000	-.000735	-10007.9194	109.5869	4.8785E-05	34.7497	5.7264
238.680	-.000523	-9432.3419	132.7654	4.1857E-05	32.7512	4.1789
243.360	-.000343	-8765.2355	149.1126	3.5372E-05	30.4348	2.8070
248.040	-.000192	-8036.6482	159.4490	2.9385E-05	27.9050	1.6103
252.720	-6.83E-05	-7272.7926	164.5852	2.3929E-05	25.2528	.5847060
257.400	3.16E-05	-6496.1305	165.3067	1.9022E-05	22.5560	-.2763768
262.080	.000110	-5725.5217	162.3618	1.4667E-05	19.8803	-.9821292
266.760	.000169	-4976.4239	156.4518	1.0853E-05	17.2792	-1.5435
271.440	.000211	-4261.1324	148.2238	7.5616E-06	14.7956	-1.9727
276.120	.000240	-3589.0488	138.2654	4.7641E-06	12.4620	-2.2830
280.800	.000256	-2966.9681	127.1018	2.4278E-06	10.3020	-2.4878
285.480	.000262	-2399.3760	115.1945	5.1542E-07	8.3312	-2.6008
290.160	.000261	-1888.7472	102.9420	-1.0127E-06	6.5582	-2.6354
294.840	.000253	-1435.8392	90.6808	-2.1974E-06	4.9856	-2.6044
299.520	.000240	-1039.9749	78.6890	-3.0797E-06	3.6110	-2.5202
304.200	.000224	-699.3098	67.1896	-3.6995E-06	2.4282	-2.3941
308.880	.000206	-411.0803	56.3546	-4.0952E-06	1.4274	-2.2363
313.560	.000186	-171.8307	46.3103	-4.3030E-06	.5966345	-2.0562
318.240	.000165	22.3836	37.1418	-4.3562E-06	.0777209	-1.8620
322.920	.000145	175.8167	28.8988	-4.2856E-06	.6104745	-1.6607
327.600	.000125	292.8763	21.6000	-4.1186E-06	1.0169	-1.4584
332.280	.000106	377.9927	15.2387	-3.8795E-06	1.3125	-1.2601
336.960	8.89E-05	435.5102	9.7870	-3.5896E-06	1.5122	-1.0697
341.640	7.28E-05	469.5990	5.2007	-3.2670E-06	1.6306	-.8902654
346.320	5.83E-05	484.1889	1.4231	-2.9272E-06	1.6812	-.7241040
351.000	4.54E-05	482.9192	-1.6115	-2.5825E-06	1.6768	-.5727168
355.680	3.41E-05	469.1056	-3.9742	-2.2433E-06	1.6288	-.4369847
360.360	2.44E-05	445.7210	-5.7391	-1.9172E-06	1.5476	-.3172417
365.040	1.62E-05	415.3881	-6.9807	-1.6104E-06	1.4423	-.2133647
369.720	9.33E-06	380.3820	-7.7721	-1.3268E-06	1.3208	-.1248602
374.400	3.75E-06	342.6411	-8.1835	-1.0691E-06	1.1897	-.0509449
379.080	-6.81E-07	303.7844	-8.2808	-8.3878E-07	1.0548	.0093805
383.760	-4.10E-06	265.1331	-8.1248	-6.3604E-07	.9206011	.0572644
388.440	-6.63E-06	227.7361	-7.7710	-4.6040E-07	.7907503	.0939454
393.120	-8.41E-06	192.3967	-7.2687	-3.1069E-07	.6680441	.1207018
397.800	-9.54E-06	159.7010	-6.6615	-1.8521E-07	.5545173	.1388084
402.480	-1.01E-05	130.0455	-5.9868	-8.1959E-08	.4515468	.1495009
407.160	-1.03E-05	103.6644	-5.2767	1.3262E-09	.3599459	.1539480
411.840	-1.01E-05	80.6552	-4.5579	6.7010E-08	.2800528	.1532293

416.520	-9.68E-06	61.0021	-3.8523	1.1749E-07	.2118127	.1483204
421.200	-9.03E-06	44.5975	-3.1775	1.5512E-07	.1548524	.1400822
425.880	-8.23E-06	31.2610	-2.5472	1.8216E-07	.1085453	.1292562
430.560	-7.33E-06	20.7556	-1.9722	2.0069E-07	.0720682	.1164635
435.240	-6.35E-06	12.8011	-1.4605	2.1265E-07	.0444481	.1022076
439.920	-5.34E-06	7.0851	-1.0181	2.1974E-07	.0246009	.0868803
444.600	-4.30E-06	3.2720	-.6491613	2.2343E-07	.0113610	.0707712
449.280	-3.24E-06	1.0089	-.3570130	2.2495E-07	.0035032	.0540785
453.960	-2.19E-06	-.0696848	-.1440689	2.2529E-07	.0002420	.0369233
458.640	-1.14E-06	-.3395732	-.0123548	2.2514E-07	.0011791	.0193648
463.320	-8.23E-08	-.1853253	.0362792	2.2496E-07	.0006435	.0014189
468.000	9.70E-07	0.0000	0.0000	2.2489E-07	0.0000	-.0169228

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      .50000000 in
Computed slope at pile head      =     -.00666766
Maximum bending moment           =   434194.88822 lbs-in
Maximum shear force              =    11172.00073 lbs
Depth of maximum bending moment  =    74.88000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             19
Number of zero deflection points =              4
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	15605.5704	-.0118764	0.0000	-137.2476
4.680	.944418	71531.0434	14943.7671	-.0118509	248.3717	-145.5743
9.360	.889075	139874.	14243.8997	-.0117756	485.6724	-153.5143
14.040	.834199	204854.	13507.8193	-.0116528	711.2984	-161.0500
18.720	.780005	266307.	12737.4587	-.0114849	924.6766	-168.1639
23.400	.726700	324077.	11934.8333	-.0112745	1125.2658	-174.8383
28.080	.674476	378017.	11102.0419	-.0110243	1312.5586	-181.0554
32.760	.623513	427992.	10241.2673	-.0107370	1486.0822	-186.7970
37.440	.573978	473875.	9354.7780	-.0104157	1645.3998	-192.0446
42.120	.526023	515552.	8444.9302	-.0100631	1790.1125	-196.7792
46.800	.479787	552920.	7514.1705	-.0096823	1919.8601	-200.9813
51.480	.435396	585885.	6565.0388	-.0092765	2034.3230	-204.6305
56.160	.392960	614368.	5600.1724	-.0088488	2133.2238	-207.7055
60.840	.352572	638303.	4622.3117	-.0084024	2216.3286	-210.1837
65.520	.314314	657633.	3634.3067	-.0079405	2283.4489	-212.0407
70.200	.278249	672320.	2639.1257	-.0074666	2334.4436	-213.2503
74.880	.244426	682336.	1639.8666	-.0069838	2369.2205	-213.7835
79.560	.212880	687669.	639.7722	-.0064956	2387.7393	-213.6073
84.240	.183627	688324.	-357.7498	-.0060053	2390.0131	-212.6841
88.920	.156670	684320.	-1349.0991	-.0055161	2376.1124	-210.9694
93.600	.131996	675696.	-2330.4437	-.0050315	2346.1674	-208.4087
98.280	.109576	662507.	-3297.6646	-.0045546	2300.3730	-204.9336
102.960	.089365	644830.	-4246.2718	-.0040887	2238.9933	-200.4541
107.640	.071306	622762.	-5171.2760	-.0036370	2162.3691	-194.8468
112.320	.055323	596427.	-6066.9776	-.0032025	2070.9268	-187.9317
117.000	.041330	565975.	-6926.6017	-.0027883	1965.1924	-179.4290
121.680	.029225	531594.	-7741.6007	-.0023972	1845.8123	-168.8612
126.360	.018893	493514.	-8494.0718	-.0020319	1713.5903	-152.7076
131.040	.010207	452089.	-9157.8544	-.0016949	1569.7550	-130.9601
135.720	.003029	407796.	-9690.8230	-.0013884	1415.9601	-96.8042
140.400	-.002789	361383.	-9696.4363	-.0011143	1254.8032	94.4054
145.080	-.007402	317038.	-9193.1614	-.0008726	1100.8259	120.6693
149.760	-.010957	275335.	-8599.2445	-.0006615	956.0255	133.1413
154.440	-.013593	236549.	-7958.8455	-.0004791	821.3504	140.5334
159.120	-.015441	200841.	-7290.4789	-.0003232	697.3630	145.0933
163.800	-.016618	168310.	-6605.1298	-.0001916	584.4099	147.7909
168.480	-.017235	139017.	-5910.2946	-8.2131E-05	482.6963	149.1472
173.160	-.017387	112990.	-5211.5073	7.6743E-06	392.3253	149.4799
177.840	-.017163	90236.8157	-4513.0683	8.0096E-05	313.3223	148.9983
182.520	-.016637	70747.3665	-3943.8197	.0001375	245.6506	94.2703
187.200	-.015876	53322.6634	-3505.5571	.0001817	185.1481	93.0214
191.880	-.014937	37935.3518	-3076.3463	.0002142	131.7200	90.4021
196.560	-.013871	24528.0621	-2662.0916	.0002365	85.1669	86.6299
201.240	-.012724	13018.1743	-2267.6863	.0002498	45.2020	81.9194
205.920	-.011533	3302.5188	-1897.0362	.0002557	11.4671	76.4780
210.600	-.010331	-4738.0849	-1553.1040	.0002551	16.4517	70.5016
215.280	-.009145	-11234.5350	-1237.9680	.0002495	39.0088	64.1720
219.960	-.007996	-16325.4651	-952.8939	.0002396	56.6856	57.6546
224.640	-.006902	-20153.6219	-698.4156	.0002266	69.9779	51.0968
229.320	-.005875	-22862.6353	-474.4212	.0002113	79.3842	44.6273
234.000	-.004924	-24594.2043	-280.2421	.0001944	85.3965	38.3552
238.680	-.004055	-25485.7016	-114.7428	.0001765	88.4920	32.3710
243.360	-.003271	-25668.1971	23.5916	.0001583	89.1257	26.7463
248.040	-.002573	-25264.8846	136.5711	.0001402	87.7253	21.5356
252.720	-.001959	-24389.8917	226.2220	.0001225	84.6871	16.7768
257.400	-.001427	-23147.4465	294.7141	.0001055	80.3731	12.4933
262.080	-.000972	-21631.3679	344.2949	8.9570E-05	75.1089	8.6951
266.760	-.000589	-19924.8460	377.2321	7.4761E-05	69.1835	5.3806
271.440	-.000272	-18100.4752	395.7632	6.1210E-05	62.8489	2.5386
276.120	-1.57E-05	-16220.5026	402.0535	4.8979E-05	56.3212	.1495363
280.800	.000186	-14337.2548	398.1619	3.8090E-05	49.7821	-1.8126
285.480	.000341	-12493.7071	386.0143	2.8528E-05	43.3809	-3.3787
290.160	.000454	-10724.1610	367.3834	2.0254E-05	37.2367	-4.5832
294.840	.000530	-9054.9988	343.8755	1.3206E-05	31.4410	-5.4629
299.520	.000577	-7505.4865	316.9230	7.3045E-06	26.0607	-6.0553
304.200	.000599	-6088.5995	287.7818	2.4601E-06	21.1410	-6.3982
308.880	.000600	-4811.8489	257.5330	-1.4244E-06	16.7078	-6.5286
313.560	.000585	-3678.0905	227.0887	-4.4498E-06	12.7711	-6.4818
318.240	.000558	-2686.2990	197.2000	-6.7179E-06	9.3274	-6.2911
322.920	.000523	-1832.2986	168.4682	-8.3281E-06	6.3621	-5.9874
327.600	.000481	-1109.4366	141.3570	-9.3764E-06	3.8522	-5.5986
332.280	.000435	-509.1969	116.2060	-9.9532E-06	1.7680	-5.1497
336.960	.000387	-21.7482	93.2449	-1.0142E-05	.0755144	-4.6627
341.640	.000340	363.5754	72.6077	-1.0021E-05	1.2624	-4.1566

346.320	.000294	657.8602	54.3471	-9.6566E-06	2.2842	-3.6471
351.000	.000249	872.2644	38.4478	-9.1114E-06	3.0287	-3.1475
355.680	.000208	1017.7313	24.8393	-8.4378E-06	3.5338	-2.6681
360.360	.000171	1104.7607	13.4084	-7.6815E-06	3.8360	-2.2169
365.040	.000136	1143.2341	4.0093	-6.8804E-06	3.9696	-1.7998
369.720	.000106	1142.2876	-3.5263	-6.0659E-06	3.9663	-1.4206
374.400	7.96E-05	1110.2276	-9.3808	-5.2632E-06	3.8550	-1.0814
379.080	5.68E-05	1054.4832	-13.7433	-4.4918E-06	3.6614	-.7829518
383.760	3.76E-05	981.5903	-16.8036	-3.7662E-06	3.4083	-.5248736
388.440	2.16E-05	897.2014	-18.7472	-3.0967E-06	3.1153	-.3057208
393.120	8.59E-06	806.1164	-19.7512	-2.4897E-06	2.7990	-.1233494
397.800	-1.71E-06	712.3298	-19.9815	-1.9486E-06	2.4734	.0249269
402.480	-9.64E-06	619.0892	-19.5906	-1.4741E-06	2.1496	.1421618
407.160	-1.55E-05	528.9622	-18.7159	-1.0650E-06	1.8367	.2316234
411.840	-1.96E-05	443.9084	-17.4797	-7.1830E-07	1.5413	.2966629
416.520	-2.22E-05	365.3522	-15.9885	-4.2991E-07	1.2686	.3406042
421.200	-2.36E-05	294.2560	-14.3335	-1.9485E-07	1.0217	.3666543
425.880	-2.41E-05	231.1904	-12.5914	-7.6060E-09	.8027445	.3778318
430.560	-2.37E-05	176.4003	-10.8253	1.3764E-07	.6125010	.3769125
435.240	-2.28E-05	129.8655	-9.0860	2.4678E-07	.4509217	.3663903
439.920	-2.14E-05	91.3554	-7.4133	3.2562E-07	.3172064	.3484521
444.600	-1.97E-05	60.4774	-5.8375	3.7972E-07	.2099908	.3249635
449.280	-1.78E-05	36.7168	-4.3810	4.1436E-07	.1274887	.2974650
453.960	-1.58E-05	19.4714	-3.0597	4.3438E-07	.0676089	.2671762
458.640	-1.38E-05	8.0778	-1.8846	4.4420E-07	.0280478	.2350073
463.320	-1.17E-05	1.8314	-.8630078	4.4773E-07	.0063589	.2015761
468.000	-9.59E-06	0.0000	0.0000	4.4839E-07	0.0000	.1672306

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.01187643
Maximum bending moment           =   688323.78157 lbs-in
Maximum shear force              =    15605.57042 lbs
Depth of maximum bending moment  =    84.24000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             21
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	-703890.	16142.1618	0.0000	2444.0635	-97.0487
4.680	.248826	-629487.	15654.0252	-.0004752	2185.7192	-104.2960
9.360	.245552	-557368.	15149.5892	-.0008981	1935.3067	-111.2884
14.040	.240420	-487687.	14613.0521	-.0012705	1693.3576	-118.0010
18.720	.233660	-420590.	14045.8111	-.0015942	1460.3825	-124.4097
23.400	.225498	-356218.	13449.3415	-.0018710	1236.8687	-130.4918
28.080	.216148	-294704.	12825.2240	-.0021030	1023.2789	-136.2251
32.760	.205814	-236174.	12175.1410	-.0022922	820.0490	-141.5882
37.440	.194693	-180745.	11500.8740	-.0024407	627.5868	-146.5601
42.120	.182969	-128526.	10804.3022	-.0025510	446.2706	-151.1202
46.800	.170816	-79616.7324	10087.4008	-.0026251	276.4470	-155.2479
51.480	.158398	-34107.8479	9352.2407	-.0026657	118.4300	-158.9230
56.160	.145866	7920.2408	8600.9884	-.0026750	27.5008	-162.1250
60.840	.133360	46397.4039	7835.9068	-.0026556	161.1021	-164.8330
65.520	.121009	81264.3288	7059.3569	-.0026101	282.1678	-167.0260
70.200	.108929	112473.	6273.8002	-.0025411	390.5312	-168.6820
74.880	.097224	139987.	5481.8025	-.0024511	486.0663	-169.7785
79.560	.085986	163783.	4686.0395	-.0023429	568.6898	-170.2912
84.240	.075295	183848.	3889.3037	-.0022190	638.3626	-170.1942
88.920	.065217	200187.	3094.5148	-.0020821	695.0921	-169.4591
93.600	.055806	212813.	2304.7342	-.0019350	738.9343	-168.0539
98.280	.047105	221759.	1523.1852	-.0017801	769.9960	-165.9414
102.960	.039144	227070.	753.2825	-.0016202	788.4378	-163.0768
107.640	.031941	228810.	-1.3228	-.0014577	794.4777	-159.4041
112.320	.025500	227058.	-736.6745	-.0012952	788.3949	-154.8488
117.000	.019817	221914.	-1448.3985	-.0011353	770.5358	-149.3068
121.680	.014874	213501.	-2131.5090	-.0009801	741.3219	-142.6208
126.360	.010644	201963.	-2774.7910	-.0008320	701.2617	-132.2860
131.040	.007086	187529.	-3363.9896	-.0006932	651.1412	-119.5083
135.720	.004155	170476.	-3888.4013	-.0005657	591.9321	-104.5993
140.400	.001792	151133.	-4331.6570	-.0004510	524.7682	-84.8262
145.080	-6.69E-05	129932.	-4469.3683	-.0003509	451.1532	25.9752
149.760	-.001492	109300.	-4219.4956	-.0002656	379.5137	80.8080
154.440	-.002553	90437.6465	-3814.0121	-.0001945	314.0196	92.4756
159.120	-.003312	73600.7883	-3366.6292	-.0001360	255.5583	98.7137
163.800	-.003826	58925.9976	-2896.1493	-8.8770E-05	204.6042	102.3460
168.480	-.004143	46492.8307	-2412.3416	-5.1203E-05	161.4334	104.4094
173.160	-.004305	36346.4803	-1921.3424	-2.1682E-05	126.2031	105.4193
177.840	-.004346	28509.0656	-1427.3912	1.4299E-06	98.9898	105.6710
182.520	-.004292	22986.0990	-1123.2137	1.9781E-05	79.8128	24.3194
187.200	-.004161	17995.7855	-1009.2549	3.4385E-05	62.4854	24.3809
191.880	-.003970	13539.4730	-895.9765	4.5623E-05	47.0121	24.0287
196.560	-.003734	9609.4458	-785.1792	5.3872E-05	33.3661	23.3206
201.240	-.003466	6190.1958	-678.3918	5.9503E-05	21.4937	22.3150
205.920	-.003177	3259.6985	-576.8732	6.2870E-05	11.3184	21.0690
210.600	-.002877	790.6629	-481.6205	6.4313E-05	2.7454	19.6373
215.280	-.002575	-1248.2696	-393.3824	6.4150E-05	4.3343	18.0713
219.960	-.002277	-2891.3968	-312.6759	6.2675E-05	10.0396	16.4187
224.640	-.001989	-4174.9156	-239.8059	6.0157E-05	14.4962	14.7223
229.320	-.001714	-5135.9801	-174.8880	5.6839E-05	17.8333	13.0204
234.000	-.001457	-5811.8673	-117.8710	5.2938E-05	20.1801	11.3459
238.680	-.001218	-6239.2530	-68.5613	4.8643E-05	21.6641	9.7267
243.360	-.001001	-6453.6009	-26.6462	4.4120E-05	22.4083	8.1858
248.040	-.000805	-6488.6610	8.2827	3.9508E-05	22.5301	6.7411
252.720	-.000631	-6376.0747	36.7074	3.4923E-05	22.1391	5.4062
257.400	-.000479	-6145.0801	59.1630	3.0461E-05	21.3371	4.1903
262.080	-.000346	-5822.3087	76.2193	2.6197E-05	20.2163	3.0987
266.760	-.000233	-5431.6676	88.4631	2.2186E-05	18.8600	2.1337
271.440	-.000139	-4994.2944	96.4840	1.8471E-05	17.3413	1.2941

276.120	-6.05E-05	-4528.5773	100.8616	1.5077E-05	15.7242	.5766575
280.800	2.48E-06	-4050.2301	102.1545	1.2020E-05	14.0633	-.0241156
285.480	5.20E-05	-3572.4110	100.8923	9.3036E-06	12.4042	-.5152913
290.160	8.96E-05	-3105.8781	97.5685	6.9238E-06	10.7843	-.9051528
294.840	.000117	-2659.1701	92.6358	4.8693E-06	9.2332	-1.2028
299.520	.000135	-2238.8070	86.5032	3.1239E-06	7.7736	-1.4179
304.200	.000146	-1849.5003	79.5340	1.6670E-06	6.4219	-1.5604
308.880	.000151	-1494.3691	72.0455	4.7535E-07	5.1888	-1.6399
313.560	.000150	-1175.1547	64.3098	-4.7596E-07	4.0804	-1.6660
318.240	.000146	-892.4298	56.5553	-1.2128E-06	3.0987	-1.6479
322.920	.000139	-645.7972	48.9692	-1.7609E-06	2.2424	-1.5940
327.600	.000130	-434.0779	41.7003	-2.1457E-06	1.5072	-1.5123
332.280	.000119	-255.4822	34.8624	-2.3915E-06	.8870911	-1.4099
336.960	.000107	-107.7663	28.5376	-2.5209E-06	.3741885	-1.2930
341.640	9.54E-05	11.6296	22.7805	-2.5552E-06	.0403806	-1.1673
346.320	8.35E-05	105.4596	17.6217	-2.5135E-06	.3661792	-1.0374
351.000	7.19E-05	176.5686	13.0711	-2.4130E-06	.6130854	-.9073123
355.680	6.09E-05	227.8053	9.1221	-2.2689E-06	.7909906	-.7803204
360.360	5.07E-05	261.9511	5.7541	-2.0943E-06	.9095524	-.6589617
365.040	4.13E-05	281.6640	2.9365	-1.9006E-06	.9780002	-.5451792
369.720	3.29E-05	289.4363	.6302913	-1.6971E-06	1.0050	-.4403591
374.400	2.54E-05	287.5636	-1.2084	-1.4915E-06	.9984846	-.3453979
379.080	1.89E-05	278.1258	-2.6268	-1.2899E-06	.9657147	-.2607684
383.760	1.34E-05	262.9766	-3.6736	-1.0970E-06	.9131133	-.1865865
388.440	8.66E-06	243.7408	-4.3973	-9.1647E-07	.8463221	-.1226739
393.120	4.78E-06	221.8180	-4.8449	-7.5057E-07	.7702015	-.0686178
397.800	1.64E-06	198.3924	-5.0612	-6.0082E-07	.6888624	-.0238253
402.480	-8.43E-07	174.4449	-5.0879	-4.6796E-07	.6057115	.0124268
407.160	-2.74E-06	150.7696	-4.9630	-3.5206E-07	.5235057	.0409481
411.840	-4.14E-06	127.9912	-4.7207	-2.5272E-07	.4444139	.0625960
416.520	-5.11E-06	106.5838	-4.3911	-1.6913E-07	.3700826	.0782432
421.200	-5.72E-06	86.8901	-4.0004	-1.0018E-07	.3017017	.0887500
425.880	-6.05E-06	69.1402	-3.5705	-4.4582E-08	.2400702	.0949421
430.560	-6.14E-06	53.4698	-3.1200	-8.8858E-10	.1856590	.0975930
435.240	-6.05E-06	39.9369	-2.6637	3.2398E-08	.1386698	.0974101
439.920	-5.84E-06	28.5375	-2.2134	5.6799E-08	.0990887	.0950252
444.600	-5.52E-06	19.2194	-1.7781	7.3818E-08	.0667342	.0909876
449.280	-5.14E-06	11.8942	-1.3645	8.4906E-08	.0412993	.0857603
453.960	-4.73E-06	6.4473	-.9773251	9.1442E-08	.0223865	.0797183
458.640	-4.29E-06	2.7464	-.6196171	9.4718E-08	.0095362	.0731484
463.320	-3.84E-06	.6476885	-.2934225	9.5928E-08	.0022489	.0662511
468.000	-3.39E-06	0.0000	0.0000	9.6158E-08	0.0000	.0591432

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =      .25000000 in
Computed slope at pile head      =     -.00002651
Maximum bending moment           =  -703890.29488 lbs-in
Maximum shear force              =    16142.16178 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             16
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .500000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-1117655.	22664.2742	0.0000	3880.7456	-115.4110
4.680	.498136	-1012945.	22083.5980	-.0007593	3517.1685	-124.0596
9.360	.492893	-910952.	21483.4068	-.0014449	3163.0261	-132.4653
14.040	.484612	-811860.	20844.4295	-.0020588	2818.9578	-140.6020
18.720	.473623	-715848.	20168.0594	-.0026032	2485.5822	-148.4451
23.400	.460246	-623087.	19455.7252	-.0030804	2163.4958	-155.9712
28.080	.444791	-533742.	18708.9635	-.0034926	1853.2711	-163.1577
32.760	.427555	-447971.	17929.4144	-.0038424	1555.4545	-169.9829
37.440	.408826	-365923.	17118.8189	-.0041325	1270.5651	-176.4255
42.120	.388875	-287739.	16279.0159	-.0043654	999.0929	-182.4647
46.800	.367965	-213551.	15411.9410	-.0045441	741.4971	-188.0802
51.480	.346343	-143483.	14519.6246	-.0046713	498.2048	-193.2517
56.160	.324242	-77647.4806	13604.1916	-.0047501	269.6093	-197.9590
60.840	.301882	-16147.7528	12667.8614	-.0047835	56.0686	-202.1821
65.520	.279468	40923.7024	11712.9484	-.0047747	142.0962	-205.9004
70.200	.257191	93485.4442	10741.8630	-.0047268	324.6022	-209.0933
74.880	.235225	141468.	9757.1141	-.0046431	491.2067	-211.7395
79.560	.213732	184812.	8761.3118	-.0045268	641.7084	-213.8170
84.240	.192855	223473.	7757.1722	-.0043813	775.9494	-215.3025
88.920	.172723	257419.	6747.5228	-.0042099	893.8165	-216.1716
93.600	.153450	286630.	5735.3109	-.0040160	995.2439	-216.3976
98.280	.135133	311102.	4723.6140	-.0038030	1080.2141	-215.9515
102.960	.117853	330843.	3715.6553	-.0035743	1148.7613	-214.8001
107.640	.101677	345880.	2714.8235	-.0033331	1200.9729	-212.9057
112.320	.086655	356254.	1724.7024	-.0030829	1236.9931	-210.2230
117.000	.072821	362023.	749.1119	-.0028269	1257.0258	-206.6961
121.680	.060195	363266.	-207.8299	-.0025685	1261.3392	-202.2534
126.360	.048780	360078.	-1133.9233	-.0023107	1250.2713	-193.5130
131.040	.038567	352652.	-2013.7375	-.0020567	1224.4867	-182.4760
135.720	.029529	341230.	-2840.1577	-.0018094	1184.8248	-170.6950
140.400	.021630	326068.	-3609.1099	-.0015717	1132.1816	-157.9170
145.080	.014819	307448.	-4314.8309	-.0013459	1067.5288	-143.6731
149.760	.009033	285681.	-4948.0970	-.0011345	991.9496	-126.9534
154.440	.004200	261134.	-5490.4995	-.0009397	906.7156	-104.8426
159.120	.000238	234290.	-5951.6471	-.0007631	813.5083	-92.2291
163.800	-.002943	205427.	-5943.0989	-.0006064	713.2871	95.8822
168.480	-.005438	178663.	-5457.1107	-.0004695	620.3576	111.8051
173.160	-.007338	154348.	-4913.5060	-.0003509	535.9310	120.5046
177.840	-.008723	132673.	-4337.0859	-.0002486	460.6687	125.8288
182.520	-.009665	113753.	-3914.5030	-.0001608	394.9757	54.7621
187.200	-.010227	96032.8340	-3646.1355	-8.6011E-05	333.4473	59.9248
191.880	-.010470	79625.1688	-3357.6346	-2.3413E-05	276.4763	63.3661
196.560	-.010447	64605.3742	-3056.6908	2.7985E-05	224.3242	65.2423
201.240	-.010208	51014.5425	-2750.2342	6.9187E-05	177.1338	65.7221

205.920	-.009799	38863.1820	-2444.3884	.0001012	134.9416	64.9813
210.600	-.009260	28135.0672	-2144.4490	.0001251	97.6912	63.1979
215.280	-.008628	18791.1391	-1854.8832	.0001418	65.2470	60.5481
219.960	-.007933	10773.3608	-1579.3472	.0001523	37.4075	57.2022
224.640	-.007202	4008.4490	-1320.7206	.0001576	13.9182	53.3219
229.320	-.006458	-1588.5842	-1081.1519	.0001585	5.5159	49.0579
234.000	-.005719	-6111.1325	-862.1150	.0001557	21.2192	44.5477
238.680	-.005000	-9657.9803	-664.4728	.0001501	33.5347	39.9148
243.360	-.004314	-12330.5975	-488.5451	.0001423	42.8146	35.2679
248.040	-.003668	-14230.7627	-334.1798	.0001328	49.4124	30.7002
252.720	-.003071	-15458.5205	-200.8236	.0001222	53.6754	26.2897
257.400	-.002524	-16110.4712	-87.5922	.0001110	55.9391	22.0998
262.080	-.002032	-16278.3834	6.6621	9.9443E-05	56.5222	18.1798
266.760	-.001593	-16048.1136	83.2875	8.7923E-05	55.7226	14.5660
271.440	-.001209	-15498.8128	143.7734	7.6681E-05	53.8153	11.2827
276.120	-.000876	-14702.3945	189.6982	6.5918E-05	51.0500	8.3433
280.800	-.000592	-13723.2380	222.6812	5.5789E-05	47.6501	5.7520
285.480	-.000354	-12618.0985	244.3423	4.6402E-05	43.8128	3.5049
290.160	-.000157	-11436.1938	256.2670	3.7830E-05	39.7090	1.5911
294.840	5.32E-07	-10219.4398	259.9774	3.0112E-05	35.4842	-.0054817
299.520	.000124	-9002.8058	256.9098	2.3262E-05	31.2597	-1.3054
304.200	.000218	-7814.7636	248.3976	1.7269E-05	27.1346	-2.3323
308.880	.000286	-6677.8045	235.6582	1.2105E-05	23.1868	-3.1119
313.560	.000332	-5609.0029	219.7863	7.7263E-06	19.4757	-3.6710
318.240	.000358	-4620.6051	201.7497	4.0808E-06	16.0438	-4.0370
322.920	.000370	-3720.6262	182.3894	1.1084E-06	12.9188	-4.2367
327.600	.000369	-2913.4404	162.4225	-1.2557E-06	10.1161	-4.2962
332.280	.000358	-2200.3516	142.4473	-3.0781E-06	7.6401	-4.2402
336.960	.000340	-1580.1338	122.9504	-4.4253E-06	5.4866	-4.0918
341.640	.000317	-1049.5356	104.3155	-5.3624E-06	3.6442	-3.8719
346.320	.000290	-603.7408	86.8325	-5.9516E-06	2.0963	-3.5995
351.000	.000261	-236.7835	70.7080	-6.2511E-06	.8221649	-3.2913
355.680	.000231	58.0860	56.0755	-6.3148E-06	.2016876	-2.9619
360.360	.000202	288.0829	43.0055	-6.1914E-06	1.0003	-2.6235
365.040	.000173	460.6180	31.5161	-5.9246E-06	1.5994	-2.2865
369.720	.000146	583.0733	21.5816	-5.5527E-06	2.0246	-1.9590
374.400	.000121	662.6215	13.1422	-5.1088E-06	2.3008	-1.6475
379.080	9.85E-05	706.0846	6.1120	-4.6210E-06	2.4517	-1.3569
383.760	7.81E-05	719.8295	.3857461	-4.1129E-06	2.4994	-1.0903
388.440	6.00E-05	709.6952	-4.1539	-3.6035E-06	2.4642	-.8497568
393.120	4.43E-05	680.9492	-7.6312	-3.1079E-06	2.3644	-.6362715
397.800	3.09E-05	638.2674	-10.1725	-2.6378E-06	2.2162	-.4497716
402.480	1.96E-05	585.7344	-11.9024	-2.2016E-06	2.0338	-.2894742
407.160	1.03E-05	526.8613	-12.9401	-1.8051E-06	1.8294	-.1539959
411.840	2.74E-06	464.6153	-13.3975	-1.4518E-06	1.6132	-.0414977
416.520	-3.28E-06	401.4604	-13.3772	-1.1431E-06	1.3940	.0501831
421.200	-7.96E-06	339.4047	-12.9710	-8.7913E-07	1.1785	.1234165
425.880	-1.15E-05	280.0520	-12.2594	-6.5838E-07	.9724029	.1806777
430.560	-1.41E-05	224.6567	-11.3114	-4.7853E-07	.7800579	.2244584
435.240	-1.60E-05	174.1775	-10.1843	-3.3640E-07	.6047829	.2571907
439.920	-1.73E-05	129.3314	-8.9245	-2.2824E-07	.4490673	.2811825
444.600	-1.81E-05	90.6438	-7.5679	-1.4985E-07	.3147356	.2985621
449.280	-1.87E-05	58.4955	-6.1410	-9.6702E-08	.2031095	.3112307
453.960	-1.90E-05	33.1639	-4.6620	-6.4038E-08	.1151526	.3208215
458.640	-1.93E-05	14.8591	-3.1422	-4.6924E-08	.0515941	.3286626
463.320	-1.95E-05	3.7528	-1.5875	-4.0292E-08	.0130304	.3357431
468.000	-1.96E-05	0.0000	0.0000	-3.8955E-08	0.0000	.3426805

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

```
Pile-head deflection             =      .50000000 in
Computed slope at pile head      =     -.00003731
Maximum bending moment           =      -1117655. lbs-in
Maximum shear force              =    22664.27416 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             14
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = 1.000000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-1772882.	31863.7966	0.0000	6155.8393	-137.2476
4.680	.997043	-1625375.	31173.1352	-.0012110	5643.6636	-147.5611
9.360	.988665	-1481100.	30459.0317	-.0023180	5142.7099	-157.6435
14.040	.975347	-1340279.	29698.2702	-.0033234	4653.7450	-167.4682
18.720	.957558	-1203125.	28892.1902	-.0042298	4177.5161	-177.0104
23.400	.935755	-1069848.	28042.1699	-.0050398	3714.7489	-186.2461
28.080	.910385	-940650.	27149.6965	-.0057563	3266.1456	-195.1527
32.760	.881877	-815727.	26216.3618	-.0063822	2832.3837	-203.7083
37.440	.850648	-695265.	25243.8582	-.0069206	2414.1138	-211.8915
42.120	.817100	-579444.	24233.9763	-.0073749	2011.9583	-219.6819
46.800	.781619	-468435.	23188.6020	-.0077483	1626.5096	-227.0592
51.480	.744576	-362399.	22109.7147	-.0080444	1258.3288	-234.0037
56.160	.706323	-261488.	20999.3856	-.0082667	907.9439	-240.4959
60.840	.667199	-165844.	19859.7769	-.0084190	575.8487	-246.5163
65.520	.627522	-75600.3291	18693.1413	-.0085050	262.5011	-252.0459
70.200	.587592	9123.3676	17501.8215	-.0085287	31.6784	-257.0652
74.880	.547693	88216.7198	16288.2505	-.0084940	306.3081	-261.5549
79.560	.508088	161581.	15054.9529	-.0084050	561.0465	-265.4954
84.240	.469022	229131.	13804.5460	-.0082658	795.5940	-268.8666
88.920	.430720	290792.	12539.7420	-.0080805	1009.6942	-271.6480
93.600	.393388	346503.	11263.3509	-.0078534	1203.1356	-273.8183
98.280	.357212	396217.	9978.2850	-.0075887	1375.7532	-275.3552
102.960	.322358	439900.	8687.5638	-.0072908	1527.4299	-276.2351
107.640	.288971	477533.	7394.3216	-.0069638	1658.0990	-276.4325
112.320	.257176	509111.	6101.8169	-.0066122	1767.7454	-275.9199
117.000	.227080	534646.	4813.4451	-.0062403	1856.4080	-274.6663
121.680	.198767	554165.	3532.7562	-.0058523	1924.1823	-272.6367
126.360	.172303	567712.	2274.0187	-.0054525	1971.2226	-265.2854
131.040	.147732	575449.	1055.9032	-.0050451	1998.0879	-255.2768

135.720	.125081	577595.	-114.4503	-.0046342	2005.5395	-244.8743
140.400	.104356	574378.	-1235.0952	-.0042237	1994.3683	-234.0338
145.080	.085547	566035.	-2303.8344	-.0038173	1965.3989	-222.6923
149.760	.068626	552814.	-3318.1066	-.0034186	1919.4937	-210.7573
154.440	.053549	534977.	-4274.8031	-.0030309	1857.5604	-198.0874
159.120	.040257	512802.	-5169.9518	-.0026575	1780.5626	-184.4548
163.800	.028675	486587.	-5998.1182	-.0023014	1689.5370	-169.4625
168.480	.018716	456660.	-6751.1105	-.0019653	1585.6237	-152.3291
173.160	.010280	423396.	-7414.4756	-.0016517	1470.1259	-131.1603
177.840	.003256	387260.	-7951.8252	-.0013628	1344.6533	-98.4763
182.520	-.002476	348967.	-8149.4344	-.0011004	1211.6916	14.0279
187.200	-.007044	310981.	-8020.0368	-.0008652	1079.7967	41.2702
191.880	-.010574	273900.	-7773.7087	-.0006568	951.0404	63.9982
196.560	-.013191	238220.	-7431.1749	-.0004743	827.1511	82.3837
201.240	-.015014	204344.	-7012.2040	-.0003166	709.5272	96.6637
205.920	-.016154	172585.	-6535.3327	-.0001823	599.2545	107.1274
210.600	-.016720	143173.	-6017.6534	-6.9741E-05	497.1289	114.1030
215.280	-.016807	116260.	-5474.6598	2.2711E-05	403.6808	117.9455
219.960	-.016507	91930.2952	-4920.1471	9.6901E-05	319.2024	119.0257
224.640	-.015900	70207.4814	-4366.1627	.0001547	243.7760	117.7198
229.320	-.015059	51063.0127	-3823.0012	.0001979	177.3021	114.4005
234.000	-.014048	34424.1902	-3299.2381	.0002284	119.5284	109.4298
238.680	-.012922	20182.1436	-2801.7965	.0002478	70.0769	103.1521
243.360	-.011728	8199.3746	-2336.0402	.0002579	28.4701	95.8891
248.040	-.010508	-1683.1930	-1905.8884	.0002603	5.8444	87.9365
252.720	-.009292	-9639.7411	-1513.9454	.0002562	33.4713	79.5605
257.400	-.008109	-15853.7223	-1161.6409	.0002471	55.0476	70.9969
262.080	-.006979	-20512.7002	-849.3757	.0002342	71.2247	62.4497
266.760	-.005917	-23803.8788	-576.6689	.0002184	82.6524	54.0916
271.440	-.004935	-25910.3208	-342.3030	.0002007	89.9664	46.0647
276.120	-.004039	-27007.8353	-144.4641	.0001818	93.7772	38.4819
280.800	-.003233	-27262.5045	19.1268	.0001625	94.6615	31.4288
285.480	-.002518	-26828.8081	151.0906	.0001432	93.1556	24.9660
290.160	-.001893	-25848.2962	254.2791	.0001244	89.7510	19.1316
294.840	-.001354	-24448.7557	331.6755	.0001065	84.8915	13.9438
299.520	-.000896	-22743.8134	386.3078	8.9681E-05	78.9716	9.4034
304.200	-.000514	-20832.9148	421.1744	7.4152E-05	72.3365	5.4969
308.880	-.000202	-18801.6208	439.1828	6.0028E-05	65.2834	2.1990
313.560	4.74E-05	-16722.1641	443.0994	4.7369E-05	58.0631	-.5251949
318.240	.000241	-14654.2103	435.5117	3.6188E-05	50.8827	-2.7174
322.920	.000386	-12645.7745	418.7998	2.6459E-05	43.9089	-4.4244
327.600	.000489	-10734.2440	395.1182	1.8127E-05	37.2717	-5.6959
332.280	.000556	-8947.4681	366.3854	1.1114E-05	31.0676	-6.5831
336.960	.000593	-7304.8771	334.2809	5.3219E-06	25.3642	-7.1368
341.640	.000606	-5818.5992	300.2487	6.4520E-07	20.2035	-7.4069
346.320	.000599	-4494.5495	265.5052	-3.0300E-06	15.6061	-7.4407
351.000	.000577	-3333.4702	231.0519	-5.8196E-06	11.5745	-7.2829
355.680	.000544	-2331.9041	197.6900	-7.8385E-06	8.0969	-6.9743
360.360	.000504	-1483.0914	166.0389	-9.1980E-06	5.1496	-6.5519
365.040	.000458	-777.7802	136.5540	-1.0004E-05	2.7006	-6.0485
369.720	.000410	-204.9455	109.5474	-1.0354E-05	.7116165	-5.4928
374.400	.000361	247.5832	85.2064	-1.0339E-05	.8596638	-4.9093
379.080	.000314	592.5867	63.6139	-1.0039E-05	2.0576	-4.3183
383.760	.000268	843.0094	44.7660	-9.5277E-06	2.9271	-3.7364
388.440	.000224	1011.5964	28.5898	-8.8668E-06	3.5125	-3.1765
393.120	.000185	1110.6101	14.9595	-8.1105E-06	3.8563	-2.6484
397.800	.000148	1151.6170	3.7105	-7.3044E-06	3.9987	-2.1588
402.480	.000116	1145.3400	-5.3472	-6.4858E-06	3.9769	-1.7119
407.160	8.77E-05	1101.5675	-12.4176	-5.6851E-06	3.8249	-1.3096
411.840	6.29E-05	1029.1109	-17.7096	-4.9258E-06	3.5733	-.9519093
416.520	4.16E-05	935.8053	-21.4282	-4.2256E-06	3.2493	-.6372112
421.200	2.34E-05	828.5432	-23.7680	-3.5969E-06	2.8769	-.3626934
425.880	7.93E-06	713.3373	-24.9081	-3.0474E-06	2.4769	-.1245449
430.560	-5.14E-06	595.4035	-25.0082	-2.5810E-06	2.0674	.0817429
435.240	-1.62E-05	479.2601	-24.2059	-2.1980E-06	1.6641	.2611215
439.920	-2.57E-05	368.8359	-22.6150	-1.8958E-06	1.2807	.4187493
444.600	-3.40E-05	267.5833	-20.3253	-1.6690E-06	.9291085	.5597692
449.280	-4.13E-05	178.5909	-17.4030	-1.5100E-06	.6201074	.6890987
453.960	-4.81E-05	104.6915	-13.8922	-1.4091E-06	.3635123	.8112265
458.640	-5.45E-05	48.5599	-9.8177	-1.3545E-06	.1686109	.9300118
463.320	-6.08E-05	12.7978	-5.1880	-1.3326E-06	.0444369	1.0485
468.000	-6.70E-05	0.0000	0.0000	-1.3280E-06	0.0000	1.1686

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.00005257
Maximum bending moment           =      -1772882. lbs-in
Maximum shear force              =    31863.79659 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             19
Number of zero deflection points =              3
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	275638.	8032.7232
4	y= .500000	M= 0.000	0.0000	.5000000	434195.	11172.0007
4	y= 1.000000	M= 0.000	0.0000	1.0000000	688324.	15605.5704
5	y= .250000	S= 0.000	0.0000	.2500000	-703890.	16142.1618
5	y= .500000	S= 0.000	0.0000	.5000000	-1117655.	22664.2742
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-1772882.	31863.7966

The analysis ended normally.

```
==============================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.25)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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==============================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Douglas\
Name of input data file:     Douglas 12 inch Abutment _3D(0.40)Row3.lpd
Name of output file:         Douglas 12 inch Abutment _3D(0.40)Row3.lpo
Name of plot output file:    Douglas 12 inch Abutment _3D(0.40)Row3.lpp
Name of runtime file:        Douglas 12 inch Abutment _3D(0.40)Row3.lpr


------------------------------------------------------------------------------
                           Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  May 11, 2009     Time:  14: 6: 3


------------------------------------------------------------------------------
                                Problem Title
------------------------------------------------------------------------------

Douglas Road Abutments1&3 /12-inch Square Concrete Pile/3D(0.40)Row3


------------------------------------------------------------------------------
                                Program Options
------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Pile Length                                =     468.00 in
Depth of ground surface below top of pile =        .00 in
Slope angle of ground surface              =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
           in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   12.00000000    1728.0000     144.0000      3800000.
  2     468.0000   12.00000000    1728.0000     144.0000      3800000.


------------------------------------------------------------------------------
                         Soil and Rock Layering Information
------------------------------------------------------------------------------

The soil profile is modelled using  4 layers

Layer  1 is stiff clay without free water
Distance from top of pile to top of layer    =         .000 in
Distance from top of pile to bottom of layer =      180.000 in

Layer  2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      180.000 in
Distance from top of pile to bottom of layer =      660.000 in
p-y subgrade modulus k for top of soil layer =       75.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       75.000 lbs/in**3

Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      660.000 in
Distance from top of pile to bottom of layer =      840.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      840.000 in
Distance from top of pile to bottom of layer =     1158.000 in


(Depth of lowest layer extends  690.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	.00	.06333
2	180.00	.06366
3	180.00	.06366
4	660.00	.06366
5	660.00	.02755
6	840.00	.02755
7	840.00	.02755
8	1158.00	.02755

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	.000	9.03000	.00	.00600	.0
2	180.000	9.03000	.00	.00600	.0
3	180.000	.00000	33.00	------	------
4	660.000	.00000	33.00	------	------
5	660.000	.00000	32.00	------	------
6	840.000	.00000	32.00	------	------
7	840.000	10.42000	.00	.00600	.0
8	1158.000	10.42000	.00	.00600	.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.4000	1.0000
2	468.000	.4000	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	6428.9273	-.0034896	0.0000	-70.5809
4.680	.233669	29314.4345	6089.0420	-.0034791	101.7862	-74.6692
9.360	.217435	56993.4336	5730.5941	-.0034484	197.8939	-78.5136
14.040	.201392	82952.7954	5354.7538	-.0033985	288.0305	-82.1019
18.720	.185625	107114.	4962.7489	-.0033308	371.9234	-85.4216
23.400	.170216	129404.	4555.8651	-.0032465	449.3199	-88.4604
28.080	.155238	149757.	4135.4467	-.0031470	519.9890	-91.2056
32.760	.140760	168112.	3702.8979	-.0030337	583.7219	-93.6443
37.440	.126842	184416.	3259.6839	-.0029081	640.3332	-95.7634
42.120	.113540	198623.	2807.3333	-.0027716	689.6616	-97.5488
46.800	.100900	210693.	2347.4409	-.0026258	731.5715	-98.9864
51.480	.088963	220595.	1881.6709	-.0024721	765.9535	-100.0606
56.160	.077761	228305.	1411.7618	-.0023121	792.7258	-100.7552
60.840	.067321	233809.	939.5329	-.0021474	811.8357	-101.0520
65.520	.057661	237099.	466.8924	-.0019796	823.2606	-100.9311
70.200	.048792	238179.	-4.1506	-.0018102	827.0097	-100.3693
74.880	.040718	237060.	-471.4699	-.0016409	823.1257	-99.3398
79.560	.033434	233766.	-932.7987	-.0014731	811.6869	-97.8093
84.240	.026930	228329.	-1385.6942	-.0013084	792.8098	-95.7358
88.920	.021187	220796.	-1827.4833	-.0011484	766.6519	-93.0629
93.600	.016181	211224.	-2255.1727	-.0009944	733.4166	-89.7103
98.280	.011879	199687.	-2665.2927	-.0008480	693.3588	-85.5546
102.960	.008244	186277.	-3053.5981	-.0007104	646.7945	-80.3878
107.640	.005230	171106.	-3414.4169	-.0005831	594.1168	-73.8082
112.320	.002786	154318.	-3738.8854	-.0004671	535.8260	-64.8536
117.000	.000857	136110.	-4007.1550	-.0003636	472.6030	-49.7916
121.680	-.000617	116811.	-4014.9341	-.0002735	405.5935	46.4672
126.360	-.001702	98529.8947	-3764.2234	-.0001967	342.1177	60.6742
131.040	-.002459	81577.7847	-3466.4626	-.0001326	283.2562	66.5740
135.720	-.002943	66083.8049	-3147.6740	-7.9944E-05	229.4577	69.6604
140.400	-.003207	52115.5558	-2818.0924	-3.7822E-05	180.9568	71.1864
145.080	-.003297	39706.4605	-2483.7610	-5.1004E-06	137.8697	71.6902
149.760	-.003255	28867.5528	-2148.7775	1.9337E-05	100.2346	71.4651
154.440	-.003116	19593.9027	-1816.1200	3.6606E-05	68.0344	70.6962
159.120	-.002912	11868.6698	-1488.0296	4.7818E-05	41.2107	69.5133
163.800	-.002669	5665.9458	-1166.2136	5.4067E-05	19.6734	68.0149
168.480	-.002406	952.9106	-851.9644	5.6426E-05	3.3087	66.2797
173.160	-.002140	-2308.4408	-546.2400	5.5943E-05	8.0154	64.3718
177.840	-.001883	-4159.8956	-249.7330	5.3637E-05	14.4441	62.3406
182.520	-.001638	-4645.9418	-88.0570	5.0499E-05	16.1317	6.7517
187.200	-.001410	-4984.1096	-58.2002	4.7068E-05	17.3059	6.0077
191.880	-.001198	-5190.6954	-31.8044	4.3442E-05	18.0232	5.2726
196.560	-.001003	-5281.7986	-8.8039	3.9710E-05	18.3396	4.5567
201.240	-.000826	-5273.1000	10.9111	3.5948E-05	18.3094	3.8686
205.920	-.000667	-5179.6705	27.4880	3.2224E-05	17.9850	3.2156
210.600	-.000525	-5015.8122	41.1048	2.8590E-05	17.4160	2.6036
215.280	-.000399	-4794.9292	51.9639	2.5094E-05	16.6491	2.0370
219.960	-.000290	-4529.4303	60.2853	2.1771E-05	15.7272	1.5191
224.640	-.000195	-4230.6584	66.3015	1.8650E-05	14.6898	1.0519
229.320	-.000115	-3908.8480	70.2513	1.5749E-05	13.5724	.6360726
234.000	-4.79E-05	-3573.1061	72.3753	1.3083E-05	12.4066	.2716103
238.680	7.32E-06	-3231.4153	72.9114	1.0658E-05	11.2202	-.0425249
243.360	5.18E-05	-2890.6558	72.0909	8.4762E-06	10.0370	-.3080898
248.040	8.67E-05	-2556.6443	70.1357	6.5350E-06	8.8772	-.5274625
252.720	.000113	-2234.1855	67.2552	4.8277E-06	7.7576	-.7035193
257.400	.000132	-1927.1354	63.6445	3.3448E-06	6.6914	-.8395166
262.080	.000144	-1638.4728	59.4828	2.0741E-06	5.6891	-.9389807
266.760	.000151	-1370.3760	54.9325	1.0019E-06	4.7583	-1.0056
271.440	.000154	-1124.3045	50.1384	1.1291E-07	3.9038	-1.0432
276.120	.000152	-901.0806	45.2278	-6.0886E-07	3.1288	-1.0554
280.800	.000148	-700.9726	40.3104	-1.1798E-06	2.4339	-1.0460
285.480	.000141	-523.7749	35.4793	-1.6162E-06	1.8187	-1.0186
290.160	.000133	-368.8861	30.8112	-1.9343E-06	1.2809	-.9763794
294.840	.000123	-235.3824	26.3675	-2.1497E-06	.8172999	-.9226134
299.520	.000113	-122.0861	22.1959	-2.2771E-06	.4239100	-.8601414
304.200	.000102	-27.6290	18.3309	-2.3304E-06	.0959339	-.7915696
308.880	9.09E-05	49.4909	14.7956	-2.3226E-06	.1718433	-.7192192
313.560	8.01E-05	110.8581	11.6031	-2.2655E-06	.3849239	-.6451225
318.240	6.97E-05	158.0956	8.7573	-2.1696E-06	.5489430	-.5710261
322.920	5.98E-05	192.8262	6.2548	-2.0446E-06	.6695355	-.4983987
327.600	5.06E-05	216.6407	4.0860	-1.8987E-06	.7522248	-.4284439
332.280	4.20E-05	231.0713	2.2361	-1.7391E-06	.8023309	-.3621168
336.960	3.43E-05	237.5707	.6864127	-1.5721E-06	.8248981	-.3001433
341.640	2.73E-05	237.4961	-.5846378	-1.4028E-06	.8246394	-.2430407
346.320	2.12E-05	232.0984	-1.6006	-1.2355E-06	.8058974	-.1911406
351.000	1.58E-05	222.5143	-2.3863	-1.0735E-06	.7726191	-.1446114
355.680	1.11E-05	209.7628	-2.9668	-9.1941E-07	.7283432	-.1034814
360.360	7.16E-06	194.7449	-3.3673	-7.7526E-07	.6761975	-.0676611
365.040	3.85E-06	178.2450	-3.6121	-6.4234E-07	.6189062	-.0369644
369.720	1.14E-06	160.9355	-3.7247	-5.2147E-07	.5588038	-.0111291
374.400	-1.03E-06	143.3822	-3.7269	-4.1303E-07	.4978550	.0101647
379.080	-2.72E-06	126.0516	-3.6393	-3.1701E-07	.4376792	.0272775
383.760	-4.00E-06	109.3184	-3.4805	-2.3313E-07	.3795778	.0405949
388.440	-4.91E-06	93.4744	-3.2673	-1.6087E-07	.3245637	.0505147
393.120	-5.50E-06	78.7367	-3.0147	-9.9498E-08	.2733913	.0574351
397.800	-5.84E-06	65.2570	-2.7358	-4.8185E-08	.2265868	.0617446
402.480	-5.95E-06	53.1296	-2.4420	-5.9964E-09	.1844779	.0638147
407.160	-5.89E-06	42.4000	-2.1429	2.8046E-08	.1472222	.0639930
411.840	-5.69E-06	33.0719	-1.8467	5.4942E-08	.1148332	.0625985
416.520	-5.38E-06	25.1150	-1.5600	7.5677E-08	.0872047	.0599184
421.200	-4.98E-06	18.4703	-1.2883	9.1209E-08	.0641331	.0562055
425.880	-4.52E-06	13.0567	-1.0358	1.0244E-07	.0453358	.0516777
430.560	-4.02E-06	8.7750	-.8060485	1.1022E-07	.0304687	.0465179
435.240	-3.49E-06	5.5121	-.6015496	1.1532E-07	.0191393	.0408748
439.920	-2.94E-06	3.1445	-.4243183	1.1840E-07	.0109183	.0348650
444.600	-2.38E-06	1.5405	-.2758676	1.2007E-07	.0053489	.0285754
449.280	-1.82E-06	.5623638	-.1573655	1.2082E-07	.0019527	.0220665
453.960	-1.25E-06	.0675477	-.0697501	1.2104E-07	.0002345	.0153760
458.640	-6.87E-07	-.0904968	-.0138247	1.2104E-07	.0003142	.0085237
463.320	-1.21E-07	-.0618515	.0096685	1.2098E-07	.0002148	.0015161
468.000	4.45E-07	0.0000	0.0000	1.2096E-07	0.0000	-.0056479

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.25000000	in
Computed slope at pile head	=	-.00348959	
Maximum bending moment	=	238178.79767	lbs-in
Maximum shear force	=	6428.92733	lbs
Depth of maximum bending moment	=	70.20000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	17	
Number of zero deflection points	=	4	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	8954.8976	-.0062129	0.0000	-83.9353
4.680	.470924	40989.7284	8550.3061	-.0061983	142.3254	-88.9670
9.360	.441984	80030.8655	8122.7520	-.0061552	277.8849	-93.7484
14.040	.413311	117019.	7673.4338	-.0060850	406.3149	-98.2679
18.720	.385029	151854.	7203.6054	-.0059891	527.2715	-102.5135
23.400	.357253	184444.	6714.5756	-.0058693	640.4321	-106.4736
28.080	.330092	214703.	6207.7090	-.0057271	745.4953	-110.1361
32.760	.303647	242549.	5684.4270	-.0055641	842.1826	-113.4887
37.440	.278012	267909.	5146.2088	-.0053822	930.2391	-116.5191
42.120	.253270	290717.	4594.5931	-.0051831	1009.4344	-119.2142
46.800	.229498	310914.	4031.1800	-.0049687	1079.5634	-121.5607
51.480	.206763	328449.	3457.6339	-.0047409	1140.4477	-123.5445
56.160	.185123	343278.	2875.6867	-.0045015	1191.9365	-125.1508
60.840	.164628	355365.	2287.1427	-.0042526	1233.9076	-126.3637
65.520	.145319	364685.	1693.8839	-.0039960	1266.2686	-127.1657
70.200	.127226	371220.	1097.8780	-.0037337	1288.9588	-127.5376
74.880	.110372	374962.	501.1888	-.0034678	1301.9497	-127.4578
79.560	.094768	375911.	-94.0104	-.0032002	1305.2474	-126.9009
84.240	.080418	374082.	-685.4170	-.0029329	1298.8943	-125.8370
88.920	.067315	369496.	-1270.5717	-.0026680	1282.9714	-124.2291
93.600	.055445	362189.	-1846.8187	-.0024072	1257.6008	-122.0303
98.280	.044784	352210.	-2411.2445	-.0021526	1222.9498	-119.1774
102.960	.035297	339620.	-2960.5816	-.0019061	1179.2353	-115.5821
107.640	.026943	324498.	-3491.0468	-.0016694	1126.7309	-111.1124
112.320	.019671	306944.	-3998.0489	-.0014444	1065.7763	-105.5551
117.000	.013423	287077.	-4475.6012	-.0012327	996.7943	-98.5271
121.680	.008132	265052.	-4914.9275	-.0010360	920.3193	-89.2192
126.360	.003726	241073.	-5296.9973	-.0008556	837.0591	-74.0585
131.040	.000124	215472.	-5582.7887	-.0006929	748.1668	-48.0746
135.720	-.002760	188818.	-5534.8754	-.0005488	655.6185	68.5503
140.400	-.005013	163666.	-5188.1369	-.0004232	568.2834	79.6285
145.080	-.006721	140257.	-4801.2734	-.0003149	487.0040	85.6977
149.760	-.007961	118726.	-4391.5228	-.0002226	412.2420	89.4094
154.440	-.008805	99152.5110	-3967.7422	-.0001450	344.2796	91.6934
159.120	-.009318	81587.6307	-3535.5525	-8.0587E-05	283.2904	93.0030
163.800	-.009559	66059.7396	-3098.9022	-2.7972E-05	229.3741	93.5997
168.480	-.009580	52581.9061	-2660.7360	1.4308E-05	182.5761	93.6508
173.160	-.009425	41155.2502	-2223.3396	4.7712E-05	142.9002	93.2708
177.840	-.009134	31771.4477	-1788.5421	7.3700E-05	110.3175	92.5401
182.520	-.008736	24414.4961	-1487.7623	9.3722E-05	84.7726	35.9982
187.200	-.008256	17845.9922	-1321.2003	.0001088	61.9653	35.1821
191.880	-.007717	12048.0615	-1159.3857	.0001194	41.8335	33.9694
196.560	-.007138	6994.1424	-1004.0277	.0001262	24.2852	32.4229
201.240	-.006536	2650.3619	-856.5438	.0001297	9.2026	30.6045
205.920	-.005925	-1023.1072	-718.0654	.0001302	3.5525	28.5743
210.600	-.005317	-4070.7307	-589.4503	.0001284	14.1345	26.3894
215.280	-.004723	-6540.3622	-471.2976	.0001246	22.7096	24.1032
219.960	-.004150	-8482.0761	-363.9672	.0001193	29.4517	21.7645
224.640	-.003606	-9947.0953	-267.6016	.0001127	34.5385	19.4174
229.320	-.003095	-10986.8269	-182.1490	.0001053	38.1487	17.1008
234.000	-.002621	-11652.0095	-107.3878	9.7193E-05	40.4584	14.8484
238.680	-.002186	-11991.9767	-42.9517	8.8767E-05	41.6388	12.6884
243.360	-.001790	-12054.0372	11.6462	8.0198E-05	41.8543	10.6440
248.040	-.001435	-11882.9684	56.9891	7.1668E-05	41.2603	8.7333
252.720	-.001119	-11520.6197	93.7339	6.3328E-05	40.0022	6.9696
257.400	-.000842	-11005.6195	122.5899	5.5300E-05	38.2140	5.3620
262.080	-.000602	-10373.1784	144.2992	4.7682E-05	36.0180	3.9155
266.760	-.000396	-9654.9789	159.6190	4.0545E-05	33.5242	2.6314
271.440	-.000222	-8879.1445	169.3058	3.3940E-05	30.8304	1.5082
276.120	-7.81E-05	-8070.2763	174.1021	2.7900E-05	28.0218	.5414573
280.800	3.90E-05	-7249.5489	174.7245	2.2440E-05	25.1720	-.2754600
285.480	.000132	-6434.8547	171.8548	1.7564E-05	22.3432	-.9509248
290.160	.000203	-5640.9880	166.1320	1.3260E-05	19.5868	-1.4947
294.840	.000256	-4879.8595	158.1470	9.5112E-06	16.9440	-1.9177
299.520	.000292	-4160.7322	148.4388	6.2895E-06	14.4470	-2.2312
304.200	.000315	-3490.4727	137.4918	3.5629E-06	12.1197	-2.4470
308.880	.000326	-2873.8092	125.7353	1.2949E-06	9.9785	-2.5771
313.560	.000327	-2313.5905	113.5435	-5.5366E-07	8.0333	-2.6330
318.240	.000321	-1811.0419	101.2371	-2.0235E-06	6.2883	-2.6261
322.920	.000308	-1366.0116	89.0851	-3.1557E-06	4.7431	-2.5670
327.600	.000291	-977.2057	77.3081	-3.9907E-06	3.3931	-2.4659
332.280	.000271	-642.4080	66.0816	-4.5679E-06	2.2306	-2.3318
336.960	.000248	-358.6823	55.5397	-4.9246E-06	1.2454	-2.1733
341.640	.000225	-122.5568	45.7792	-5.0961E-06	.4255444	-1.9978
346.320	.000201	69.8114	36.8641	-5.1149E-06	.2424007	-1.8120
351.000	.000177	222.4916	28.8294	-5.0108E-06	.7725403	-1.6216
355.680	.000154	339.6542	21.6852	-4.8104E-06	1.1794	-1.4314
360.360	.000132	425.4647	15.4211	-4.5378E-06	1.4773	-1.2455
365.040	.000111	483.9958	10.0099	-4.2137E-06	1.6805	-1.0670
369.720	9.23E-05	519.1572	5.4107	-3.8562E-06	1.8026	-.8984569
374.400	7.51E-05	534.6402	1.5727	-3.4807E-06	1.8564	-.7417093
379.080	5.97E-05	533.8780	-1.5622	-3.0999E-06	1.8537	-.5980019
383.760	4.61E-05	520.0181	-4.0568	-2.7243E-06	1.8056	-.4680598
388.440	3.42E-05	495.9066	-5.9761	-2.3623E-06	1.7219	-.3521570
393.120	2.40E-05	464.0820	-7.3856	-2.0202E-06	1.6114	-.2501847
397.800	1.53E-05	426.7778	-8.3494	-1.7027E-06	1.4819	-.1617164
402.480	8.03E-06	385.9315	-8.9292	-1.4131E-06	1.3400	-.0860705
407.160	2.06E-06	343.2002	-9.1830	-1.1533E-06	1.1917	-.0223667
411.840	-2.77E-06	299.9789	-9.1641	-9.2407E-07	1.0416	.0304205

416.520	-6.59E-06	257.4239	-8.9212	-7.2543E-07	.8938331	.0734151
421.200	-9.56E-06	216.4769	-8.4971	-5.5655E-07	.7516560	.1077971
425.880	-1.18E-05	177.8909	-7.9295	-4.1601E-07	.6176768	.1347646
430.560	-1.34E-05	142.2566	-7.2503	-3.0193E-07	.4939465	.1555017
435.240	-1.46E-05	110.0281	-6.4859	-2.1202E-07	.3820421	.1711493
439.920	-1.54E-05	81.5482	-5.6577	-1.4375E-07	.2831536	.1827807
444.600	-1.60E-05	57.0717	-4.7822	-9.4354E-08	.1981656	.1913798
449.280	-1.63E-05	36.7868	-3.8715	-6.0906E-08	.1277320	.1978216
453.960	-1.65E-05	20.8347	-2.9339	-4.0373E-08	.0723427	.2028559
458.640	-1.67E-05	9.3256	-1.9746	-2.9625E-08	.0323807	.2070909
463.320	-1.68E-05	2.3523	-.9963279	-2.5463E-08	.0081679	.2109790
468.000	-1.69E-05	0.0000	0.0000	-2.4625E-08	0.0000	.2148021

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      .50000000 in
Computed slope at pile head      =     -.00621291
Maximum bending moment           =   375911.25615 lbs-in
Maximum shear force              =     8954.89756 lbs
Depth of maximum bending moment  =    79.56000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             12
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	12537.4198	-.0110640	0.0000	-99.8165
4.680	.948221	57582.0148	12055.8594	-.0110435	199.9376	-105.9786
9.360	.896633	112843.	11546.0626	-.0109827	391.8154	-111.8832
14.040	.845422	165653.	11009.2609	-.0108835	575.1846	-117.5192
18.720	.794764	215890.	10446.7375	-.0107475	749.6164	-122.8754
23.400	.744825	263435.	9859.8282	-.0105767	914.7036	-127.9406
28.080	.695766	308178.	9249.9212	-.0103730	1070.0608	-132.7035
32.760	.647734	350014.	8618.4579	-.0101385	1215.3260	-137.1526
37.440	.600870	388846.	7966.9338	-.0098752	1350.1607	-141.2764
42.120	.555302	424584.	7296.8996	-.0095853	1474.2513	-145.0630
46.800	.511151	457145.	6609.9619	-.0092711	1587.3099	-148.5001
51.480	.468525	486454.	5907.7859	-.0089348	1689.0751	-151.5752
56.160	.427522	512442.	5192.0964	-.0085788	1779.3130	-154.2751
60.840	.388227	535052.	4464.6813	-.0082056	1857.8182	-156.5861
65.520	.350718	554232.	3727.3946	-.0078174	1924.4151	-158.4937
70.200	.315057	569940.	2982.1607	-.0074168	1978.9586	-159.9824
74.880	.281297	582145.	2230.9795	-.0070062	2021.3353	-161.0352
79.560	.249478	590822.	1475.9338	-.0065882	2051.4654	-161.6339
84.240	.219631	595959.	719.1979	-.0061653	2069.3032	-161.7576
88.920	.191771	597554.	-36.9506	-.0057400	2074.8393	-161.3828
93.600	.165905	595613.	-790.1146	-.0053148	2068.1023	-160.4821
98.280	.142025	590158.	-1537.7561	-.0048922	2049.1606	-159.0228
102.960	.120113	581220.	-2277.1659	-.0044748	2018.1252	-156.9643
107.640	.100141	568844.	-3005.4195	-.0040650	1975.1527	-154.2552
112.320	.082065	553089.	-3719.3130	-.0036651	1920.4491	-150.8275
117.000	.065835	534031.	-4415.2627	-.0032777	1854.2750	-146.5869
121.680	.051386	511762.	-5089.1421	-.0029051	1776.9531	-141.3958
126.360	.038644	486397.	-5730.7250	-.0025494	1688.8779	-132.7849
131.040	.027524	458123.	-6326.9006	-.0022128	1590.7045	-121.9910
135.720	.017932	427177.	-6868.8452	-.0018973	1483.2537	-109.6093
140.400	.009765	393831.	-7345.7085	-.0016047	1367.4670	-94.1785
145.080	.002912	358421.	-7729.1137	-.0013366	1244.5181	-69.6699
149.760	-.002746	321486.	-7731.9949	-.0010943	1116.2708	68.4387
154.440	-.007331	286050.	-7366.9275	-.0008778	993.2283	87.5730
159.120	-.010962	252532.	-6935.3544	-.0006859	876.8457	96.8599
163.800	-.013751	221135.	-6468.8141	-.0005171	767.8293	102.5163
168.480	-.015802	191983.	-5980.5401	-.0003699	666.6092	106.1478
173.160	-.017213	165157.	-5478.3920	-.0002426	573.4617	108.4454
177.840	-.018073	140706.	-4967.7496	-.0001336	488.5615	109.7779
182.520	-.018464	118659.	-4532.8243	-4.1203E-05	412.0099	76.0877
187.200	-.018459	98278.4722	-4170.7185	3.6105E-05	341.2447	78.6584
191.880	-.018126	79620.9139	-3799.9612	9.9501E-05	276.4615	79.7848
196.560	-.017528	62710.8351	-3426.9737	.0001502	217.7460	79.6115
201.240	-.016720	47544.4401	-3057.4824	.0001895	165.0849	78.2907
205.920	-.015754	34092.7999	-2696.4929	.0002186	118.3778	75.9783
210.600	-.014674	22305.2670	-2348.2811	.0002387	77.4488	72.8302
215.280	-.013520	12112.8892	-2016.4007	.0002510	42.0586	68.9991
219.960	-.012325	3431.7564	-1703.7042	.0002565	11.9158	64.6319
224.640	-.011119	-3833.7818	-1412.3750	.0002564	13.3117	59.8677
229.320	-.009925	-9788.0734	-1143.9696	.0002515	33.9864	54.8354
234.000	-.008764	-14541.3374	-899.4666	.0002428	50.4908	49.6530
238.680	-.007652	-18207.0811	-679.3211	.0002312	63.2190	44.4263
243.360	-.006601	-20899.7831	-483.5227	.0002172	72.5687	39.2483
248.040	-.005619	-22732.8535	-311.6552	.0002017	78.9335	34.1993
252.720	-.004713	-23816.8762	-162.9571	.0001851	82.6975	29.3469
257.400	-.003886	-24258.1320	-36.3802	.0001680	84.2296	24.7458
262.080	-.003141	-24157.3948	69.3529	.0001507	83.8798	20.4393
266.760	-.002476	-23608.9888	155.6948	.0001337	81.9757	16.4590
271.440	-.001889	-22700.0912	224.2231	.0001172	78.8198	12.8266
276.120	-.001379	-21510.2608	276.5940	.0001014	74.6884	9.5542
280.800	-.000940	-20111.1715	314.5014	8.6600E-05	69.8305	6.6456
285.480	-.000568	-18566.5281	339.6399	7.2816E-05	64.4671	4.0974
290.160	-.000259	-16932.1419	353.6739	6.0166E-05	58.7922	1.9000
294.840	-5.17E-06	-15256.1406	358.2105	4.8696E-05	52.9727	.0386943
299.520	.000197	-13579.2918	354.7783	3.8420E-05	47.1503	-1.5055
304.200	.000354	-11935.4162	344.8100	2.9327E-05	41.4424	-2.7545
308.880	.000472	-10351.8700	329.6302	2.1385E-05	35.9440	-3.7326
313.560	.000555	-8850.0775	310.4460	1.4542E-05	30.7294	-4.4657
318.240	.000608	-7446.0952	288.3425	8.7349E-06	25.8545	-4.9802
322.920	.000636	-6151.1920	264.2803	3.8894E-06	21.3583	-5.3027
327.600	.000644	-4972.4317	239.0969	-7.4600E-08	17.2654	-5.4594
332.280	.000636	-3913.2454	213.5094	-3.2411E-06	13.5877	-5.4754
336.960	.000614	-2973.9841	188.1199	-5.6954E-06	10.3263	-5.3748
341.640	.000582	-2152.4427	163.4224	-7.5223E-06	7.4738	-5.1798

346.320	.000544	-1444.3507	139.8099	-8.8040E-06	5.0151	-4.9110
351.000	.000500	-843.8219	117.5841	-9.6194E-06	2.9299	-4.5872
355.680	.000454	-343.7637	96.9638	-1.0043E-05	1.1936	-4.2249
360.360	.000406	63.7590	78.0949	-1.0142E-05	.2213855	-3.8387
365.040	.000359	387.2046	61.0598	-9.9817E-06	1.3445	-3.4412
369.720	.000313	635.2792	45.8867	-9.6174E-06	2.2058	-3.0430
374.400	.000269	816.7045	32.5586	-9.0999E-06	2.8358	-2.6528
379.080	.000227	940.0276	21.0217	-8.4739E-06	3.2640	-2.2775
383.760	.000189	1013.4679	11.1937	-7.7778E-06	3.5190	-1.9225
388.440	.000155	1044.8007	2.9707	-7.0443E-06	3.6278	-1.5916
393.120	.000123	1041.2732	-3.7662	-6.3009E-06	3.6155	-1.2874
397.800	9.56E-05	1009.5492	-9.1446	-5.5700E-06	3.5054	-1.0111
402.480	7.12E-05	955.6799	-13.2962	-4.8697E-06	3.3183	-.7631216
407.160	5.00E-05	885.0964	-16.3524	-4.2137E-06	3.0733	-.5429220
411.840	3.17E-05	802.6216	-18.4401	-3.6123E-06	2.7869	-.3492467
416.520	1.62E-05	712.4974	-19.6791	-3.0724E-06	2.4739	-.1802743
421.200	2.99E-06	618.4248	-20.1799	-2.5981E-06	2.1473	-.0337412
425.880	-8.14E-06	523.6132	-20.0414	-2.1911E-06	1.8181	.0929354
430.560	-1.75E-05	430.8371	-19.3500	-1.8510E-06	1.4960	.2025433
435.240	-2.55E-05	342.4972	-18.1788	-1.5754E-06	1.1892	.2979681
439.920	-3.23E-05	260.6835	-16.5875	-1.3605E-06	.9051512	.3820943
444.600	-3.82E-05	187.2386	-14.6223	-1.2008E-06	.6501341	.4577107
449.280	-4.35E-05	123.8187	-12.3171	-1.0900E-06	.4299260	.5274211
453.960	-4.84E-05	71.9505	-9.6940	-1.0202E-06	.2498282	.5935569
458.640	-5.31E-05	33.0827	-6.7652	-9.8279E-07	.1148704	.6580901
463.320	-5.76E-05	8.6286	-3.5345	-9.6792E-07	.0299604	.7225461
468.000	-6.21E-05	0.0000	0.0000	-9.6485E-07	0.0000	.7879129

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.01106399
Maximum bending moment           =   597553.72651 lbs-in
Maximum shear force              =    12537.41982 lbs
Depth of maximum bending moment  =    88.92000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             22
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	-609842.	12971.1668	0.0000	2117.5065	-70.5809
4.680	.248983	-549968.	12616.0324	-.0004133	1909.6097	-75.8636
9.360	.246131	-491755.	12249.1004	-.0007845	1707.4824	-80.9847
14.040	.241640	-435316.	11858.5257	-.0011149	1511.5140	-85.9276
18.720	.235696	-380759.	11445.2729	-.0014057	1322.0803	-90.6762
23.400	.228482	-328188.	11010.2860	-.0016584	1139.5426	-95.2156
28.080	.220174	-277703.	10554.5790	-.0018743	964.2460	-99.5310
32.760	.210939	-229397.	10079.2328	-.0020550	796.5188	-103.6084
37.440	.200939	-183361.	9585.3933	-.0022021	636.6710	-107.4341
42.120	.190327	-139678.	9074.2704	-.0023172	484.9935	-110.9945
46.800	.179250	-98426.0692	8547.1363	-.0024020	341.7572	-114.2765
51.480	.167844	-59676.9358	8005.3252	-.0024584	207.2116	-117.2667
56.160	.156239	-23496.2255	7450.2327	-.0024880	81.5841	-119.9522
60.840	.144556	10057.2426	6883.3162	-.0024928	34.9210	-122.3198
65.520	.132907	40931.6145	6306.0952	-.0024746	142.1237	-124.3559
70.200	.121394	69082.2933	5720.1522	-.0024354	239.8691	-126.0471
74.880	.110111	94472.2388	5127.1348	-.0023772	328.0286	-127.3791
79.560	.099143	117072.	4528.7580	-.0023018	406.5010	-128.3375
84.240	.088566	136861.	3926.8071	-.0022113	475.2132	-128.9065
88.920	.078446	153827.	3323.1432	-.0021077	534.1222	-129.0696
93.600	.068838	167966.	2719.7089	-.0019930	583.2154	-128.8084
98.280	.059791	179284.	2118.5377	-.0018693	622.5127	-128.1024
102.960	.051342	187796.	1521.7665	-.0017385	652.0679	-126.9280
107.640	.043519	193527.	931.6533	-.0016026	671.9701	-125.2571
112.320	.036342	196516.	350.6037	-.0014636	682.3466	-123.0547
117.000	.029820	196809.	-218.7894	-.0013234	683.3648	-120.2757
121.680	.023955	194468.	-773.6846	-.0011840	675.2359	-116.8590
126.360	.018738	189567.	-1306.4867	-.0010471	658.2200	-110.8343
131.040	.014154	182239.	-1807.6533	-.0009146	632.7751	-103.3395
135.720	.010177	172648.	-2272.1881	-.0007882	599.4713	-95.1796
140.400	.006776	160972.	-2696.1689	-.0006693	558.9290	-86.0088
145.080	.003913	147412.	-3073.0031	-.0005594	511.8458	-75.0315
149.760	.001541	132208.	-3388.0400	-.0004597	459.0564	-59.5996
154.440	-.000390	115700.	-3430.6985	-.0003714	401.7345	41.3695
159.120	-.001935	100097.	-3187.4174	-.0002945	347.5587	62.5968
163.800	-.003147	85865.3058	-2875.3095	-.0002282	298.1434	70.7827
168.480	-.004072	73184.0130	-2532.9311	-.0001715	254.1112	75.5328
173.160	-.004752	62157.0705	-2172.4195	-.0001233	215.8232	78.5319
177.840	-.005226	52850.1661	-1800.4408	-8.2321E-05	183.5075	80.4333
182.520	-.005523	45304.9450	-1558.9712	-4.7342E-05	157.3088	22.7588
187.200	-.005669	38258.1958	-1449.1898	-1.7564E-05	132.8410	24.1563
191.880	-.005687	31740.5287	-1334.0862	7.3810E-06	110.2102	25.0332
196.560	-.005600	25771.1490	-1215.9921	2.7876E-05	89.4832	25.4344
201.240	-.005426	20358.8428	-1097.0199	4.4315E-05	70.6904	25.4084
205.920	-.005185	15503.0427	-979.0494	5.7094E-05	53.8300	25.0063
210.600	-.004892	11194.9409	-863.7199	6.6608E-05	38.8713	24.2798
215.280	-.004561	7418.6242	-752.4293	7.3242E-05	25.7591	23.2803
219.960	-.004206	4152.2031	-646.3366	7.7365E-05	14.4174	22.0584
224.640	-.003837	1368.9136	-546.3706	7.9333E-05	4.7532	20.6621
229.320	-.003464	-961.8256	-453.2405	7.9478E-05	3.3397	19.1370
234.000	-.003093	-2873.4177	-367.4508	7.8111E-05	9.9771	17.5252
238.680	-.002733	-4401.1655	-289.3176	7.5518E-05	15.2818	15.8651
243.360	-.002387	-5581.4305	-218.9867	7.1961E-05	19.3800	14.1909
248.040	-.002059	-6450.8814	-156.4533	6.7673E-05	22.3989	12.5328
252.720	-.001753	-7045.8335	-101.5812	6.2864E-05	24.4647	10.9168
257.400	-.001471	-7401.6814	-54.1229	5.7715E-05	25.7003	9.3645
262.080	-.001213	-7552.4241	-13.7390	5.2386E-05	26.2237	7.8936
266.760	-.000980	-7530.2786	19.9834	4.7011E-05	26.1468	6.5177
271.440	-.000773	-7365.3793	47.5131	4.1703E-05	25.5742	5.2471

276.120	-.000590	-7085.5563	69.3581	3.6553E-05	24.6026	4.0884
280.800	-.000431	-6716.1873	86.0514	3.1635E-05	23.3201	3.0455
285.480	-.000294	-6280.1154	98.1369	2.7003E-05	21.8060	2.1193
290.160	-.000178	-5797.6255	106.1584	2.2699E-05	20.1306	1.3087
294.840	-8.15E-05	-5286.4723	110.6490	1.8750E-05	18.3558	.6103730
299.520	-2.56E-06	-4761.9505	112.1229	1.5169E-05	16.5346	.0195010
304.200	6.05E-05	-4237.0016	111.0685	1.1962E-05	14.7118	-.4700993
308.880	.000109	-3722.3489	107.9430	9.1254E-06	12.9248	-.8655907
313.560	.000146	-3226.6548	103.1684	6.6491E-06	11.2037	-1.1748
318.240	.000172	-2756.6925	97.1288	4.5168E-06	9.5718	-1.4062
322.920	.000188	-2317.5288	90.1690	2.7086E-06	8.0470	-1.5681
327.600	.000197	-1912.7104	82.5938	1.2011E-06	6.6414	-1.6692
332.280	.000199	-1544.4513	74.6682	-3.0882E-08	5.3627	-1.7178
336.960	.000197	-1213.8157	66.6192	-1.0138E-06	4.2146	-1.7220
341.640	.000190	-920.8956	58.6366	-1.7745E-06	3.1976	-1.6894
346.320	.000180	-664.9770	50.8760	-2.3397E-06	2.3089	-1.6271
351.000	.000168	-444.6967	43.4607	-2.7351E-06	1.5441	-1.5418
355.680	.000154	-258.1852	36.4851	-2.9856E-06	.8964763	-1.4392
360.360	.000140	-103.1961	30.0175	-3.1144E-06	.3583199	-1.3247
365.040	.000125	22.7784	24.1029	-3.1430E-06	.0790917	-1.2029
369.720	.000111	122.4074	18.7666	-3.0913E-06	.4250256	-1.0776
374.400	9.64E-05	198.4341	14.0167	-2.9770E-06	.6890074	-.9522653
379.080	8.28E-05	253.6040	9.8473	-2.8159E-06	.8805694	-.8295482
383.760	7.01E-05	290.6047	6.2410	-2.6219E-06	1.0090	-.7116046
388.440	5.83E-05	312.0197	3.1717	-2.4072E-06	1.0834	-.6000617
393.120	4.75E-05	320.2918	.6067353	-2.1819E-06	1.1121	-.4960736
397.800	3.78E-05	317.6987	-1.4909	-1.9545E-06	1.1031	-.4003705
402.480	2.92E-05	306.3365	-3.1610	-1.7321E-06	1.0637	-.3133096
407.160	2.16E-05	288.1122	-4.4438	-1.5203E-06	1.0004	-.2349258
411.840	1.50E-05	264.7423	-5.3796	-1.3233E-06	.9192442	-.1649806
416.520	9.25E-06	237.7590	-6.0067	-1.1442E-06	.8255522	-.1030105
421.200	4.29E-06	208.5196	-6.3609	-9.8517E-07	.7240262	-.0483720
425.880	2.50E-08	178.2206	-6.4748	-8.4735E-07	.6188216	-.0002851
430.560	-3.64E-06	147.9154	-6.3769	-7.3113E-07	.5135953	.0421255
435.240	-6.82E-06	118.5329	-6.0916	-6.3618E-07	.4115726	.0797925
439.920	-9.60E-06	90.8980	-5.6389	-5.6155E-07	.3156181	.1136687
444.600	-1.21E-05	65.7528	-5.0343	-5.0572E-07	.2283082	.1446923
449.280	-1.43E-05	43.7766	-4.2892	-4.6669E-07	.1520021	.1737522
453.960	-1.64E-05	25.6060	-3.4107	-4.4197E-07	.0889098	.2016552
458.640	-1.85E-05	11.8522	-2.4028	-4.2862E-07	.0411534	.2290915
463.320	-2.05E-05	3.1160	-1.2663	-4.2328E-07	.0108195	.2566007
468.000	-2.24E-05	0.0000	0.0000	-4.2217E-07	0.0000	.2845358

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =      .25000000 in
Computed slope at pile head      =     -.00002134
Maximum bending moment           =  -609841.86971 lbs-in
Maximum shear force              =    12971.16678 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             19
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .500000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-968959.	18240.3566	0.0000	3364.4415	-83.9353
4.680	.498384	-884582.	17818.0334	-.0006605	3071.4670	-90.2364
9.360	.493817	-802182.	17381.3596	-.0012616	2785.3549	-96.3835
14.040	.486575	-721893.	16916.3012	-.0018047	2506.5728	-102.3594
18.720	.476925	-643846.	16423.7145	-.0022914	2235.5751	-108.1478
23.400	.465127	-568167.	15904.5130	-.0027233	1972.8021	-113.7332
28.080	.451435	-494979.	15359.6813	-.0031022	1718.6784	-119.1008
32.760	.436091	-424400.	14790.2722	-.0034298	1473.6124	-124.2364
37.440	.419331	-356542.	14197.4043	-.0037081	1237.9946	-129.1260
42.120	.401383	-291513.	13582.2604	-.0039391	1012.1968	-133.7561
46.800	.382461	-229412.	12946.0857	-.0041247	796.5711	-138.1134
51.480	.362775	-170337.	12290.1873	-.0042672	591.4490	-142.1850
56.160	.342521	-114376.	11615.9327	-.0043686	397.1400	-145.9579
60.840	.321885	-61612.1776	10924.7499	-.0044313	213.9312	-149.4193
65.520	.301043	-12120.6686	10218.1272	-.0044576	42.0857	-152.5562
70.200	.280162	34029.4934	9497.6134	-.0044498	118.1580	-155.3557
74.880	.259393	76776.9929	8764.8183	-.0044103	266.5868	-157.8046
79.560	.238881	116068.	8021.4143	-.0043416	403.0146	-159.8894
84.240	.218756	151857.	7269.1376	-.0042461	527.2827	-161.5963
88.920	.199137	184107.	6509.7909	-.0041264	639.2615	-162.9108
93.600	.180133	212789.	5745.2464	-.0039850	738.8510	-163.8176
98.280	.161838	237883.	4977.4503	-.0038244	825.9820	-164.3004
102.960	.144337	259378.	4208.4284	-.0036472	900.6181	-164.3414
107.640	.127700	277274.	3440.2943	-.0034559	962.7560	-163.9210
112.320	.111989	291579.	2675.2596	-.0032532	1012.4277	-163.0169
117.000	.097251	302314.	1915.6483	-.0030416	1049.7019	-161.6033
121.680	.083520	309510.	1163.9179	-.0028235	1074.6862	-159.6491
126.360	.070822	313208.	428.8261	-.0026016	1087.5292	-154.4927
131.040	.059169	313523.	-278.3190	-.0023783	1088.6231	-147.7060
135.720	.048562	310603.	-952.9351	-.0021559	1078.4839	-140.5915
140.400	.038990	304604.	-1593.3459	-.0019366	1057.6527	-133.0883
145.080	.030435	295690.	-2197.5115	-.0017227	1026.7001	-125.1021
149.760	.022866	284035.	-2762.8119	-.0015161	986.2336	-116.4793
154.440	.016244	269830.	-3285.6327	-.0013187	936.9087	-106.9484
159.120	.010522	253282.	-3760.4524	-.0011323	879.4505	-95.9660
163.800	.005645	234632.	-4177.2959	-.0009585	814.6940	-82.1723
168.480	.001551	214182.	-4509.1728	-.0007985	743.6884	-59.6554
173.160	-.001829	192426.	-4504.3063	-.0006536	668.1459	61.7351
177.840	-.004567	172022.	-4177.9001	-.0005237	597.2984	77.7547
182.520	-.006731	153321.	-3931.0477	-.0004078	532.3642	27.7378
187.200	-.008384	135227.	-3782.5428	-.0003050	469.5394	35.7259
191.880	-.009586	117916.	-3600.2132	-.0002148	409.4315	42.1927
196.560	-.010394	101529.	-3391.0095	-.0001366	352.5324	47.2106
201.240	-.010864	86176.4293	-3161.5016	-6.9674E-05	299.2237	50.8697

205.920	-.011046	71937.6863	-2917.8042	-1.3329E-05	249.7836	53.2745
210.600	-.010989	58865.7821	-2665.5195	3.3285E-05	204.3951	54.5395
215.280	-.010735	46988.4235	-2409.6973	7.1007E-05	163.1542	54.7862
219.960	-.010324	36311.0149	-2154.8105	.0001007	126.0799	54.1398
224.640	-.009792	26819.3974	-1904.7449	.0001232	93.1229	52.7258
229.320	-.009171	18482.6024	-1662.8025	.0001393	64.1757	50.6684
234.000	-.008488	11255.5659	-1431.7146	.0001499	39.0818	48.0872
238.680	-.007768	5081.7535	-1213.6655	.0001558	17.6450	45.0962
243.360	-.007030	-104.3431	-1010.3231	.0001575	.3623026	41.8022
248.040	-.006293	-4374.8707	-822.8762	.0001559	15.1905	38.3033
252.720	-.005571	-7806.4647	-652.0761	.0001516	27.1058	34.6882
257.400	-.004874	-10478.3031	-498.2811	.0001451	36.3830	31.0361
262.080	-.004213	-12470.3762	-361.5035	.0001369	43.2999	27.4159
266.760	-.003593	-13861.9755	-241.4560	.0001275	48.1319	23.8865
271.440	-.003019	-14730.4040	-137.5990	.0001173	51.1472	20.4968
276.120	-.002495	-15149.9025	-49.1858	.0001067	52.6038	17.2866
280.800	-.002021	-15190.7830	24.6948	9.5861E-05	52.7458	14.2863
285.480	-.001598	-14918.7594	85.0773	8.5131E-05	51.8012	11.5182
290.160	-.001224	-14394.4591	133.0830	7.4685E-05	49.9808	8.9970
294.840	-.000899	-13673.1022	169.8857	6.4683E-05	47.4760	6.7306
299.520	-.000619	-12804.3291	196.6819	5.5248E-05	44.4595	4.7208
304.200	-.000381	-11832.1597	214.6649	4.6468E-05	41.0839	2.9643
308.880	-.000184	-10795.0659	225.0022	3.8405E-05	37.4829	1.4534
313.560	-2.20E-05	-9726.1395	228.8171	3.1092E-05	33.7713	.1769137
318.240	.000107	-8653.3383	227.1737	2.4542E-05	30.0463	-.8791915
322.920	.000208	-7599.7935	221.0657	1.8750E-05	26.3882	-1.7311
327.600	.000283	-6584.1636	211.4074	1.3695E-05	22.8617	-2.3964
332.280	.000336	-5621.0203	199.0288	9.3460E-06	19.5174	-2.8936
336.960	.000370	-4721.2539	184.6724	5.6605E-06	16.3932	-3.2416
341.640	.000389	-3892.4863	168.9926	2.5909E-06	13.5156	-3.4592
346.320	.000395	-3139.4829	152.5568	8.4965E-08	10.9010	-3.5647
351.000	.000390	-2464.5546	135.8484	-1.9121E-06	8.5575	-3.5757
355.680	.000377	-1867.9422	119.2708	-3.4560E-06	6.4859	-3.5087
360.360	.000357	-1348.1798	103.1530	-4.6021E-06	4.6812	-3.3792
365.040	.000334	-902.4305	87.7549	-5.4041E-06	3.1334	-3.2011
369.720	.000307	-526.7936	73.2746	-5.9135E-06	1.8291	-2.9871
374.400	.000278	-216.5804	59.8543	-6.1784E-06	.7520153	-2.7481
379.080	.000249	33.4430	47.5881	-6.2436E-06	.1161214	-2.4939
383.760	.000220	228.8443	36.5282	-6.1502E-06	.7945984	-2.2326
388.440	.000191	375.3469	26.6919	-5.9348E-06	1.3033	-1.9709
393.120	.000164	478.6809	18.0682	-5.6305E-06	1.6621	-1.7144
397.800	.000139	544.4652	10.6233	-5.2659E-06	1.8905	-1.4671
402.480	.000115	578.1154	4.3069	-4.8659E-06	2.0073	-1.2322
407.160	9.31E-05	584.7781	-.9431865	-4.4514E-06	2.0305	-1.0115
411.840	7.33E-05	569.2872	-5.1963	-4.0402E-06	1.9767	-.8061073
416.520	5.53E-05	536.1405	-8.5248	-3.6463E-06	1.8616	-.6163211
421.200	3.92E-05	489.4950	-11.0005	-3.2808E-06	1.6996	-.4416665
425.880	2.46E-05	433.1759	-12.6918	-2.9520E-06	1.5041	-.2811196
430.560	1.15E-05	370.6996	-13.6613	-2.6655E-06	1.2872	-.1331963
435.240	-3.36E-07	305.3060	-13.9638	-2.4246E-06	1.0601	.0039336
439.920	-1.12E-05	239.9985	-13.6449	-2.2303E-06	.8333282	.1323326
444.600	-2.12E-05	177.5895	-12.7405	-2.0815E-06	.6166301	.2541819
449.280	-3.07E-05	120.7476	-11.2760	-1.9751E-06	.4192625	.3716682
453.960	-3.97E-05	72.0461	-9.2670	-1.9064E-06	.2501602	.4868673
458.640	-4.85E-05	34.0083	-6.7200	-1.8686E-06	.1180843	.6016245
463.320	-5.72E-05	9.1474	-3.6334	-1.8533E-06	.0317619	.7174302
468.000	-6.58E-05	0.0000	0.0000	-1.8500E-06	0.0000	.8352887

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

```
Pile-head deflection             =      .50000000 in
Computed slope at pile head      =     -.00003007
Maximum bending moment           =  -968959.15716 lbs-in
Maximum shear force              =    18240.35660 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             20
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = 1.000000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-1530944.	25591.0762	0.0000	5315.7771	-99.8165
4.680	.997447	-1412353.	25088.6960	-.0010489	4904.0032	-107.3280
9.360	.990183	-1296113.	24569.2499	-.0020141	4500.3917	-114.6938
14.040	.978595	-1182385.	24015.6289	-.0028973	4105.5026	-121.8964
18.720	.963064	-1071327.	23428.7198	-.0037004	3719.8837	-128.9195
23.400	.943959	-963092.	22809.3987	-.0044254	3344.0692	-135.7476
28.080	.921642	-857831.	22158.6128	-.0050743	2978.5783	-142.3660
32.760	.896464	-755687.	21477.3772	-.0056493	2623.9143	-148.7603
37.440	.868764	-656802.	20766.7723	-.0061527	2280.5635	-154.9170
42.120	.838875	-561310.	20027.9418	-.0065867	1948.9942	-160.8226
46.800	.807112	-469341.	19262.0903	-.0069540	1629.6554	-166.4643
51.480	.773785	-381017.	18470.4826	-.0072571	1322.9763	-171.8296
56.160	.739186	-296457.	17654.4415	-.0074985	1029.3647	-176.9060
60.840	.703599	-215772.	16815.3472	-.0076810	749.2069	-181.6813
65.520	.667292	-139065.	15954.6364	-.0078075	482.8660	-186.1438
70.200	.630521	-66436.1928	15073.8016	-.0078807	230.6812	-190.2814
74.880	.593529	2025.3894	14174.3906	-.0079037	7.0326	-194.0823
79.560	.556543	66236.1028	13258.0063	-.0078793	229.9865	-197.5349
84.240	.519778	126120.	12326.3070	-.0078108	437.9178	-200.6272
88.920	.483434	181610.	11381.0064	-.0077011	630.5914	-203.3474
93.600	.447695	232647.	10423.8744	-.0075535	807.8005	-205.6834
98.280	.412733	279178.	9456.7376	-.0073711	969.3674	-207.6229
102.960	.378702	321162.	8481.4814	-.0071572	1115.1445	-209.1533
107.640	.345742	358564.	7500.0513	-.0069149	1245.0155	-210.2613
112.320	.313978	391362.	6514.4557	-.0066477	1358.8962	-210.9334
117.000	.283519	419540.	5526.7693	-.0063587	1456.7353	-211.1548
121.680	.254460	443093.	4539.1378	-.0060513	1538.5162	-210.9099
126.360	.226879	462026.	3561.9958	-.0057288	1604.2573	-206.6721
131.040	.200839	476433.	2609.2864	-.0053943	1654.2810	-200.4687

135.720	.176388	486449.	1686.0712	-.0050512	1689.0591	-194.0677
140.400	.153560	492215.	793.2979	-.0047025	1709.0783	-187.4593
145.080	.132373	493874.	-68.0308	-.0043511	1714.8413	-180.6299
149.760	.112834	491578.	-896.8372	-.0039999	1706.8673	-173.5609
154.440	.094934	485480.	-1691.9400	-.0036517	1685.6941	-166.2266
159.120	.078654	475741.	-2452.0131	-.0033092	1651.8793	-158.5910
163.800	.063960	462529.	-3175.5244	-.0029748	1606.0037	-150.6019
168.480	.050810	446018.	-3860.6392	-.0026510	1548.6747	-142.1822
173.160	.039147	426393.	-4505.0591	-.0023401	1480.5329	-133.2110
177.840	.028906	403851.	-5105.7343	-.0020443	1402.2603	-123.4878
182.520	.020013	378604.	-5587.6731	-.0017654	1314.5965	-82.4689
187.200	.012382	351550.	-5904.1131	-.0015052	1220.6609	-52.7619
191.880	.005924	323341.	-6088.5880	-.0012647	1122.7128	-26.0736
196.560	.000544	294561.	-6155.3810	-.0010445	1022.7818	-2.4704
201.240	-.003853	265727.	-6118.9420	-.0008449	922.6630	18.0427
205.920	-.007364	237288.	-5993.6151	-.0006656	823.9162	35.5158
210.600	-.010083	209627.	-5793.3993	-.0005064	727.8705	50.0465
215.280	-.012104	183062.	-5531.7435	-.0003664	635.6307	61.7722
219.960	-.013513	157850.	-5221.3769	-.0002449	548.0888	70.8631
224.640	-.014396	134190.	-4874.1727	-.0001409	465.9360	77.5148
229.320	-.014831	112227.	-4501.0449	-5.3042E-05	389.6782	81.9415
234.000	-.014892	92059.7854	-4111.8763	1.9758E-05	319.6520	84.3698
238.680	-.014646	73740.1555	-3715.4747	7.8842E-05	256.0422	85.0326
243.360	-.014155	57282.9426	-3319.5554	.0001255	198.8991	84.1637
248.040	-.013471	42669.1167	-2930.7470	.0001612	148.1567	81.9938
252.720	-.012646	29851.1507	-2554.6165	.0001870	103.6498	78.7458
257.400	-.011721	18757.9063	-2195.7123	.0002043	65.1316	74.6321
262.080	-.010734	9299.2835	-1857.6208	.0002143	32.2892	69.8515
266.760	-.009715	1370.5755	-1543.0339	.0002181	4.7589	64.5874
271.440	-.008692	-5143.5137	-1253.8248	.0002168	17.8594	59.0063
276.120	-.007686	-10365.2245	-991.1294	.0002112	35.9904	53.2567
280.800	-.006715	-14420.4852	-755.4309	.0002024	50.0711	47.4691
285.480	-.005792	-17436.0580	-546.6451	.0001911	60.5419	41.7556
290.160	-.004927	-19537.0835	-364.2051	.0001779	67.8371	36.2102
294.840	-.004127	-20845.0180	-207.1436	.0001635	72.3785	30.9101
299.520	-.003396	-21475.9471	-74.1707	.0001484	74.5693	25.9159
304.200	-.002737	-21539.2554	36.2522	.0001331	74.7891	21.2733
308.880	-.002151	-21136.6269	125.8449	.0001179	73.3911	17.0142
313.560	-.001634	-20361.3476	196.4474	.0001031	70.6991	13.1579
318.240	-.001186	-19297.8793	249.9652	8.8957E-05	67.0065	9.7130
322.920	-.000801	-18021.6737	288.3212	7.5657E-05	62.5753	6.6785
327.600	-.000477	-16599.1928	313.4154	6.3320E-05	57.6361	4.0455
332.280	-.000209	-15088.1053	327.0903	5.2028E-05	52.3893	1.7985
336.960	9.54E-06	-13537.6272	331.1034	4.1827E-05	47.0056	-.0834713
341.640	.000183	-11988.9773	327.1054	3.2730E-05	41.6284	-1.6251
346.320	.000316	-10475.9205	316.6243	2.4725E-05	36.3747	-2.8540
351.000	.000414	-9025.3736	301.0545	1.7775E-05	31.3381	-3.7997
355.680	.000482	-7658.0500	281.6505	1.1830E-05	26.5905	-4.4926
360.360	.000525	-6389.1252	259.5242	6.8239E-06	22.1845	-4.9631
365.040	.000546	-5228.9035	235.6468	2.6837E-06	18.1559	-5.2410
369.720	.000550	-4183.4716	210.8521	-6.7046E-07	14.5259	-5.3550
374.400	.000540	-3255.3277	185.8437	-3.3214E-06	11.3032	-5.3323
379.080	.000519	-2443.9748	161.2026	-5.3524E-06	8.4860	-5.1980
383.760	.000490	-1746.4714	137.3976	-6.8457E-06	6.0641	-4.9750
388.440	.000455	-1157.9332	114.7958	-7.8807E-06	4.0206	-4.6839
393.120	.000416	-671.9827	93.6740	-8.5328E-06	2.3333	-4.3426
397.800	.000375	-281.1447	74.2305	-8.8724E-06	.9761968	-3.9666
402.480	.000333	22.8144	56.5967	-8.9645E-06	.0792167	-3.5691
407.160	.000291	248.6007	40.8489	-8.8678E-06	.8631969	-3.1607
411.840	.000250	405.1604	27.0189	-8.6348E-06	1.4068	-2.7496
416.520	.000210	501.4979	15.1047	-8.3117E-06	1.7413	-2.3420
421.200	.000172	546.5404	5.0799	-7.9382E-06	1.8977	-1.9421
425.880	.000136	549.0461	-3.0971	-7.5478E-06	1.9064	-1.5524
430.560	.000102	517.5514	-9.4759	-7.1677E-06	1.7971	-1.1736
435.240	6.88E-05	460.3517	-14.1068	-6.8192E-06	1.5984	-.8054105
439.920	3.77E-05	385.5115	-17.0356	-6.5178E-06	1.3386	-.4462131
444.600	7.82E-06	300.8983	-18.2990	-6.2732E-06	1.0448	-.0936790
449.280	-2.10E-05	214.2332	-17.9213	-6.0896E-06	.7438652	.2550719
453.960	-4.92E-05	133.1548	-15.9130	-5.9658E-06	.4623430	.6031621
458.640	-7.69E-05	65.2871	-12.2701	-5.8951E-06	.2266913	.9536453
463.320	-.000104	18.3065	-6.9751	-5.8653E-06	.0635643	1.3092
468.000	-.000132	0.0000	0.0000	-5.8588E-06	0.0000	1.6716

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.00004226
Maximum bending moment           =      -1530944. lbs-in
Maximum shear force              =    25591.07622 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             15
Number of zero deflection points =              3
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	238179.	6428.9273
4	y= .500000	M= 0.000	0.0000	.5000000	375911.	8954.8976
4	y= 1.000000	M= 0.000	0.0000	1.0000000	597554.	12537.4198
5	y= .250000	S= 0.000	0.0000	.2500000	-609842.	12971.1668
5	y= .500000	S= 0.000	0.0000	.5000000	-968959.	18240.3566
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-1530944.	25591.0762

The analysis ended normally.

```
==============================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.25)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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==============================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Douglas\
Name of input data file:     Douglas Bent 2 12 inch Sq pile_3D(0.75)Row1.lpd
Name of output file:         Douglas Bent 2 12 inch Sq pile_3D(0.75)Row1.lpo
Name of plot output file:    Douglas Bent 2 12 inch Sq pile_3D(0.75)Row1.lpp
Name of runtime file:        Douglas Bent 2 12 inch Sq pile_3D(0.75)Row1.lpr


------------------------------------------------------------------------------
                           Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  May 11, 2009     Time:  14: 6:14


------------------------------------------------------------------------------
                                 Problem Title
------------------------------------------------------------------------------

Douglas Road Bent 2/ 12-inch Square Concrete Pile/3D(0.75)Row1


------------------------------------------------------------------------------
                                 Program Options
------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Pile Length                                =     348.00 in
Depth of ground surface below top of pile =    -108.00 in
Slope angle of ground surface              =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
           in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   12.00000000    1728.0000     144.0000      3800000.
  2     348.0000   12.00000000    1728.0000     144.0000      3800000.


------------------------------------------------------------------------------
                         Soil and Rock Layering Information
------------------------------------------------------------------------------

The soil profile is modelled using  3 layers

Layer  1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =     -108.000 in
Distance from top of pile to bottom of layer =      372.000 in
p-y subgrade modulus k for top of soil layer =       75.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       75.000 lbs/in**3

Layer  2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      372.000 in
Distance from top of pile to bottom of layer =      552.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  3 is stiff clay without free water
Distance from top of pile to top of layer    =      552.000 in
Distance from top of pile to bottom of layer =      870.000 in


(Depth of lowest layer extends  522.00 in below pile tip)


------------------------------------------------------------------------------
                    Effective Unit Weight of Soil vs. Depth
------------------------------------------------------------------------------
```

Distribution of effective unit weight of soil with depth
is defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-108.00	.06366
2	372.00	.06366
3	372.00	.02755
4	552.00	.02755
5	552.00	.02755
6	870.00	.02755

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-108.000	.00000	33.00	------	------
2	372.000	.00000	33.00	------	------
3	372.000	.00000	32.00	------	------
4	552.000	.00000	32.00	------	------
5	552.000	10.42000	.00	.00600	.0
6	870.000	10.42000	.00	.00600	.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

---

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.7500	1.0000
2	348.000	.7500	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

---

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)

Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	31531.4781	-.0055778	0.0000	-909.5430
3.480	.230589	104222.	28355.0708	-.0055502	361.8822	-915.9784
6.960	.211370	197351.	25162.7360	-.0054703	685.2475	-918.6968
10.440	.192516	279355.	21967.1202	-.0053440	969.9817	-917.8641
13.920	.174176	350242.	18782.7415	-.0051772	1216.1196	-912.2386
17.400	.156483	410083.	15626.8855	-.0049757	1423.8979	-901.4717
20.880	.139546	459006.	12517.4029	-.0047454	1593.7693	-885.5873
24.360	.123455	497204.	9472.0000	-.0044920	1726.4018	-864.6443
27.840	.108281	524931.	6527.8824	-.0042211	1822.6760	-827.3774
31.320	.094076	542638.	3805.4339	-.0039383	1884.1590	-737.2482
34.800	.080871	551417.	1392.3244	-.0036484	1914.6407	-649.5964
38.280	.068683	552328.	-721.3218	-.0033559	1917.8068	-565.1428
41.760	.057514	546396.	-2547.6984	-.0030647	1897.2087	-484.4989
45.240	.047353	534596.	-4100.9400	-.0027783	1856.2374	-408.1686
48.720	.038177	517854.	-5396.7535	-.0024994	1798.1027	-336.5518
52.200	.029957	497035.	-6452.0652	-.0022305	1725.8159	-269.9492
55.680	.022653	472947.	-7284.6856	-.0019734	1642.1778	-208.5682
59.160	.016222	446334.	-7912.9957	-.0017298	1549.7693	-152.5295
62.640	.010614	417873.	-8355.6578	-.0015008	1450.9470	-101.8740
66.120	.005776	388178.	-8631.3526	-.0012872	1347.8409	-56.5712
69.600	.001654	357799.	-8758.5426	-.0010896	1242.3560	-16.5265
73.080	-.001807	327219.	-8755.2645	-.0009081	1136.1762	18.4104
76.560	-.004666	296862.	-8638.9491	-.0007427	1030.7705	48.4375
80.040	-.006977	267092.	-8426.2688	-.0005932	927.4016	73.7925
83.520	-.008795	238215.	-8133.0126	-.0004593	827.1356	94.7455
87.000	-.010174	210486.	-7773.9866	-.0003404	730.8538	111.5913
90.480	-.011164	184108.	-7362.9393	-.0002359	639.2643	124.6428
93.960	-.011815	159240.	-6912.5095	-.0001449	552.9161	134.2248
97.440	-.012173	135997.	-6434.1962	-6.6667E-05	472.2120	140.6679
100.920	-.012279	114458.	-5938.3462	-3.0002E-07	397.4230	144.3034
104.400	-.012175	94666.1591	-5434.1606	5.5115E-05	328.7019	145.4585
107.880	-.011896	76636.0605	-4929.7154	.0001005	266.0974	144.4526
111.360	-.011475	60355.3402	-4431.9954	.0001368	209.5672	141.5934
114.840	-.010944	45789.3727	-3946.9395	.0001649	158.9909	137.1743
118.320	-.010327	32884.6413	-3479.4948	.0001858	114.1828	131.4720
121.800	-.009650	21572.0889	-3033.6780	.0002002	74.9031	124.7445
125.280	-.008934	11770.2423	-2612.6425	.0002090	40.8689	117.2299
128.760	-.008196	3388.0973	-2218.7488	.0002131	11.7642	109.1457
132.240	-.007451	-3672.2495	-1853.6382	.0002130	12.7509	100.6880
135.720	-.006713	-9513.2247	-1518.3062	.0002095	33.0320	92.0316
139.200	-.005993	-14239.6604	-1213.1765	.0002032	49.4433	83.3303
142.680	-.005299	-17956.9328	-938.1735	.0001947	62.3505	74.7174
146.160	-.004638	-20769.3481	-692.7926	.0001844	72.1158	66.3062
149.640	-.004015	-22778.7690	-476.1668	.0001729	79.0929	58.1914
153.120	-.003435	-24083.4691	-287.1310	.0001605	83.6232	50.4499
156.600	-.002899	-24777.2006	-124.2807	.0001475	86.0319	43.1422
160.080	-.002408	-24948.4628	13.9726	.0001343	86.6266	36.3137
163.560	-.001964	-24679.9515	129.3515	.0001212	85.6943	29.9960
167.040	-.001565	-24048.1764	223.6674	.0001083	83.5006	24.2085
170.520	-.001210	-23123.2262	298.7802	9.5763E-05	80.2890	18.9597
174.000	-.000898	-21968.6661	356.5627	8.3815E-05	76.2801	14.2486
177.480	-.000627	-20641.5500	398.8699	7.2524E-05	71.6720	10.0659
180.960	-.000393	-19192.5315	427.5133	6.1968E-05	66.6407	6.3958
184.440	-.000196	-17666.0574	444.2388	5.2201E-05	61.3405	3.2166
187.920	-3.02E-05	-16100.6293	450.7095	4.3254E-05	55.9050	.5021903
191.400	.000106	-14529.1195	448.4916	3.5137E-05	50.4483	-1.7768
194.880	.000214	-12979.1279	439.0446	2.7848E-05	45.0664	-3.6525
198.360	.000299	-11473.3693	423.7140	2.1368E-05	39.8381	-5.1582
201.840	.000363	-10030.0788	403.7272	1.5670E-05	34.8267	-6.3284
205.320	.000408	-8663.4282	380.1919	1.0717E-05	30.0813	-7.1976
208.800	.000438	-7383.9431	354.0965	6.4644E-06	25.6387	-7.7997
212.280	.000453	-6198.9162	326.3126	2.8651E-06	21.5240	-8.1680
215.760	.000458	-5112.8075	297.5986	-1.3232E-07	17.7528	-8.3343
219.240	.000452	-4127.6301	268.6052	-2.5809E-06	14.3320	-8.3286
222.720	.000440	-3243.3152	239.8816	-4.5341E-06	11.2615	-8.1793
226.200	.000421	-2458.0544	211.8819	-6.0449E-06	8.5349	-7.9125
229.680	.000398	-1768.6170	184.9733	-7.1649E-06	6.1410	-7.5523
233.160	.000371	-1170.6404	159.4430	-7.9437E-06	4.0647	-7.1203
236.640	.000342	-658.8935	135.5069	-8.4285E-06	2.2878	-6.6361
240.120	.000312	-227.5123	113.3168	-8.6634E-06	.7899734	-6.1168
243.600	.000282	129.7914	92.9685	-8.6893E-06	.4506646	-5.5776
247.080	.000252	419.5485	74.5092	-8.5438E-06	1.4568	-5.0312
250.560	.000223	648.3757	57.9447	-8.2608E-06	2.2513	-4.4886
254.040	.000194	822.8437	43.2459	-7.8709E-06	2.8571	-3.9589
257.520	.000168	949.3672	30.3553	-7.4013E-06	3.2964	-3.4494
261.000	.000143	1034.1167	19.1927	-6.8757E-06	3.5907	-2.9658
264.480	.000120	1082.9487	9.6605	-6.3147E-06	3.7602	-2.5125
267.960	9.89E-05	1101.3538	1.6482	-5.7359E-06	3.8241	-2.0923
271.440	8.00E-05	1094.4200	-4.9632	-5.1541E-06	3.8001	-1.7073
274.920	6.31E-05	1066.8097	-10.2976	-4.5814E-06	3.7042	-1.3584
278.400	4.81E-05	1022.7487	-14.4806	-4.0277E-06	3.5512	-1.0456
281.880	3.50E-05	966.0250	-17.6368	-3.5007E-06	3.3543	-.7683115
285.360	2.37E-05	899.9969	-19.8877	-3.0062E-06	3.1250	-.5253273
288.840	1.41E-05	827.6067	-21.3498	-2.5484E-06	2.8736	-.3149742
292.320	6.01E-06	751.4022	-22.1332	-2.1300E-06	2.6090	-.1352209
295.800	-7.14E-07	673.5600	-22.3402	-1.7524E-06	2.3388	.0162288
299.280	-6.19E-06	595.9144	-22.0651	-1.4160E-06	2.0691	.1418500
302.760	-1.06E-05	519.9866	-21.3934	-1.1203E-06	1.8055	.2442218
306.240	-1.40E-05	447.0165	-20.4013	-8.6408E-07	1.5521	.3259618
309.720	-1.66E-05	377.9939	-19.1561	-6.4546E-07	1.3125	.3896689
313.200	-1.85E-05	313.6903	-17.7161	-4.6218E-07	1.0892	.4378751
316.680	-1.98E-05	254.6896	-16.1312	-3.1156E-07	.8843389	.4730039
320.160	-2.07E-05	201.4171	-14.4428	-1.9070E-07	.6993651	.4973363
323.640	-2.11E-05	154.1676	-12.6849	-9.6477E-08	.5353043	.5129820
327.120	-2.13E-05	113.1305	-10.8842	-2.5647E-08	.3928144	.5218556
330.600	-2.13E-05	78.4133	-9.0616	2.5110E-08	.2722685	.5256575
334.080	-2.11E-05	50.0620	-7.2319	5.9154E-08	.1738265	.5258572
337.560	-2.09E-05	28.0791	-5.4057	7.9860E-08	.0974968	.5236804
341.040	-2.06E-05	12.4381	-3.5896	9.0596E-08	.0431879	.5200969
344.520	-2.03E-05	3.0957	-1.7871	9.4713E-08	.0107490	.5158105
348.000	-1.99E-05	0.0000	0.0000	9.5533E-08	0.0000	.5112498

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection = .25000000 in
Computed slope at pile head = -.00557784
Maximum bending moment = 552328.36605 lbs-in

Maximum shear force = 31531.47810 lbs
Depth of maximum bending moment = 38.28000000 in
Depth of maximum shear force = 0.00000 in
Number of iterations = 5
Number of zero deflection points = 3

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	54478.1827	-.0107364	0.0000	-1389.5796
3.480	.462637	181170.	49493.8769	-.0106884	629.0621	-1474.9639
6.960	.425609	344477.	44322.5933	-.0105491	1196.1020	-1497.0381
10.440	.389216	489655.	39142.9795	-.0103281	1700.1915	-1479.7514
13.920	.353725	616913.	34034.9003	-.0100349	2142.0574	-1455.9263
17.400	.319373	726538.	29019.8639	-.0096789	2522.7016	-1426.2785
20.880	.286361	818891.	24116.7600	-.0092693	2843.3707	-1391.5973
24.360	.254858	894391.	19341.6302	-.0088153	3105.5233	-1352.7302
27.840	.225006	953509.	14707.4947	-.0083257	3310.7935	-1310.5661
31.320	.196912	996755.	10224.3017	-.0078089	3460.9544	-1265.9815
34.800	.170656	1024670.	5905.1120	-.0072732	3557.8808	-1216.3115
38.280	.146290	1037854.	1771.0610	-.0067267	3603.6613	-1159.5799
41.760	.123838	1036996.	-2061.7959	-.0061769	3600.6814	-1043.2115
45.240	.103299	1023504.	-5426.2953	-.0056309	3553.8345	-890.4089
48.720	.084647	999229.	-8274.0045	-.0050949	3469.5459	-746.2056
52.200	.067838	965917.	-10636.0764	-.0045742	3353.8794	-611.3069
55.680	.052811	925202.	-12545.7893	-.0040730	3212.5074	-486.2293
59.160	.039490	878599.	-14037.9124	-.0035951	3050.6895	-371.3127
62.640	.027789	827498.	-15148.1145	-.0031430	2873.2579	-266.7344
66.120	.017615	773168.	-15912.4222	-.0027188	2684.6101	-172.5229
69.600	.008866	716748.	-16366.7295	-.0023240	2488.7077	-88.5733
73.080	.001440	659255.	-16546.3609	-.0019594	2289.0808	-14.6631
76.560	-.004771	601585.	-16485.6890	-.0016253	2088.8373	49.5320
80.040	-.009872	544515.	-16217.8067	-.0013216	1890.6766	104.4233
83.520	-.013969	488709.	-15774.2527	-.0010478	1696.9070	150.4928
87.000	-.017165	434726.	-15184.7880	-.0008031	1509.4655	188.2800
90.480	-.019559	383023.	-14477.2223	-.0005864	1329.9412	218.3670
93.960	-.021247	333965.	-13677.2867	-.0003964	1159.5993	241.3662
97.440	-.022318	287829.	-12808.5491	-.0002317	999.4068	257.9083
100.920	-.022859	244817.	-11892.3695	-9.0511E-05	850.0594	268.6317
104.400	-.022948	205058.	-10947.8907	2.8700E-05	712.0079	274.1722
107.880	-.022659	168620.	-9992.0607	.0001277	585.4853	275.1553
111.360	-.022059	135514.	-9039.6834	.0002083	470.5331	272.1880
114.840	-.021209	105704.	-8103.4920	.0002722	367.0263	265.8530
118.320	-.020164	79113.2241	-7194.2436	.0003212	274.6987	256.7035
121.800	-.018974	55631.6473	-6320.8290	.0003569	193.1654	245.2589
125.280	-.017680	35120.2542	-5490.3953	.0003810	121.9453	232.0018
128.760	-.016322	17418.4957	-4708.4784	.0003949	60.4809	217.3757
132.240	-.014932	2349.2443	-3979.1408	.0004001	8.1571	201.7838
135.720	-.013537	-10276.3240	-3305.1133	.0003980	35.6817	185.5883
139.200	-.012162	-20654.3442	-2687.9379	.0003898	71.7165	169.1103
142.680	-.010824	-28984.3715	-2128.1084	.0003767	100.6402	152.6308
146.160	-.009540	-35465.9784	-1625.2086	.0003596	123.1458	136.3920
149.640	-.008322	-40295.8235	-1178.0454	.0003395	139.9161	120.5984
153.120	-.007177	-43665.1740	-784.7747	.0003173	151.6152	105.4192
156.600	-.006113	-45757.8553	-443.0214	.0002936	158.8814	90.9907
160.080	-.005134	-46748.6028	-149.9898	.0002691	162.3215	77.4183
163.560	-.004241	-46801.7842	97.4341	.0002443	162.5062	64.7794
167.040	-.003434	-46070.4615	302.5898	.0002197	159.9669	53.1262
170.520	-.002712	-44695.7591	468.9591	.0001956	155.1936	42.4883
174.000	-.002073	-42806.5063	600.0919	.0001724	148.6337	32.8754
177.480	-.001512	-40519.1196	699.5419	.0001503	140.6914	24.2798
180.960	-.001026	-37937.6944	770.8112	.0001295	131.7281	16.6795
184.440	-.000610	-35154.2738	817.3030	.0001102	122.0635	10.0399
187.920	-.000259	-32249.2656	842.2837	9.2317E-05	111.9766	4.3168
191.400	3.22E-05	-29291.9794	848.8516	7.6010E-05	101.7083	-.5421214
194.880	.000270	-26341.2586	839.9134	6.1268E-05	91.4627	-4.5948
198.360	.000459	-23446.1821	818.1669	4.8075E-05	81.4104	-7.9032
201.840	.000604	-20646.8166	786.0898	3.6391E-05	71.6903	-10.5320
205.320	.000712	-17974.9973	745.9330	2.6157E-05	62.4132	-12.5466
208.800	.000786	-15455.1230	699.7197	1.7298E-05	53.6636	-14.0127
212.280	.000832	-13104.9480	649.2474	9.7303E-06	45.5033	-14.9944
215.760	.000854	-10936.3611	596.0934	3.3597E-06	37.9735	-15.5539
219.240	.000856	-8956.1379	541.6235	-1.9115E-06	31.0977	-15.7507
222.720	.000841	-7166.6615	487.0024	-6.1838E-06	24.8842	-15.6408
226.200	.000813	-5566.6010	433.2063	-9.5579E-06	19.3285	-15.2766
229.680	.000774	-4151.5459	381.0360	-1.2133E-05	14.4151	-14.7063
233.160	.000728	-2914.5905	331.1319	-1.4006E-05	10.1201	-13.9742
236.640	.000677	-1846.8679	283.9885	-1.5267E-05	6.4127	-13.1197
240.120	.000622	-938.0307	239.9695	-1.6005E-05	3.2571	-12.1785
243.600	.000565	-176.6799	199.3230	-1.6301E-05	.6134719	-11.1816
247.080	.000508	449.2576	162.1957	-1.6228E-05	1.5599	-10.1560
250.560	.000452	952.2023	128.6471	-1.5857E-05	3.3063	-9.1248
254.040	.000398	1344.6415	98.6629	-1.5248E-05	4.6689	-8.1075
257.520	.000346	1638.8957	72.1672	-1.4458E-05	5.6906	-7.1199
261.000	.000297	1846.9252	49.0345	-1.3534E-05	6.4129	-6.1747
264.480	.000252	1980.1760	29.1001	-1.2520E-05	6.8756	-5.2818
267.960	.000210	2049.4616	12.1694	-1.1452E-05	7.1162	-4.4484
271.440	.000172	2064.8750	-1.9729	-1.0362E-05	7.1697	-3.6793
274.920	.000138	2035.7304	-13.5555	-9.2753E-06	7.0685	-2.9774
278.400	.000108	1970.5285	-22.8142	-8.2137E-06	6.8421	-2.3437
281.880	8.11E-05	1876.9437	-29.9855	-7.1942E-06	6.5172	-1.7778
285.360	5.78E-05	1761.8293	-35.3025	-6.2300E-06	6.1175	-1.2780
288.840	3.77E-05	1631.2380	-38.9906	-5.3309E-06	5.6640	-.8416072
292.320	2.07E-05	1490.4545	-41.2643	-4.5036E-06	5.1752	-.4651205
295.800	6.36E-06	1344.0382	-42.3249	-3.7525E-06	4.6668	-.1443964
299.280	-5.46E-06	1195.8732	-42.3584	-3.0795E-06	4.1523	.1251373
302.760	-1.51E-05	1049.2236	-41.5346	-2.4846E-06	3.6431	.3483385
306.240	-2.28E-05	906.7926	-40.0059	-1.9663E-06	3.1486	.5302143
309.720	-2.88E-05	770.7827	-37.9074	-1.5217E-06	2.6763	.6758005
313.200	-3.33E-05	642.9570	-35.3568	-1.1471E-06	2.2325	.7900580
316.680	-3.67E-05	524.6992	-32.4548	-8.3771E-07	1.8219	.8777838
320.160	-3.92E-05	417.0717	-29.2857	-5.8816E-07	1.4482	.9435341
323.640	-4.08E-05	320.8708	-25.9186	-3.9261E-07	1.1141	.9915603
327.120	-4.19E-05	236.6781	-22.4085	-2.4487E-07	.8217989	1.0258
330.600	-4.25E-05	164.9077	-18.7974	-1.3845E-07	.5725961	1.0496
334.080	-4.29E-05	105.8483	-15.1160	-6.6709E-08	.3675287	1.0661

337.560	-4.30E-05	59.7000	-11.3855	-2.2841E-08	.2072918	1.0779
341.040	-4.30E-05	26.6055	-7.6187	2.9061E-11	.0923801	1.0869
344.520	-4.30E-05	6.6740	-3.8226	8.8476E-09	.0231736	1.0947
348.000	-4.30E-05	0.0000	0.0000	1.0616E-08	0.0000	1.1022

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      .50000000 in
Computed slope at pile head      =     -.01073640
Maximum bending moment           =       1037854. lbs-in
Maximum shear force              =    54478.18266 lbs
Depth of maximum bending moment  =    38.28000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              6
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	80977.0756	-.0201325	0.0000	-1389.5796
3.480	.929939	273386.	75992.7697	-.0200601	949.2571	-1474.9640
6.960	.860382	528910.	70706.9142	-.0198475	1836.4919	-1562.8839
10.440	.791800	765506.	65110.6857	-.0195045	2658.0075	-1653.3393
13.920	.724630	982080.	59195.2607	-.0190414	3410.0002	-1746.3302
17.400	.659272	1177505.	52951.8155	-.0184692	4088.5596	-1841.8567
20.880	.596085	1350625.	46371.5264	-.0177992	4689.6690	-1939.9187
24.360	.535389	1500251.	39445.5696	-.0170438	5209.2049	-2040.5163
27.840	.477460	1625166.	32165.1210	-.0162156	5642.9370	-2143.6496
31.320	.422529	1724120.	24707.0865	-.0153281	5986.5286	-2142.5772
34.800	.370777	1797127.	17438.2611	-.0143950	6240.0249	-2034.9086
38.280	.322339	1845491.	10549.7805	-.0134298	6407.9533	-1923.9883
41.760	.277305	1870554.	4050.0665	-.0124451	6494.9779	-1811.4795
45.240	.235721	1873679.	-2058.1745	-.0114529	6505.8299	-1699.0038
48.720	.197593	1856229.	-7777.7096	-.0104645	6445.2387	-1588.0854
52.200	.162888	1819546.	-13094.9970	-.0094905	6317.8686	-1467.8269
55.680	.131539	1765088.	-17756.2970	-.0085406	6128.7763	-1211.0811
59.160	.103445	1695962.	-21556.0264	-.0076235	5888.7581	-972.6714
62.640	.078480	1615058.	-24559.1918	-.0067461	5607.8390	-753.2857
66.120	.056492	1525030.	-26832.6501	-.0059141	5295.2442	-553.2995
69.600	.037318	1428302.	-28444.0690	-.0051315	4959.3833	-372.8033
73.080	.020777	1327060.	-29460.9858	-.0044013	4607.8459	-211.6317
76.560	.006684	1223254.	-29949.9689	-.0037255	4247.4094	-69.3931
80.040	-.005153	1118608.	-29975.8827	-.0031050	3884.0550	54.5001
83.520	-.014926	1014622.	-29601.2568	-.0025397	3522.9923	160.8022
87.000	-.022829	912583.	-28885.7556	-.0020290	3168.6913	250.4053
90.480	-.029048	813577.	-27885.7481	-.0015716	2824.9199	324.3116
93.960	-.033767	718498.	-26653.9696	-.0011656	2494.7857	383.6071
97.440	-.037161	628065.	-25239.2733	-.0008088	2180.7823	429.4368
100.920	-.039397	542833.	-23686.4632	-.0004986	1884.8366	462.9828
104.400	-.040631	463208.	-22036.2028	-.0002320	1608.3594	485.4427
107.880	-.041011	389461.	-20324.9914	-6.0257E-06	1352.2950	498.0121
111.360	-.040673	321746.	-18585.2010	.0001824	1117.1721	501.8674
114.840	-.039742	260108.	-16845.1669	.0003366	903.1527	498.1522
118.320	-.038330	204503.	-15129.3223	.0004597	710.0806	487.9653
121.800	-.036542	154808.	-13458.3726	.0005549	537.5274	472.3506
125.280	-.034468	110833.	-11849.4995	.0006253	384.8366	452.2892
128.760	-.032190	72335.3738	-10316.5896	.0006739	251.1645	428.6935
132.240	-.029778	39029.4672	-8870.4814	.0007034	135.5190	402.4031
135.720	-.027294	10596.8232	-7519.2239	.0007165	36.7945	374.1817
139.200	-.024791	-13304.3314	-6268.3419	.0007158	46.1956	344.7160
142.680	-.022312	-33030.8367	-5121.1035	.0007035	114.6904	314.6164
146.160	-.019894	-48947.2116	-4078.7850	.0006818	169.9556	284.4172
149.640	-.017567	-61419.1802	-3140.9303	.0006526	213.2610	254.5797
153.120	-.015352	-70808.0863	-2305.6006	.0006175	245.8614	225.4948
156.600	-.013269	-77466.1603	-1569.6129	.0005782	268.9797	197.4866
160.080	-.011328	-81732.5922	-928.7644	.0005361	283.7937	170.8171
163.560	-.009538	-83930.3605	-378.0414	.0004922	291.4249	145.6904
167.040	-.007902	-84363.7603	88.1880	.0004476	292.9297	122.2576
170.520	-.006423	-83316.5722	475.9987	.0004031	289.2937	100.6222
174.000	-.005097	-81050.8095	791.7514	.0003596	281.4264	80.8449
177.480	-.003920	-77805.9827	1041.9526	.0003175	270.1597	62.9489
180.960	-.002887	-73798.8195	1233.1326	.0002773	256.2459	46.9247
184.440	-.001990	-69223.3795	1371.7404	.0002394	240.3590	32.7350
187.920	-.001221	-64251.5062	1464.0546	.0002040	223.0955	20.3192
191.400	-.000570	-59033.5597	1516.1102	.0001714	204.9776	9.5979
194.880	-2.80E-05	-53699.3792	1533.6399	.0001415	186.4562	.4766877
198.360	.000415	-48359.4258	1522.0284	.0001145	167.9147	-7.1500
201.840	.000769	-43106.0613	1486.2792	9.0214E-05	149.6738	-13.3956
205.320	.001043	-38014.9224	1430.9924	6.8718E-05	131.9963	-18.3785
208.800	.001247	-33146.3545	1360.3520	4.9862E-05	115.0915	-22.2194
212.280	.001390	-28546.8725	1278.1226	3.3514E-05	99.1211	-25.0389
215.760	.001480	-24250.6215	1187.6523	1.9523E-05	84.2035	-26.9555
219.240	.001526	-20280.8125	1091.8832	7.7231E-06	70.4195	-28.0842
222.720	.001534	-16651.1146	993.3658	-2.0633E-06	57.8164	-28.5349
226.200	.001511	-13366.9863	894.2789	-1.0018E-05	46.4131	-28.4116
229.680	.001464	-10426.9336	796.4514	-1.6323E-05	36.2046	-27.8111
233.160	.001398	-7823.6844	701.3878	-2.1159E-05	27.1656	-26.8231
236.640	.001317	-5545.2742	610.2944	-2.4701E-05	19.2544	-25.5294
240.120	.001226	-3576.0356	524.1065	-2.7118E-05	12.4168	-24.0038
243.600	.001128	-1897.4928	443.5168	-2.8569E-05	6.5885	-22.3121
247.080	.001027	-489.1586	369.0024	-2.9201E-05	1.6985	-20.5123
250.560	.000925	670.7640	300.8521	-2.9153E-05	2.3290	-18.6546
254.040	.000824	1604.7719	239.1920	-2.8550E-05	5.5721	-16.7822
257.520	.000726	2335.5407	184.0108	-2.7506E-05	8.1095	-14.9311
261.000	.000633	2885.4873	135.1824	-2.6123E-05	10.0191	-13.1312
264.480	.000544	3276.4098	92.4874	-2.4490E-05	11.3764	-11.4061
267.960	.000462	3529.1999	55.6336	-2.2686E-05	12.2542	-9.7743
271.440	.000386	3663.6196	24.2728	-2.0780E-05	12.7209	-8.2492
274.920	.000318	3698.1388	-1.9822	-1.8830E-05	12.8408	-6.8400
278.400	.000255	3649.8233	-23.5443	-1.6883E-05	12.6730	-5.5520
281.880	.000200	3534.2707	-40.8388	-1.4979E-05	12.2718	-4.3874

285.360	.000151	3365.5854	-54.2936	-1.3150E-05	11.6861	-3.3453
288.840	.000109	3156.3875	-64.3296	-1.1422E-05	10.9597	-2.4226
292.320	7.17E-05	2917.8511	-71.3538	-9.8127E-06	10.1314	-1.6143
295.800	4.02E-05	2659.7649	-75.7528	-8.3347E-06	9.2353	-.9138185
299.280	1.37E-05	2390.6119	-77.8881	-6.9964E-06	8.3007	-.3134008
302.760	-8.46E-06	2117.6636	-78.0932	-5.8018E-06	7.3530	.1955409
306.240	-2.67E-05	1847.0833	-76.6704	-4.7512E-06	6.4135	.6221472
309.720	-4.15E-05	1584.0375	-73.8899	-3.8420E-06	5.5001	.9758500
313.200	-5.34E-05	1332.8096	-69.9888	-3.0691E-06	4.6278	1.2661
316.680	-6.29E-05	1096.9152	-65.1716	-2.4252E-06	3.8087	1.5024
320.160	-7.03E-05	879.2152	-59.6106	-1.9016E-06	3.0528	1.6936
323.640	-7.61E-05	682.0253	-53.4477	-1.4879E-06	2.3681	1.8483
327.120	-8.07E-05	507.2195	-46.7958	-1.1727E-06	1.7612	1.9746
330.600	-8.43E-05	356.3267	-39.7416	-9.4391E-07	1.2372	2.0795
334.080	-8.72E-05	230.6177	-32.3483	-7.8838E-07	.8007561	2.1695
337.560	-8.98E-05	131.1826	-24.6582	-6.9251E-07	.4554953	2.2500
341.040	-9.21E-05	58.9964	-16.6969	-6.4211E-07	.2048488	2.3254
344.520	-9.42E-05	14.9721	-8.4765	-6.2251E-07	.0519866	2.3989
348.000	-9.64E-05	0.0000	0.0000	-6.1854E-07	0.0000	2.4726

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.02013254
Maximum bending moment           =       1873679. lbs-in
Maximum shear force              =    80977.07564 lbs
Depth of maximum bending moment  =    45.24000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              7
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	-1665978.	66164.5891	0.0000	5784.6450	-909.5430
3.480	.248464	-1441547.	62818.4001	-.0008234	5005.3721	-961.5167
6.960	.244269	-1228761.	59392.4108	-.0015310	4266.5310	-1007.5063
10.440	.237808	-1028176.	55816.9327	-.0021291	3570.0555	-1047.3661
13.920	.229450	-840275.	52113.4627	-.0026242	2917.6218	-1081.0650
17.400	.219543	-665466.	48303.3034	-.0030232	2310.6469	-1108.6818
20.880	.208409	-504084.	44407.3018	-.0033331	1750.2920	-1130.3996
24.360	.196345	-356391.	40445.5816	-.0035611	1237.4704	-1146.4510
27.840	.183623	-222583.	36438.7444	-.0037146	772.8571	-1156.3290
31.320	.170491	-102778.	32408.6698	-.0038008	356.8674	-1159.8058
34.800	.157170	2981.4983	28377.5474	-.0038272	10.3524	-1156.9312
38.280	.143854	94729.9136	24367.3134	-.0038013	328.9233	-1147.8010
41.760	.130713	172578.	20454.1847	-.0037305	599.2292	-1101.1236
45.240	.117890	237091.	16770.0767	-.0036219	823.2328	-1016.1798
48.720	.105504	289298.	13383.6010	-.0034824	1004.5060	-930.0706
52.200	.093652	330241.	10296.8567	-.0033183	1146.6698	-843.9204
55.680	.082409	360964.	7508.2318	-.0031351	1253.3467	-758.7376
59.160	.071831	382498.	5012.8099	-.0029381	1328.1187	-675.4129
62.640	.061960	395853.	2802.7817	-.0027319	1374.4896	-594.7183
66.120	.052818	402006.	867.8537	-.0025204	1395.8526	-517.3093
69.600	.044417	401893.	-804.3512	-.0023074	1395.4628	-443.7281
73.080	.036758	396407.	-2227.9077	-.0020959	1376.4141	-374.4078
76.560	.029830	386387.	-3418.2186	-.0018885	1341.6217	-309.6789
80.040	.023614	372616.	-4391.6685	-.0016873	1293.8072	-249.7751
83.520	.018086	355821.	-5165.3008	-.0014943	1235.4897	-194.8412
87.000	.013214	336666.	-5756.5223	-.0013108	1168.9791	-144.9412
90.480	.008963	315756.	-6182.8347	-.0011379	1096.3737	-100.0660
93.960	.005294	293633.	-6461.5965	-.0009764	1019.5606	-60.1420
97.440	.002167	270783.	-6609.8129	-.0008269	940.2185	-25.0398
100.920	-.000461	247629.	-6643.9552	-.0006895	859.8234	5.4178
104.400	-.002632	224541.	-6579.8091	-.0005644	779.6562	31.4478
107.880	-.004389	201834.	-6432.3498	-.0004514	700.8114	53.2990
111.360	-.005774	179772.	-6215.6434	-.0003503	624.2078	71.2450
114.840	-.006827	158573.	-5942.7729	-.0002606	550.6000	85.5772
118.320	-.007588	138410.	-5625.7871	-.0001819	480.5908	96.5986
121.800	-.008093	119417.	-5275.6700	-.0001136	414.6435	104.6182
125.280	-.008379	101691.	-4902.3289	-5.5025E-05	353.0954	109.9457
128.760	-.008476	85297.1119	-4514.5998	-5.4756E-06	296.1705	112.8871
132.240	-.008417	70269.8585	-4120.2670	3.5747E-05	243.9926	113.7409
135.720	-.008228	56620.0535	-3726.0949	6.9371E-05	196.5974	112.7947
139.200	-.007934	44336.2380	-3337.8710	9.6123E-05	153.9453	110.3225
142.680	-.007559	33388.4716	-2960.4568	.0001167	115.9322	106.5822
146.160	-.007122	23731.4586	-2597.8463	.0001319	82.4009	101.8146
149.640	-.006641	15307.4616	-2253.2282	.0001422	53.1509	96.2417
153.120	-.006132	8048.9902	-1929.0530	.0001484	27.9479	90.0659
156.600	-.005608	1881.2528	-1627.1008	.0001510	6.5321	83.4699
160.080	-.005081	-3275.6311	-1348.5505	.0001507	11.3737	76.6165
163.560	-.004560	-7504.6589	-1094.0488	.0001478	26.0578	69.6489
167.040	-.004052	-10890.2108	-863.7767	.0001429	37.8132	62.6914
170.520	-.003565	-13516.5449	-657.5148	.0001365	46.9324	55.8499
174.000	-.003102	-15466.5142	-474.7053	.0001288	53.7032	49.2131
177.480	-.002669	-16820.4936	-314.5099	.0001202	58.4045	42.8533
180.960	-.002266	-17655.5029	-175.8648	.0001111	61.3038	36.8278
184.440	-.001895	-18044.5125	-57.5306	.0001016	62.6546	31.1803
187.920	-.001558	-18055.9161	41.8618	9.2055E-05	62.6942	25.9418
191.400	-.001255	-17753.1543	123.7705	8.2566E-05	61.6429	21.1322
194.880	-.000984	-17194.4737	189.7053	7.3306E-05	59.7030	16.7614
198.360	-.000745	-16432.8054	241.1964	6.4395E-05	57.0584	12.8311
201.840	-.000536	-15515.7469	279.7661	5.5929E-05	53.8741	9.3354
205.320	-.000355	-14485.6334	306.9057	4.7979E-05	50.2973	6.2621
208.800	-.000202	-13379.6832	324.0560	4.0595E-05	46.4572	3.5944
212.280	-7.28E-05	-12230.2037	332.5914	3.3809E-05	42.4660	1.3110
215.760	3.36E-05	-11064.8473	333.8076	2.7636E-05	38.4196	-.6120150
219.240	.000120	-9906.9027	328.9129	2.2079E-05	34.3990	-2.2011
222.720	.000187	-8775.6138	319.0211	1.7128E-05	30.4709	-3.4839
226.200	.000239	-7686.5159	305.1484	1.2766E-05	26.6893	-4.4889
229.680	.000276	-6651.7806	288.2116	8.9666E-06	23.0965	-5.2449

233.160	.000301	-5680.5629	269.0283	5.6987E-06	19.7242	-5.7800
236.640	.000316	-4779.3435	248.3190	2.9269E-06	16.5949	-6.1219
240.120	.000322	-3952.2625	226.7104	6.1320E-07	13.7231	-6.2968
243.600	.000320	-3201.4388	204.7399	-1.2824E-06	11.1161	-6.3299
247.080	.000313	-2527.2729	182.8605	-2.8005E-06	8.7753	-6.2445
250.560	.000301	-1928.7300	161.4470	-3.9812E-06	6.6970	-6.0621
254.040	.000285	-1403.6015	140.8025	-4.8642E-06	4.8736	-5.8026
257.520	.000267	-948.7445	121.1644	-5.4876E-06	3.2943	-5.4837
261.000	.000247	-560.2972	102.7116	-5.8875E-06	1.9455	-5.1214
264.480	.000226	-233.8717	85.5710	-6.0979E-06	.8120546	-4.7296
267.960	.000204	35.2769	69.8240	-6.1505E-06	.1224891	-4.3204
271.440	.000183	252.1034	55.5130	-6.0744E-06	.8753590	-3.9043
274.920	.000162	421.6476	42.6474	-5.8958E-06	1.4641	-3.4898
278.400	.000142	548.9292	31.2090	-5.6387E-06	1.9060	-3.0840
281.880	.000123	638.8624	21.1579	-5.3239E-06	2.2183	-2.6925
285.360	.000105	696.1880	12.4367	-4.9701E-06	2.4173	-2.3197
288.840	8.82E-05	725.4216	4.9754	-4.5934E-06	2.5188	-1.9684
292.320	7.29E-05	730.8167	-1.3047	-4.2075E-06	2.5376	-1.6408
295.800	5.89E-05	716.3411	-6.4874	-3.8241E-06	2.4873	-1.3378
299.280	4.63E-05	685.6644	-10.6588	-3.4526E-06	2.3808	-1.0596
302.760	3.49E-05	642.1559	-13.9043	-3.1007E-06	2.2297	-.8056297
306.240	2.47E-05	588.8908	-16.3062	-2.7745E-06	2.0448	-.5748243
309.720	1.56E-05	528.6644	-17.9425	-2.4784E-06	1.8356	-.3655459
313.200	7.42E-06	464.0110	-18.8844	-2.2153E-06	1.6111	-.1758006
316.680	1.39E-07	397.2287	-19.1961	-1.9871E-06	1.3793	-.0033126
320.160	-6.41E-06	330.4062	-18.9332	-1.7943E-06	1.1472	.1543820
323.640	-1.23E-05	265.4534	-18.1429	-1.6364E-06	.9217132	.2998452
327.120	-1.78E-05	204.1318	-16.8631	-1.5120E-06	.7087910	.4356510
330.600	-2.29E-05	148.0861	-15.1232	-1.4186E-06	.5141880	.5643023
334.080	-2.77E-05	98.8744	-12.9439	-1.3532E-06	.3433138	.6881482
337.560	-3.23E-05	57.9964	-10.3384	-1.3116E-06	.2013763	.8093031
341.040	-3.68E-05	26.9194	-7.3127	-1.2891E-06	.0934700	.9295643
344.520	-4.13E-05	7.0997	-3.8677	-1.2801E-06	.0246519	1.0503
348.000	-4.57E-05	0.0000	0.0000	-1.2782E-06	0.0000	1.1725

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =      .25000000 in
Computed slope at pile head      =     -.00005947
Maximum bending moment           =      -1665978. lbs-in
Maximum shear force              =    66164.58910 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              5
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)

Specified deflection at pile head = .500000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-3082360.	114935.	0.0000	10702.6383	-1389.5796
3.480	.497158	-2691316.	109802.	-.0015299	9344.8473	-1474.9635
6.960	.489352	-2318135.	104517.	-.0028574	8049.0784	-1562.8828
10.440	.477270	-1963880.	98920.4035	-.0039920	6819.0288	-1653.3376
13.920	.461567	-1629649.	93004.9859	-.0049443	5658.5020	-1746.3277
17.400	.442858	-1316566.	86801.0871	-.0057250	4571.4083	-1819.1313
20.880	.421721	-1025513.	80425.2250	-.0063456	3560.8091	-1845.1572
24.360	.398693	-756806.	73978.8157	-.0068179	2627.7987	-1859.6757
27.840	.374269	-510620.	67500.9538	-.0071537	1772.9877	-1863.2334
31.320	.348903	-286999.	61028.5702	-.0073651	996.5256	-1856.5273
34.800	.323008	-85861.6019	54595.9371	-.0074639	298.1306	-1840.3882
38.280	.296954	92988.3404	48234.2383	-.0074620	322.8762	-1815.7605
41.760	.271072	249849.	41971.2084	-.0073712	867.5302	-1783.6819
45.240	.245651	385108.	35830.8478	-.0072029	1337.1804	-1745.2609
48.720	.220940	499231.	29833.2170	-.0069686	1733.4424	-1701.6533
52.200	.197150	592747.	23994.3858	-.0066792	2058.1498	-1653.9968
55.680	.174453	666232.	18332.4466	-.0063456	2313.3067	-1599.9912
59.160	.152984	720341.	13045.5188	-.0059782	2501.1839	-1438.4730
62.640	.132844	757029.	8323.8881	-.0055867	2628.5734	-1275.1079
66.120	.114101	778275.	4160.6934	-.0051799	2702.3446	-1117.5327
69.600	.096793	785988.	533.6784	-.0047654	2729.1235	-966.9587
73.080	.080934	781990.	-2583.2402	-.0043499	2715.2418	-824.3738
76.560	.066518	768008.	-5219.2122	-.0039391	2666.6952	-690.5526
80.040	.053518	745664.	-7405.7346	-.0035380	2589.1108	-566.0695
83.520	.041893	716464.	-9175.9785	-.0031506	2487.7232	-451.3121
87.000	.031590	681799.	-10564.1672	-.0027801	2367.3580	-346.4975
90.480	.022544	642938.	-11605.0095	-.0024290	2232.4225	-251.6878
93.960	.014683	601028.	-12333.1908	-.0020994	2086.9036	-166.8072
97.440	.007932	557099.	-12782.9220	-.0017925	1934.3704	-91.6590
100.920	.002207	512059.	-12987.5474	-.0015092	1777.9830	-25.9418
104.400	-.002572	466705.	-12979.2103	-.0012498	1620.5047	30.7333
107.880	-.006491	421724.	-12788.5746	-.0010144	1464.3187	78.8274
111.360	-.009633	377697.	-12444.6005	-.0008026	1311.4475	118.8588
114.840	-.012078	335109.	-11974.3700	-.0006137	1163.5742	151.3886
118.320	-.013904	294355.	-11402.9611	-.0004469	1022.0669	177.0074
121.800	-.015188	255745.	-10753.3644	-.0003011	888.0027	196.3240
125.280	-.016000	219512.	-10046.4407	-.0001752	762.1939	209.9540
128.760	-.016407	185822.	-9300.9129	-6.7799E-05	645.2137	218.5103
132.240	-.016472	154777.	-8533.3901	2.2455E-05	537.4218	222.5948
135.720	-.016251	126429.	-7758.4184	9.6970E-05	438.9901	222.7912
139.200	-.015797	100779.	-6988.5551	.0001572	349.9267	219.6589
142.680	-.015157	77788.8037	-6234.4619	.0002045	270.1000	213.7280
146.160	-.014374	57387.0422	-5505.0130	.0002403	199.2606	205.4955
149.640	-.013485	39473.9135	-4807.4157	.0002660	137.0622	195.4225
153.120	-.012523	23927.4289	-4147.3390	.0002828	83.0814	183.9320
156.600	-.011516	10608.4341	-3529.0473	.0002919	36.8348	171.4081
160.080	-.010491	-634.7403	-2955.5376	.0002946	2.2040	158.1952
163.560	-.009466	-9962.1075	-2428.6762	.0002918	34.5907	144.5987
167.040	-.008460	-17538.3269	-1949.3342	.0002845	60.8970	130.8853
170.520	-.007486	-23529.4732	-1517.5184	.0002736	81.6996	117.2847
174.000	-.006556	-28100.2547	-1132.4981	.0002599	97.5703	103.9913
177.480	-.005677	-31411.6601	-792.9248	.0002441	109.0683	91.1658

180.960	-.004857	-33619.0113	-496.9443	.0002269	116.7327	78.9380
184.440	-.004098	-34870.3922	-242.3009	.0002088	121.0778	67.4088
187.920	-.003404	-35305.4255	-26.4332	.0001902	122.5883	56.6531
191.400	-.002774	-35054.3671	153.4398	.0001715	121.7166	46.7222
194.880	-.002210	-34237.4846	300.2410	.0001532	118.8802	37.6463
198.360	-.001708	-32964.6898	416.9671	.0001354	114.4607	29.4376
201.840	-.001268	-31335.3937	506.6289	.0001183	108.8035	22.0922
205.320	-.000885	-29438.5525	572.2007	.0001022	102.2172	15.5928
208.800	-.000556	-27352.8766	616.5773	8.7166E-05	94.9753	9.9110
212.280	-.000278	-25147.1748	642.5387	7.3255E-05	87.3166	5.0094
215.760	-4.63E-05	-22880.8074	652.7228	6.0528E-05	79.4472	.8435469
219.240	.000143	-20604.2242	649.6035	4.9005E-05	71.5424	-2.6362
222.720	.000295	-18359.5671	635.4754	3.8680E-05	63.7485	-5.4833
226.200	.000412	-16181.3154	612.4438	2.9527E-05	56.1851	-7.7532
229.680	.000500	-14096.9580	582.4193	2.1504E-05	48.9478	-9.5023
233.160	.000562	-12127.6771	547.1162	1.4555E-05	42.1100	-10.7868
236.640	.000602	-10289.0291	508.0553	8.6148E-06	35.7258	-11.6620
240.120	.000622	-8591.6123	466.5685	3.6117E-06	29.8320	-12.1810
243.600	.000627	-7041.7123	423.8069	-5.3093E-07	24.4504	-12.3946
247.080	.000618	-5641.9163	380.7500	-3.8919E-06	19.5900	-12.3507
250.560	.000600	-4391.6926	338.2167	-6.5507E-06	15.2489	-12.0937
254.040	.000573	-3287.9280	296.8778	-8.5857E-06	11.4164	-11.6643
257.520	.000540	-2325.4231	257.2682	-1.0073E-05	8.0744	-11.0998
261.000	.000503	-1497.3412	219.8005	-1.1086E-05	5.1991	-10.4334
264.480	.000463	-795.6117	184.7780	-1.1694E-05	2.7625	-9.6945
267.960	.000421	-211.2867	152.4078	-1.1960E-05	.7336342	-8.9090
271.440	.000379	265.1469	122.8141	-1.1946E-05	.9206491	-8.0989
274.920	.000338	643.4993	96.0495	-1.1705E-05	2.2344	-7.2830
278.400	.000298	933.6514	72.1075	-1.1288E-05	3.2418	-6.4767
281.880	.000260	1145.3676	50.9331	-1.0737E-05	3.9770	-5.6925
285.360	.000223	1288.1454	32.4326	-1.0092E-05	4.4727	-4.9400
288.840	.000189	1371.0984	16.4834	-9.3871E-06	4.7608	-4.2262
292.320	.000158	1402.8702	2.9421	-8.6520E-06	4.8711	-3.5562
295.800	.000129	1391.5754	-8.3483	-7.9116E-06	4.8319	-2.9326
299.280	.000103	1344.7660	-17.5513	-7.1865E-06	4.6693	-2.3565
302.760	7.91E-05	1269.4186	-24.8313	-6.4938E-06	4.4077	-1.8274
306.240	5.77E-05	1171.9402	-30.3490	-5.8468E-06	4.0692	-1.3436
309.720	3.84E-05	1058.1898	-34.2568	-5.2559E-06	3.6743	-.9022287
313.200	2.11E-05	933.5131	-36.6958	-4.7281E-06	3.2414	-.4995181
316.680	5.49E-06	802.7870	-37.7932	-4.2680E-06	2.7875	-.1311567
320.160	-8.62E-06	670.4726	-37.6601	-3.8776E-06	2.3280	.2076511
323.640	-2.15E-05	540.6729	-36.3906	-3.5567E-06	1.8773	.5219607
327.120	-3.34E-05	417.1943	-34.0609	-3.3029E-06	1.4486	.8169052
330.600	-4.45E-05	303.6088	-30.7298	-3.1119E-06	1.0542	1.0975
334.080	-5.50E-05	203.3147	-26.4389	-2.9775E-06	.7059538	1.3686
337.560	-6.52E-05	119.5943	-21.2139	-2.8920E-06	.4152581	1.6343
341.040	-7.52E-05	55.6663	-15.0667	-2.8455E-06	.1932856	1.8985
344.520	-8.50E-05	14.7299	-7.9980	-2.8269E-06	.0511453	2.1640
348.000	-9.48E-05	0.0000	0.0000	-2.8230E-06	0.0000	2.4326

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection = .50000000 in
Computed slope at pile head = -.00010362
Maximum bending moment = -3082360. lbs-in
Maximum shear force = 114935.35277 lbs
Depth of maximum bending moment = 0.00000 in
Depth of maximum shear force = 0.00000 in
Number of iterations = 6
Number of zero deflection points = 3

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = 1.000000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-5219081.	165809.	0.0000	18121.8079	-1389.5796
3.480	.995187	-4650995.	160676.	-.0026154	16149.2894	-1474.9636
6.960	.981797	-4100772.	155391.	-.0049345	14238.7931	-1562.8833
10.440	.960843	-3569477.	149794.	-.0069670	12394.0161	-1653.3386
13.920	.933306	-3058203.	143879.	-.0087233	10618.7620	-1746.3295
17.400	.900129	-2568079.	137636.	-.0102141	8916.9410	-1841.8562
20.880	.862216	-2100260.	131055.	-.0114512	7292.5701	-1939.9186
24.360	.820429	-1655935.	124129.	-.0124465	5749.7727	-2040.5168
27.840	.775588	-1236320.	116849.	-.0132129	4292.7791	-2143.6509
31.320	.728467	-842667.	109205.	-.0137638	2925.9260	-2249.3209
34.800	.679792	-476253.	101189.	-.0141133	1653.6568	-2357.5268
38.280	.630238	-138390.	92792.2595	-.0142762	480.5217	-2468.2688
41.760	.580429	169581.	84005.5803	-.0142679	588.8228	-2581.5468
45.240	.530933	446289.	74820.2808	-.0141047	1549.6132	-2697.3610
48.720	.482261	690330.	65227.5349	-.0138035	2396.9796	-2815.7114
52.200	.434861	900272.	55352.2027	-.0133821	3125.9453	-2859.7669
55.680	.389121	1075581.	45611.7311	-.0128585	3734.6578	-2738.2052
59.160	.345366	1217730.	36305.6313	-.0122508	4228.2288	-2610.1280
62.640	.303856	1328269.	27452.7132	-.0115761	4612.0439	-2477.7559
66.120	.264796	1408801.	19064.1591	-.0108509	4891.6693	-2343.2522
69.600	.228334	1460955.	11143.7881	-.0100904	5072.7611	-2208.6851
73.080	.194567	1486362.	3852.3331	-.0093094	5160.9776	-1981.8063
76.560	.163540	1487767.	-2550.1732	-.0085213	5165.8591	-1697.7950
80.040	.135258	1468612.	-7993.6846	-.0077379	5099.3484	-1430.6598
83.520	.109685	1432131.	-12539.0715	-.0069693	4972.6784	-1181.6315
87.000	.086752	1381340.	-16250.8289	-.0062237	4796.3208	-951.5625
90.480	.066367	1319026.	-19195.8150	-.0055082	4579.9500	-740.9582
93.960	.048415	1247738.	-21442.0981	-.0048280	4332.4219	-550.0091
97.440	.032764	1169789.	-23057.9205	-.0041874	4061.7660	-378.6244
100.920	.019271	1087254.	-24110.7779	-.0035893	3775.1889	-226.4661
104.400	.007783	1001978.	-24666.6183	-.0030357	3479.0889	-92.9824
107.880	-.001858	915575.	-24789.1554	-.0025276	3179.0789	22.5588
111.360	-.009809	829445.	-24539.2958	-.0020652	2880.0176	121.0387
114.840	-.016231	744781.	-23974.6738	-.0016480	2586.0459	203.4567
118.320	-.021280	662581.	-23149.2892	-.0012751	2300.6296	270.9023
121.800	-.025106	583662.	-22113.2395	-.0009449	2026.6048	324.5285
125.280	-.027856	508673.	-20912.5419	-.0006554	1766.2264	365.5276

128.760	-.029668	438111.	-19589.0336	-.0004045	1521.2184	395.1093
132.240	-.030672	372334.	-18180.3459	-.0001898	1292.8247	414.4813
135.720	-.030989	311576.	-16719.9403	-8.5526E-06	1081.8600	424.8323
139.200	-.030731	255963.	-15237.2006	.0001418	888.7595	427.3170
142.680	-.030002	205525.	-13757.5719	.0002641	713.6277	423.0443
146.160	-.028893	160210.	-12302.7384	.0003610	556.2848	413.0669
149.640	-.027489	119898.	-10890.8322	.0004353	416.3115	398.3734
153.120	-.025863	84409.8396	-9536.6675	.0004894	293.0897	379.8822
156.600	-.024082	53522.4993	-8251.9910	.0005260	185.8420	358.4377
160.080	-.022203	26975.9823	-7045.7447	.0005473	93.6666	334.8074
163.560	-.020273	4484.1164	-5924.3346	.0005556	15.5698	309.6812
167.040	-.018336	-14257.3862	-4891.9005	.0005530	49.5048	283.6717
170.520	-.016424	-29563.5108	-3950.5825	.0005414	102.6511	257.3156
174.000	-.014567	-41753.4405	-3100.7810	.0005225	144.9772	231.0761
177.480	-.012788	-51144.9468	-2341.4064	.0004979	177.5866	205.3461
180.960	-.011102	-58049.6293	-1670.1167	.0004690	201.5612	180.4526
184.440	-.009524	-62768.9593	-1083.5405	.0004370	217.9478	156.6602
187.920	-.008061	-65591.0713	-577.4840	.0004029	227.7468	134.1769
191.400	-.006719	-66788.2477	-147.1210	.0003679	231.9036	113.1582
194.880	-.005501	-66615.0336	212.8343	.0003325	231.3022	93.7127
198.360	-.004405	-65306.9210	507.9733	.0002976	226.7601	75.9074
201.840	-.003430	-63079.5396	744.0559	.0002635	219.0262	59.7723
205.320	-.002571	-60128.2919	926.8916	.0002309	208.7788	45.3057
208.800	-.001823	-56628.3739	1062.2371	.0001999	196.6263	32.4790
212.280	-.001179	-52735.1219	1155.7099	.0001710	183.1081	21.2410
215.760	-.000633	-48584.6327	1212.7181	.0001441	168.6966	11.5223
219.240	-.000176	-44294.6036	1238.4030	.0001195	153.8007	3.2391
222.720	.000199	-39965.3481	1237.5953	9.7178E-05	138.7686	-3.7032
226.200	.000500	-35680.9403	1214.7839	7.7133E-05	123.8922	-9.4068
229.680	.000736	-31510.4523	1174.0939	5.9328E-05	109.4113	-13.9783
233.160	.000913	-27509.2471	1119.2749	4.3689E-05	95.5182	-17.5268
236.640	.001040	-23720.2987	1053.6978	3.0114E-05	82.3621	-20.1612
240.120	.001123	-20175.5107	980.3571	1.8482E-05	70.0539	-21.9886
243.600	.001169	-16897.0131	901.8813	8.6585E-06	58.6702	-23.1125
247.080	.001183	-13898.4168	820.5462	4.9815E-07	48.2584	-23.6318
250.560	.001172	-11186.0116	738.2933	-6.1489E-06	38.8403	-23.6399
254.040	.001140	-8759.8952	656.7509	-1.1434E-05	30.4163	-23.2235
257.520	.001093	-6615.0251	577.2572	-1.5508E-05	22.9688	-22.4625
261.000	.001032	-4742.1853	500.8849	-1.8518E-05	16.4659	-21.4296
264.480	.000964	-3128.8665	428.4670	-2.0604E-05	10.8641	-20.1899
267.960	.000889	-1760.0551	360.6225	-2.1899E-05	6.1113	-18.8012
271.440	.000811	-618.9337	297.7821	-2.2529E-05	2.1491	-17.3140
274.920	.000732	312.5081	240.2128	-2.2611E-05	1.0851	-15.7718
278.400	.000654	1052.9472	188.0424	-2.2249E-05	3.6561	-14.2112
281.880	.000577	1621.2835	141.2824	-2.1540E-05	5.6295	-12.6624
285.360	.000504	2036.2726	99.8488	-2.0571E-05	7.0704	-11.1499
288.840	.000434	2316.2314	63.5830	-1.9418E-05	8.0425	-9.6925
292.320	.000369	2478.8100	32.2690	-1.8147E-05	8.6070	-8.3040
295.800	.000308	2540.8240	5.6511	-1.6817E-05	8.8223	-6.9937
299.280	.000252	2518.1416	-16.5523	-1.5476E-05	8.7435	-5.7669
302.760	.000200	2425.6197	-34.6350	-1.4166E-05	8.4223	-4.6254
306.240	.000153	2277.0819	-48.8917	-1.2920E-05	7.9065	-3.5680
309.720	.000110	2085.3337	-59.6082	-1.1764E-05	7.2407	-2.5909
313.200	7.12E-05	1862.2090	-67.0536	-1.0718E-05	6.4660	-1.6881
316.680	3.57E-05	1618.6410	-71.4733	-9.7958E-06	5.6203	-.8520259
320.160	3.07E-06	1364.7546	-73.0845	-9.0052E-06	4.7387	-.0739487
323.640	-2.70E-05	1109.9727	-72.0721	-8.3495E-06	3.8541	.6557775
327.120	-5.50E-05	863.1326	-68.5870	-7.8266E-06	2.9970	1.3472
330.600	-8.15E-05	632.6073	-62.7450	-7.4303E-06	2.1966	2.0103
334.080	-.000107	426.4272	-54.6280	-7.1496E-06	1.4806	2.6547
337.560	-.000131	252.3967	-44.2853	-6.9698E-06	.8763774	3.2893
341.040	-.000155	118.2014	-31.7380	-6.8716E-06	.4104216	3.9218
344.520	-.000179	31.5005	-16.9830	-6.8319E-06	.1093769	4.5581
348.000	-.000203	0.0000	0.0000	-6.8235E-06	0.0000	5.2022

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

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Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.00015053
Maximum bending moment           =      -5219081. lbs-in
Maximum shear force              =   165809.34588 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              7
Number of zero deflection points =              3
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	552328.	31531.4781
4	y= .500000	M= 0.000	0.0000	.5000000	1037854.	54478.1827
4	y= 1.000000	M= 0.000	0.0000	1.0000000	1873679.	80977.0756
5	y= .250000	S= 0.000	0.0000	.2500000	-1665978.	66164.5891
5	y= .500000	S= 0.000	0.0000	.5000000	-3082360.	114935.
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-5219081.	165809.

The analysis ended normally.

```
==============================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.25)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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==============================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Douglas\
Name of input data file:     Douglas Bent 2 12 inch Sq pile_3D(0.55)Row2.lpd
Name of output file:         Douglas Bent 2 12 inch Sq pile_3D(0.55)Row2.lpo
Name of plot output file:    Douglas Bent 2 12 inch Sq pile_3D(0.55)Row2.lpp
Name of runtime file:        Douglas Bent 2 12 inch Sq pile_3D(0.55)Row2.lpr


------------------------------------------------------------------------------
                           Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  May 11, 2009     Time:  14: 5:49


------------------------------------------------------------------------------
                                 Problem Title
------------------------------------------------------------------------------

Douglas Road Bent 2/ 12-inch Square Concrete Pile/3D(0.55)Row2


------------------------------------------------------------------------------
                                 Program Options
------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Pile Length                                =     348.00 in
Depth of ground surface below top of pile =    -108.00 in
Slope angle of ground surface              =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
           in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   12.00000000    1728.0000     144.0000      3800000.
  2     348.0000   12.00000000    1728.0000     144.0000      3800000.


------------------------------------------------------------------------------
                        Soil and Rock Layering Information
------------------------------------------------------------------------------

The soil profile is modelled using  3 layers

Layer  1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =     -108.000 in
Distance from top of pile to bottom of layer =      372.000 in
p-y subgrade modulus k for top of soil layer =       75.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       75.000 lbs/in**3

Layer  2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      372.000 in
Distance from top of pile to bottom of layer =      552.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  3 is stiff clay without free water
Distance from top of pile to top of layer    =      552.000 in
Distance from top of pile to bottom of layer =      870.000 in


(Depth of lowest layer extends  522.00 in below pile tip)


------------------------------------------------------------------------------
                    Effective Unit Weight of Soil vs. Depth
------------------------------------------------------------------------------
```

Distribution of effective unit weight of soil with depth
is defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-108.00	.06366
2	372.00	.06366
3	372.00	.02755
4	552.00	.02755
5	552.00	.02755
6	870.00	.02755

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-108.000	.00000	33.00	------	------
2	372.000	.00000	33.00	------	------
3	372.000	.00000	32.00	------	------
4	552.000	.00000	32.00	------	------
5	552.000	10.42000	.00	.00600	.0
6	870.000	10.42000	.00	.00600	.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

---

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.5500	1.0000
2	348.000	.5500	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

---

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)

Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	25268.2441	-.0051867	0.0000	-666.9982
3.480	.231950	83894.6818	22934.4532	-.0051644	291.3010	-674.2609
6.960	.214056	159624.	20579.7327	-.0050999	554.2493	-679.0267
10.440	.196455	227130.	18212.5180	-.0049974	788.6445	-681.4415
13.920	.179274	286383.	15842.1984	-.0048613	994.3851	-680.8112
17.400	.162620	337391.	13480.0852	-.0046960	1171.4976	-676.7251
20.880	.146589	380204.	11138.2300	-.0045059	1320.1539	-669.1687
24.360	.131259	414913.	8828.6948	-.0042952	1440.6715	-658.1504
27.840	.116695	441652.	6563.4775	-.0040682	1533.5140	-643.6986
31.320	.102945	460595.	4414.0280	-.0038291	1599.2889	-591.6172
34.800	.090044	472374.	2461.7119	-.0035819	1640.1863	-530.4036
38.280	.078014	477729.	719.7168	-.0033301	1658.7803	-470.7430
41.760	.066866	477383.	-818.1210	-.0030771	1657.5795	-413.0718
45.240	.056598	472035.	-2159.3773	-.0028255	1639.0090	-357.7652
48.720	.047201	462354.	-3312.8299	-.0025779	1605.3945	-305.1386
52.200	.038656	448977.	-4288.2525	-.0023364	1558.9490	-255.4491
55.680	.030939	432507.	-5096.2150	-.0021028	1501.7618	-208.8972
59.160	.024021	413508.	-5747.8924	-.0018786	1435.7904	-165.6301
62.640	.017864	392502.	-6254.8843	-.0016650	1362.8544	-125.7446
66.120	.012432	369974.	-6629.0463	-.0014630	1284.6307	-89.2910
69.600	.007682	346364.	-6882.3339	-.0012732	1202.6524	-56.2766
73.080	.003570	322073.	-7026.6608	-.0010961	1118.3077	-26.6699
76.560	5.32E-05	297458.	-7073.7714	-.0009319	1032.8414	-.4051204
80.040	-.002915	272839.	-7035.1276	-.0007808	947.3582	22.6142
83.520	-.005381	248494.	-6921.8107	-.0006426	862.8259	42.5105
87.000	-.007388	224663.	-6744.4376	-.0005172	780.0811	59.4281
90.480	-.008981	201553.	-6513.0910	-.0004043	699.8353	73.5297
93.960	-.010202	179332.	-6237.2636	-.0003034	622.6814	84.9918
97.440	-.011092	158141.	-5925.8151	-.0002139	549.1014	94.0016
100.920	-.011691	138089.	-5586.9411	-.0001355	479.4742	100.7536
104.400	-.012035	119256.	-5228.1538	-6.7258E-05	414.0837	105.4461
107.880	-.012159	101701.	-4856.2727	-8.7081E-06	353.1272	108.2787
111.360	-.012096	85456.4407	-4477.4251	4.0886E-05	296.7238	109.4498
114.840	-.011875	70537.7415	-4097.0548	8.2222E-05	244.9227	109.1539
118.320	-.011524	56940.9393	-3719.9379	.0001160	197.7116	107.5800
121.800	-.011067	44646.9734	-3350.2058	.0001429	155.0242	104.9098
125.280	-.010529	33623.5071	-2991.3725	.0001637	116.7483	101.3163
128.760	-.009928	23827.0212	-2646.3674	.0001789	82.7327	96.9625
132.240	-.009284	15204.7898	-2317.5712	.0001892	52.7944	92.0008
135.720	-.008611	7696.7254	-2006.8541	.0001953	26.7247	86.5722
139.200	-.007924	1237.0850	-1715.6165	.0001977	4.2954	80.8058
142.680	-.007235	-4243.9654	-1444.8302	.0001969	14.7360	74.8186
146.160	-.006554	-8818.9332	-1195.0808	.0001934	30.6213	68.7156
149.640	-.005889	-12561.7277	-966.6092	.0001877	43.6171	62.5899
153.120	-.005248	-15546.5332	-759.3529	.0001803	53.9810	56.5229
156.600	-.004635	-17846.8239	-572.9859	.0001714	61.9681	50.5846
160.080	-.004054	-19534.5152	-406.9572	.0001615	67.8282	44.8342
163.560	-.003510	-20679.2463	-260.5274	.0001509	71.8029	39.3209
167.040	-.003004	-21347.7859	-132.8029	.0001397	74.1243	34.0840
170.520	-.002538	-21603.5547	-22.7685	.0001284	75.0123	29.1542
174.000	-.002111	-21506.2545	70.6836	.0001169	74.6745	24.5539
177.480	-.001724	-21111.5967	148.7262	.0001056	73.3042	20.2982
180.960	-.001375	-20471.1200	212.5730	9.4628E-05	71.0803	16.3954
184.440	-.001065	-19632.0887	263.4566	8.4002E-05	68.1670	12.8481
187.920	-.000791	-18637.4618	302.6097	7.3861E-05	64.7134	9.6536
191.400	-.000551	-17525.9255	331.2476	6.4278E-05	60.8539	6.8050
194.880	-.000343	-16331.9782	350.5551	5.5306E-05	56.7083	4.2913
198.360	-.000166	-15086.0616	361.6737	4.6981E-05	52.3822	2.0987
201.840	-1.65E-05	-13814.7293	365.6920	3.9322E-05	47.9678	.2107302
205.320	.000108	-12540.8450	363.6386	3.2339E-05	43.5446	-1.3909
208.800	.000209	-11283.8046	356.4756	2.6025E-05	39.1799	-2.7258
212.280	.000289	-10059.7751	345.0948	2.0370E-05	34.9298	-3.8149
215.760	.000350	-8881.9450	330.3153	1.5350E-05	30.8401	-4.6791
219.240	.000396	-7760.7809	312.8821	1.0940E-05	26.9472	-5.3399
222.720	.000427	-6704.2855	293.4665	7.1073E-06	23.2788	-5.8185
226.200	.000445	-5718.2542	272.6667	3.8155E-06	19.8550	-6.1354
229.680	.000453	-4806.5255	251.0102	1.0266E-06	16.6893	-6.3108
233.160	.000452	-3971.2235	228.9564	-1.2994E-06	13.7890	-6.3638
236.640	.000444	-3212.9893	206.8999	-3.2031E-06	11.1562	-6.3123
240.120	.000430	-2531.1999	185.1747	-4.7253E-06	8.7889	-6.1735
243.600	.000411	-1924.1735	164.0576	-5.9059E-06	6.6812	-5.9628
247.080	.000389	-1389.3593	143.7733	-6.7839E-06	4.8242	-5.6948
250.560	.000364	-923.5116	124.4987	-7.3968E-06	3.2066	-5.3825
254.040	.000337	-522.8482	106.3677	-7.7800E-06	1.8154	-5.0376
257.520	.000310	-183.1922	89.4755	-7.9671E-06	.6360842	-4.6705
261.000	.000282	99.9016	73.8835	-7.9892E-06	.3468805	-4.2904
264.480	.000254	331.0367	59.6232	-7.8750E-06	1.1494	-3.9051
267.960	.000227	514.8793	46.7012	-7.6509E-06	1.7878	-3.5213
271.440	.000201	656.0772	35.1025	-7.3406E-06	2.2780	-3.1446
274.920	.000176	759.1925	24.7944	-6.9655E-06	2.6361	-2.7795
278.400	.000152	828.6466	15.7306	-6.5448E-06	2.8772	-2.4296
281.880	.000130	868.6775	7.8536	-6.0950E-06	3.0162	-2.0975
285.360	.000110	883.3074	1.0981	-5.6308E-06	3.0670	-1.7850
288.840	9.12E-05	876.3201	-4.6063	-5.1645E-06	3.0428	-1.4934
292.320	7.41E-05	851.2475	-9.3328	-4.7067E-06	2.9557	-1.2230
295.800	5.85E-05	811.3635	-13.1555	-4.2661E-06	2.8172	-.9739077
299.280	4.44E-05	759.6852	-16.1472	-3.8498E-06	2.6378	-.7454504
302.760	3.17E-05	698.9791	-18.3781	-3.4633E-06	2.4270	-.5366854
306.240	2.03E-05	631.7735	-19.9145	-3.1107E-06	2.1937	-.3463029
309.720	1.00E-05	560.3741	-20.8176	-2.7948E-06	1.9457	-.1727224
313.200	8.15E-07	486.8830	-21.1428	-2.5173E-06	1.6906	-.0141577
316.680	-7.50E-06	413.2204	-20.9389	-2.2788E-06	1.4348	.1313205
320.160	-1.50E-05	341.1481	-20.2481	-2.0789E-06	1.1845	.2657248
323.640	-2.20E-05	272.2939	-19.1052	-1.9163E-06	.9454649	.3910939
327.120	-2.84E-05	208.1760	-17.5383	-1.7890E-06	.7228332	.5094359
330.600	-3.44E-05	150.2275	-15.5684	-1.6940E-06	.5216233	.6226742
334.080	-4.02E-05	99.8199	-13.2102	-1.6278E-06	.3465968	.7325923
337.560	-4.57E-05	58.2843	-10.4726	-1.5859E-06	.2023759	.8407795
341.040	-5.12E-05	26.9308	-7.3591	-1.5633E-06	.0935097	.9485756
344.520	-5.66E-05	7.0650	-3.8694	-1.5543E-06	.0245312	1.0570
348.000	-6.20E-05	0.0000	0.0000	-1.5524E-06	0.0000	1.1668

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection = .25000000 in
Computed slope at pile head = -.00518665
Maximum bending moment = 477728.72169 lbs-in

Maximum shear force = 25268.24406 lbs
Depth of maximum bending moment = 38.28000000 in
Depth of maximum shear force = 0.00000 in
Number of iterations = 5
Number of zero deflection points = 3

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	43757.9487	-.0099963	0.0000	-1019.0250
3.480	.465213	146107.	40102.7912	-.0099576	507.3169	-1081.6402
6.960	.430695	279115.	36292.9955	-.0098449	969.1508	-1107.8975
10.440	.396692	398707.	32449.8454	-.0096653	1384.3976	-1100.8094
13.920	.363425	504966.	28639.3422	-.0094258	1753.3554	-1089.1349
17.400	.331089	598036.	24876.7565	-.0091335	2076.5150	-1073.2706
20.880	.299856	678109.	21175.8888	-.0087954	2354.5437	-1053.6648
24.360	.269873	745421.	17548.9038	-.0084182	2588.2657	-1030.8093
27.840	.241265	800249.	14006.1948	-.0080086	2778.6422	-1005.2304
31.320	.214133	842904.	10556.2800	-.0075732	2926.7487	-977.4793
34.800	.188556	873721.	7206.4187	-.0071183	3033.7523	-947.7283
38.280	.164590	893060.	3967.8223	-.0066501	3100.9038	-913.5339
41.760	.142271	901337.	856.7363	-.0061746	3129.6413	-874.4465
45.240	.121614	899023.	-2002.4132	-.0056976	3121.6083	-768.7428
48.720	.102616	887400.	-4494.3087	-.0052242	3081.2497	-663.3810
52.200	.085254	867743.	-6628.8729	-.0047591	3012.9958	-563.3800
55.680	.069493	841263.	-8425.5618	-.0043062	2921.0519	-469.1998
59.160	.055283	809101.	-9905.2452	-.0038689	2809.3781	-381.1929
62.640	.042565	772322.	-11089.8422	-.0034499	2681.6751	-299.6100
66.120	.031272	731916.	-12001.9787	-.0030513	2541.3736	-224.6064
69.600	.021328	688789.	-12664.6682	-.0026748	2391.6273	-156.2496
73.080	.012655	643770.	-13101.0194	-.0023217	2235.3108	-94.5269
76.560	.005169	597606.	-13333.9709	-.0019927	2075.0194	-39.3532
80.040	-.001215	550965.	-13386.0537	-.0016884	1913.0731	9.4206
83.520	-.006582	504439.	-13279.1830	-.0014087	1751.5231	51.9994
87.000	-.011019	458542.	-13034.4778	-.0011535	1592.1595	88.6358
90.480	-.014611	413719.	-12672.1088	-.0009224	1436.5232	119.6223
93.960	-.017439	370344.	-12211.1733	-.0007146	1285.9169	145.2832
97.440	-.019585	328729.	-11669.5962	-.0005294	1141.4198	165.9680
100.920	-.021124	289124.	-11064.0556	-.0003657	1003.9017	182.0439
104.400	-.022130	251723.	-10409.9310	-.0002224	874.0385	193.8898
107.880	-.022671	216671.	-9721.2737	-9.8244E-05	752.3283	201.8903
111.360	-.022814	184063.	-9010.7955	7.9446E-06	639.1077	206.4305
114.840	-.022616	153955.	-8289.8762	9.7515E-05	534.5675	207.8910
118.320	-.022135	126365.	-7568.5852	.0001718	438.7690	206.6441
121.800	-.021420	101278.	-6855.7179	.0002321	351.6600	203.0498
125.280	-.020519	78649.6823	-6158.8431	.0002798	273.0892	197.4530
128.760	-.019473	58412.5255	-5484.3603	.0003161	202.8213	190.1808
132.240	-.018319	40478.5344	-4837.5650	.0003423	140.5505	181.5407
135.720	-.017091	24743.0732	-4222.7197	.0003596	85.9134	171.8187
139.200	-.015816	11088.4050	-3643.1303	.0003691	38.5014	161.2787
142.680	-.014522	-613.1140	-3101.2248	.0003719	2.1289	150.1613
146.160	-.013228	-10496.1193	-2598.6336	.0003689	36.4449	138.6842
149.640	-.011954	-18699.6040	-2136.2713	.0003612	64.9292	127.0413
153.120	-.010714	-25364.5674	-1714.4162	.0003495	88.0714	115.4041
156.600	-.009521	-30631.9404	-1332.7893	.0003347	106.3609	103.9216
160.080	-.008385	-34640.7808	-990.6304	.0003174	120.2805	92.7214
163.560	-.007312	-37526.7281	-686.7709	.0002983	130.3011	81.9105
167.040	-.006309	-39420.7065	-419.7028	.0002779	136.8775	71.5769
170.520	-.005378	-40447.8596	-187.6433	.0002567	140.4440	61.7906
174.000	-.004522	-40726.7040	11.4046	.0002352	141.4122	52.6048
177.480	-.003741	-40368.4832	179.5976	.0002137	140.1683	44.0578
180.960	-.003035	-39476.7050	319.2009	.0001925	137.0719	36.1740
184.440	-.002401	-38146.8451	432.5439	.0001720	132.4543	28.9657
187.920	-.001838	-36466.1994	521.9797	.0001522	126.6187	22.4342
191.400	-.001342	-34513.8665	589.8498	.0001334	119.8398	16.5716
194.880	-.000909	-32360.8447	638.4541	.0001157	112.3640	11.3619
198.360	-.000537	-30070.2258	670.0250	9.9135E-05	104.4105	6.7823
201.840	-.000219	-27697.4710	686.7058	8.3827E-05	96.1718	2.8044
205.320	4.68E-05	-25290.7533	690.5341	6.9786E-05	87.8151	-.6042636
208.800	.000266	-22891.3535	683.4278	5.7019E-05	79.4839	-3.4798
212.280	.000444	-20534.0959	667.1753	4.5511E-05	71.2989	-5.8607
215.760	.000583	-18247.8136	643.4289	3.5235E-05	63.3605	-7.7867
219.240	.000689	-16055.8309	613.7009	2.6145E-05	55.7494	-9.2984
222.720	.000765	-13976.4551	579.3623	1.8187E-05	48.5294	-10.4365
226.200	.000815	-12023.4696	541.6432	1.1297E-05	41.7482	-11.2411
229.680	.000844	-10206.6187	501.6362	5.4065E-06	35.4396	-11.7514
233.160	.000853	-8532.0816	460.3005	4.4103E-07	29.6253	-12.0048
236.640	.000847	-7002.9275	418.4674	-3.6755E-06	24.3157	-12.0372
240.120	.000827	-5619.5488	376.8473	-7.0203E-06	19.5123	-11.8824
243.600	.000798	-4380.0703	336.0373	-9.6700E-06	15.2086	-11.5717
247.080	.000760	-3280.7291	296.5293	-1.1700E-05	11.3914	-11.1341
250.560	.000716	-2316.2266	258.7184	-1.3183E-05	8.0425	-10.5963
254.040	.000668	-1480.0494	222.9120	-1.4189E-05	5.1391	-9.9821
257.520	.000618	-764.7592	189.3386	-1.4784E-05	2.6554	-9.3130
261.000	.000566	-162.2526	158.1565	-1.5030E-05	.5633771	-8.6078
264.480	.000513	336.0104	129.4625	-1.4984E-05	1.1667	-7.8830
267.960	.000461	738.8067	103.3001	-1.4699E-05	2.5653	-7.1528
271.440	.000411	1054.9792	79.6676	-1.4223E-05	3.6631	-6.4291
274.920	.000362	1293.2929	58.5254	-1.3601E-05	4.4906	-5.7216
278.400	.000316	1462.3159	39.8034	-1.2871E-05	5.0775	-5.0382
281.880	.000273	1570.3247	23.4073	-1.2067E-05	5.4525	-4.3849
285.360	.000232	1625.2308	9.2246	-1.1221E-05	5.6432	-3.7661
288.840	.000195	1634.5279	-2.8699	-1.0357E-05	5.6754	-3.1848
292.320	.000160	1605.2562	-13.0092	-9.4983E-06	5.5738	-2.6424
295.800	.000128	1543.9837	-21.3297	-8.6638E-06	5.3611	-2.1395
299.280	9.97E-05	1456.8014	-27.9674	-7.8686E-06	5.0583	-1.6753
302.760	7.37E-05	1349.3306	-33.0547	-7.1250E-06	4.6852	-1.2484
306.240	5.01E-05	1226.7410	-36.7173	-6.4424E-06	4.2595	-.8565613
309.720	2.88E-05	1093.7781	-39.0724	-5.8275E-06	3.7978	-.4969379
313.200	9.57E-06	954.7970	-40.2264	-5.2847E-06	3.3153	-.1662513
316.680	-7.94E-06	813.8026	-40.2736	-4.8160E-06	2.8257	.1391199
320.160	-2.40E-05	674.4931	-39.2955	-4.4216E-06	2.3420	.4230101
323.640	-3.87E-05	540.3063	-37.3600	-4.0997E-06	1.8761	.6893476
327.120	-5.25E-05	414.4678	-34.5213	-3.8467E-06	1.4391	.9420386
330.600	-6.55E-05	300.0378	-30.8205	-3.6574E-06	1.0418	1.1849
334.080	-7.79E-05	199.9568	-26.2858	-3.5249E-06	.6942944	1.4213

337.560	-9.00E-05	117.0884	-20.9338	-3.4409E-06	.4065570	1.6546
341.040	-.000102	54.2575	-14.7710	-3.3955E-06	.1883941	1.8873
344.520	-.000114	14.2824	-7.7956	-3.3773E-06	.0495915	2.1215
348.000	-.000125	0.0000	0.0000	-3.3736E-06	0.0000	2.3587

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      .50000000 in
Computed slope at pile head      =     -.00999629
Maximum bending moment           =   901336.69856 lbs-in
Maximum shear force              =    43757.94866 lbs
Depth of maximum bending moment  =    41.76000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              6
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	65265.0695	-.0187664	0.0000	-1019.0250
3.480	.934693	220952.	61609.9118	-.0187078	767.1946	-1081.6403
6.960	.869794	428805.	57733.6176	-.0185356	1488.9062	-1146.1150
10.440	.805685	622778.	53629.7164	-.0182570	2162.4237	-1212.4489
13.920	.742725	802068.	49291.7377	-.0178794	2784.9577	-1280.6423
17.400	.681244	965849.	44713.2107	-.0174110	3353.6407	-1350.6951
20.880	.621545	1113272.	39887.6648	-.0168600	3865.5269	-1422.6072
24.360	.563899	1243467.	34808.6290	-.0162355	4317.5926	-1496.3789
27.840	.508546	1355540.	29469.6324	-.0155468	4706.7355	-1572.0100
31.320	.455693	1448575.	23864.2040	-.0148038	5029.7754	-1649.5006
34.800	.405511	1521635.	18217.0497	-.0140167	5283.4537	-1595.9904
38.280	.358136	1575366.	12790.2801	-.0131960	5470.0207	-1522.8427
41.760	.313667	1610655.	7622.2011	-.0123518	5592.5522	-1447.3176
45.240	.272168	1628416.	2719.2689	-.0114935	5654.2239	-1370.4595
48.720	.233672	1629581.	-1915.6603	-.0106302	5658.2678	-1293.2928
52.200	.198182	1615083.	-6283.2098	-.0097704	5607.9288	-1216.7931
55.680	.165670	1585850.	-10346.7483	-.0089222	5506.4236	-1118.5739
59.160	.136084	1543070.	-13925.7866	-.0080931	5357.8824	-938.3447
62.640	.109343	1488927.	-16897.7024	-.0072896	5169.8838	-769.6530
66.120	.085348	1425462.	-19303.5310	-.0065174	4949.5212	-613.0071
69.600	.063982	1354574.	-21185.7575	-.0057807	4703.3818	-468.7323
73.080	.045114	1278009.	-22587.7037	-.0050831	4437.5321	-336.9840
76.560	.028604	1197364.	-23552.9635	-.0044271	4157.5123	-217.7631
80.040	.014301	1114081.	-24124.8910	-.0038147	3868.3355	-110.9309
83.520	.002054	1029454.	-24346.1425	-.0032466	3574.4941	-16.2251
87.000	-.008295	944631.	-24258.2728	-.0027235	3279.9704	66.7250
90.480	-.016902	860617.	-23901.3859	-.0022452	2988.2525	138.3825
93.960	-.023922	778278.	-23313.8392	-.0018109	2702.3535	199.2880
97.440	-.029506	698352.	-22532.0000	-.0014196	2424.8347	250.0449
100.920	-.033802	621455.	-21590.0505	-.0010699	2157.8302	291.3054
104.400	-.036952	548086.	-20519.8415	-.0007600	1903.0751	323.7573
107.880	-.039092	478637.	-19350.7887	-.0004879	1661.9340	348.1121
111.360	-.040348	413404.	-18109.8110	-.0002515	1435.4311	365.0935
114.840	-.040842	352593.	-16821.3052	-4.8545E-05	1224.2803	375.4271
118.320	-.040686	296328.	-15507.1548	.0001234	1028.9162	379.8317
121.800	-.039983	244663.	-14186.7687	.0002668	849.5240	379.0109
125.280	-.038829	197588.	-12877.1453	.0003840	686.0693	373.6462
128.760	-.037311	155038.	-11592.9600	.0004774	538.3264	364.3913
132.240	-.035507	116901.	-10346.6708	.0005495	405.9061	351.8668
135.720	-.033487	83025.1613	-9148.6397	.0006024	288.2818	336.6568
139.200	-.031314	53226.4198	-8007.2652	.0006385	184.8140	319.3055
142.680	-.029042	27294.5958	-6929.1250	.0006599	94.7729	300.3152
146.160	-.026721	4999.7096	-5919.1239	.0006684	17.3601	280.1452
149.640	-.024390	-13902.5067	-4980.6450	.0006661	48.2726	259.2106
153.120	-.022085	-29665.5794	-4115.7022	.0006545	103.0055	237.8830
156.600	-.019835	-42547.7942	-3325.0919	.0006354	147.7354	216.4908
160.080	-.017663	-52808.2193	-2608.5408	.0006101	183.3619	195.3202
163.560	-.015588	-60703.2383	-1964.8498	.0005800	210.7751	174.6171
167.040	-.013626	-66483.5742	-1392.0319	.0005463	230.8457	154.5886
170.520	-.011786	-70391.7806	-887.4426	.0005101	244.4159	135.4053
174.000	-.010076	-72660.1745	-447.9024	.0004722	252.2923	117.2040
177.480	-.008499	-73509.1816	-69.8115	.0004334	255.2402	100.0897
180.960	-.007059	-73146.0622	250.7463	.0003946	253.9794	84.1389
184.440	-.005753	-71763.9870	517.9074	.0003562	249.1805	69.4019
187.920	-.004580	-69541.4270	735.9425	.0003187	241.4633	55.9056
191.400	-.003535	-66641.8274	909.1806	.0002826	231.3952	43.6565
194.880	-.002613	-63213.5301	1041.9416	.0002482	219.4914	32.6429
198.360	-.001807	-59389.9140	1138.4782	.0002157	206.2150	22.8379
201.840	-.001111	-55289.7217	1202.9268	.0001854	191.9782	14.2015
205.320	-.000517	-51017.5431	1239.2664	.0001572	177.1442	6.6833
208.800	-1.71E-05	-46664.4275	1251.2851	.0001313	162.0293	.2240353
212.280	.000397	-42308.5986	1242.5544	.0001077	146.9049	-5.2417
215.760	.000733	-38016.2490	1216.4093	8.6440E-05	132.0009	-9.7842
219.240	.000998	-33842.3899	1175.9354	6.7398E-05	117.5083	-13.4767
222.720	.001202	-29831.7386	1123.9605	5.0525E-05	103.5824	-16.3940
226.200	.001350	-26019.6247	1063.0516	3.5726E-05	90.3459	-18.6111
229.680	.001450	-22432.8992	995.5159	2.2886E-05	77.8920	-20.2025
233.160	.001509	-19090.8339	923.4053	1.1883E-05	66.2876	-21.2404
236.640	.001533	-16005.9983	848.5243	2.5830E-06	55.5764	-21.7947
240.120	.001527	-13185.1049	772.4401	-5.1522E-06	45.7816	-21.9319
243.600	.001497	-10629.8153	696.4950	-1.1463E-05	36.9091	-21.7147
247.080	.001448	-8337.4999	621.8202	-1.6489E-05	28.9497	-21.2018
250.560	.001382	-6301.9469	549.3509	-2.0368E-05	21.8818	-20.4472
254.040	.001306	-4514.0173	479.8423	-2.3234E-05	15.6737	-19.5003
257.520	.001221	-2962.2442	413.8856	-2.5215E-05	10.2856	-18.4059
261.000	.001130	-1633.3734	351.9247	-2.6433E-05	5.6714	-17.2039
264.480	.001037	-512.8484	294.2724	-2.7002E-05	1.7807	-15.9296
267.960	.000942	414.7626	241.1268	-2.7028E-05	1.4401	-14.6138
271.440	.000849	1165.3940	192.5864	-2.6609E-05	4.0465	-13.2829
274.920	.000757	1755.1637	148.6652	-2.5835E-05	6.0943	-11.9591
278.400	.000669	2200.1040	109.3070	-2.4787E-05	7.6393	-10.6606
281.880	.000585	2515.9407	74.3983	-2.3537E-05	8.7359	-9.4019

285.360	.000505	2717.9163	43.7807	-2.2150E-05	9.4372	-8.1944
288.840	.000430	2820.6541	17.2621	-2.0683E-05	9.7939	-7.0461
292.320	.000361	2838.0607	-5.3725	-1.9183E-05	9.8544	-5.9623
295.800	.000297	2783.2616	-24.3525	-1.7694E-05	9.6641	-4.9457
299.280	.000238	2668.5675	-39.9129	-1.6249E-05	9.2659	-3.9970
302.760	.000184	2505.4679	-52.2874	-1.4878E-05	8.6995	-3.1147
306.240	.000134	2304.6474	-61.7019	-1.3603E-05	8.0022	-2.2959
309.720	8.91E-05	2076.0227	-68.3696	-1.2443E-05	7.2084	-1.5361
313.200	4.78E-05	1828.7953	-72.4863	-1.1408E-05	6.3500	-.8298297
316.680	9.75E-06	1571.5183	-74.2273	-1.0507E-05	5.4567	-.1707690
320.160	-2.54E-05	1312.1732	-73.7449	-9.7428E-06	4.5562	.4480159
323.640	-5.81E-05	1058.2538	-71.1666	-9.1146E-06	3.6745	1.0338
327.120	-8.88E-05	816.8540	-66.5943	-8.6178E-06	2.8363	1.5939
330.600	-.000118	594.7573	-60.1049	-8.2437E-06	2.0651	2.1356
334.080	-.000146	398.5239	-51.7505	-7.9805E-06	1.3838	2.6657
337.560	-.000174	234.5735	-41.5609	-7.8127E-06	.8144913	3.1904
341.040	-.000201	109.2599	-29.5457	-7.7216E-06	.3793747	3.7149
344.520	-.000227	28.9353	-15.6983	-7.6850E-06	.1004698	4.2434
348.000	-.000254	0.0000	0.0000	-7.6773E-06	0.0000	4.7786

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.01876636
Maximum bending moment           =       1629581. lbs-in
Maximum shear force              =    65265.06954 lbs
Depth of maximum bending moment  =    48.72000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              7
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	-1445137.	53279.7210	0.0000	5017.8378	-666.9982
3.480	.248667	-1263996.	50824.5635	-.0007179	4388.8742	-705.4927
6.960	.245004	-1091398.	48308.9399	-.0013420	3789.5765	-740.2925
10.440	.239327	-927766.	45678.8559	-.0018771	3221.4081	-771.2500
13.920	.231939	-773473.	42947.8628	-.0023279	2685.6708	-798.2863
17.400	.223125	-628848.	40129.6273	-.0026995	2183.5015	-821.3893
20.880	.213151	-494171.	37237.7452	-.0029971	1715.8715	-840.6119
24.360	.202265	-369674.	34285.5228	-.0032260	1283.5893	-856.0677
27.840	.190698	-255544.	31286.1819	-.0033916	887.3047	-867.6915
31.320	.178660	-151922.	28253.7742	-.0034996	527.5066	-875.0716
34.800	.166341	-58897.4875	25203.1162	-.0035555	204.5052	-878.1801
38.280	.153913	23491.8004	22149.0461	-.0035649	81.5688	-877.0326
41.760	.141529	95259.8732	19106.2995	-.0035334	330.7634	-871.6724
45.240	.129321	156472.	16167.2128	-.0034667	543.3043	-817.4579
48.720	.117401	207784.	13424.2381	-.0033702	721.4711	-758.9643
52.200	.105865	249904.	10886.3695	-.0032489	867.7234	-699.5809
55.680	.094789	283553.	8555.5037	-.0031075	984.5584	-639.9972
59.160	.084236	309451.	6431.2475	-.0029504	1074.4814	-580.8397
62.640	.074254	328314.	4511.1413	-.0027814	1139.9802	-522.6697
66.120	.064878	340848.	2790.8858	-.0026041	1183.5007	-465.9829
69.600	.056130	347739.	1264.5710	-.0024216	1207.4266	-411.2095
73.080	.048024	349650.	-75.0976	-.0022368	1214.0611	-358.7150
76.560	.040562	347216.	-1236.5782	-.0020521	1205.6117	-308.8026
80.040	.033741	341043.	-2229.2787	-.0018698	1184.1772	-261.7150
83.520	.027548	331700.	-3063.3531	-.0016915	1151.7375	-217.6381
87.000	.021968	319722.	-3749.5088	-.0015189	1110.1461	-176.7042
90.480	.016977	305604.	-4298.8271	-.0013532	1061.1244	-138.9960
93.960	.012550	289802.	-4722.5976	-.0011954	1006.2578	-104.5503
97.440	.008657	272735.	-5032.1665	-.0010463	946.9949	-73.3629
100.920	.005267	254778.	-5238.8014	-.0009066	884.6471	-45.3928
104.400	.002347	236272.	-5353.5704	-.0007764	820.3905	-20.5664
107.880	-.000137	217518.	-5387.2370	-.0006562	755.2692	1.2178
111.360	-.002220	198777.	-5350.1696	-.0005459	690.1990	20.0853
114.840	-.003936	180280.	-5252.2666	-.0004454	625.9734	36.1808
118.320	-.005320	162222.	-5102.8947	-.0003547	563.2692	49.6651
121.800	-.006405	144764.	-4910.8408	-.0002733	502.6534	60.7107
125.280	-.007222	128042.	-4684.2769	-.0002010	444.5906	69.4985
128.760	-.007804	112162.	-4430.7359	-.0001374	389.4501	76.2147
132.240	-.008178	97204.1582	-4157.0989	-8.1908E-05	337.5144	81.0480
135.720	-.008374	83228.2156	-3869.5910	-3.4096E-05	288.9869	84.1864
139.200	-.008416	70271.8045	-3573.7871	6.5792E-06	243.9993	85.8158
142.680	-.008328	58354.6575	-3274.6238	4.0663E-05	202.6203	86.1171
146.160	-.008133	47480.4228	-2976.4193	6.8708E-05	164.8626	85.2648
149.640	-.007850	37638.7793	-2682.8975	9.1263E-05	130.6902	83.4259
153.120	-.007498	28807.4562	-2397.2177	.0001089	100.0259	80.7580
156.600	-.007092	20954.1443	-2122.0071	.0001221	72.7574	77.4090
160.080	-.006648	14038.2865	-1859.3971	.0001313	48.7441	73.5163
163.560	-.006178	8012.7407	-1611.0601	.0001372	27.8220	69.2061
167.040	-.005693	2825.3083	-1378.2491	.0001400	9.8101	64.5933
170.520	-.005203	-1579.8734	-1161.8371	.0001404	5.4857	59.7814
174.000	-.004716	-5261.0779	-962.3561	.0001386	18.2676	54.8628
177.480	-.004239	-8277.8717	-780.0363	.0001350	28.7426	49.9186
180.960	-.003777	-10690.1307	-614.8441	.0001299	37.1185	45.0194
184.440	-.003335	-12557.1869	-466.5184	.0001238	43.6013	40.2253
187.920	-.002915	-13937.0986	-334.6051	.0001168	48.3927	35.5869
191.400	-.002522	-14886.0385	-218.4905	.0001091	51.6876	31.1456
194.880	-.002156	-15457.7925	-117.4313	.0001011	53.6729	26.9344
198.360	-.001818	-15703.3603	-30.5832	9.2831E-05	54.5256	22.9783
201.840	-.001510	-15670.6517	42.9732	8.4518E-05	54.4120	19.2955
205.320	-.001230	-15404.2670	104.2092	7.6283E-05	53.4870	15.8976
208.800	-.000979	-14945.3557	154.1269	6.8241E-05	51.8936	12.7907
212.280	-.000755	-14331.5439	193.7407	6.0483E-05	49.7623	9.9758
215.760	-.000558	-13596.9207	224.0611	5.3083E-05	47.2115	7.4497
219.240	-.000386	-12772.0785	246.0812	4.6095E-05	44.3475	5.2055
222.720	-.000237	-11884.1959	260.7644	3.9562E-05	41.2646	3.2331
226.200	-.000110	-10957.1585	269.0354	3.3509E-05	38.0457	1.5203
229.680	-3.77E-06	-10011.7096	271.7722	2.7953E-05	34.7629	.0525681

233.160	8.43E-05	-9065.6241	269.8002	2.2897E-05	31.4779	-1.1859
236.640	.000156	-8133.9003	263.8879	1.8340E-05	28.2427	-2.2119
240.120	.000212	-7228.9641	254.7442	1.4269E-05	25.1006	-3.0431
243.600	.000255	-6360.8805	243.0166	1.0668E-05	22.0864	-3.6970
247.080	.000286	-5537.5686	229.2909	7.5147E-06	19.2277	-4.1914
250.560	.000307	-4765.0161	214.0917	4.7847E-06	16.5452	-4.5437
254.040	.000319	-4047.4900	197.8843	2.4495E-06	14.0538	-4.7709
257.520	.000324	-3387.7411	181.0762	4.7926E-07	11.7630	-4.8890
261.000	.000323	-2787.1997	164.0201	-1.1570E-06	9.6778	-4.9134
264.480	.000316	-2246.1611	147.0173	-2.4908E-06	7.7992	-4.8583
267.960	.000305	-1763.9590	130.3211	-3.5534E-06	6.1249	-4.7372
271.440	.000291	-1339.1262	114.1405	-4.3757E-06	4.6497	-4.5620
274.920	.000275	-969.5413	98.6443	-4.9874E-06	3.3665	-4.3438
278.400	.000257	-652.5621	83.9652	-5.4173E-06	2.2658	-4.0924
281.880	.000237	-385.1438	70.2038	-5.6922E-06	1.3373	-3.8164
285.360	.000217	-163.9438	57.4327	-5.8377E-06	.5692493	-3.5233
288.840	.000197	14.5877	45.7003	-5.8773E-06	.0506517	-3.2194
292.320	.000176	154.1305	35.0349	-5.8326E-06	.5351754	-2.9101
295.800	.000156	258.4303	25.4477	-5.7233E-06	.8973275	-2.5997
299.280	.000136	331.2465	16.9370	-5.5670E-06	1.1502	-2.2915
302.760	.000117	376.3116	9.4906	-5.3795E-06	1.3066	-1.9880
306.240	9.90E-05	397.3010	3.0893	-5.1745E-06	1.3795	-1.6909
309.720	8.13E-05	397.8130	-2.2908	-4.9639E-06	1.3813	-1.4011
313.200	6.44E-05	381.3568	-6.6759	-4.7574E-06	1.3242	-1.1190
316.680	4.82E-05	351.3485	-10.0924	-4.5632E-06	1.2200	-.8444261
320.160	3.26E-05	311.1139	-12.5650	-4.3877E-06	1.0803	-.5766012
323.640	1.77E-05	263.8964	-14.1155	-4.2353E-06	.9163069	-.3145265
327.120	3.17E-06	212.8698	-14.7618	-4.1090E-06	.7391314	-.0568861
330.600	-1.09E-05	161.1544	-14.5166	-4.0099E-06	.5595639	.1978130
334.080	-2.47E-05	111.8346	-13.3874	-3.9375E-06	.3883144	.4511411
337.560	-3.83E-05	67.9782	-11.3763	-3.8899E-06	.2360354	.7046419
341.040	-5.18E-05	32.6554	-8.4803	-3.8632E-06	.1133867	.9597250
344.520	-6.52E-05	8.9552	-4.6919	-3.8522E-06	.0310943	1.2176
348.000	-7.86E-05	0.0000	0.0000	-3.8498E-06	0.0000	1.4789

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =      .25000000 in
Computed slope at pile head      =     -.00004800
Maximum bending moment           =      -1445137. lbs-in
Maximum shear force              =    53279.72099 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              5
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)

```
Specified deflection at pile head   =         .500000 in
Specified slope at pile head        =       0.000E+00 in/in
Specified axial load at pile head   =            .000 lbs
```

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-2679772.	92794.9206	0.0000	9304.7622	-1019.0250
3.480	.497529	-2363395.	89030.7415	-.0013364	8206.2317	-1081.6399
6.960	.490699	-2060117.	85154.5220	-.0025085	7153.1842	-1146.1140
10.440	.480069	-1770719.	81050.6251	-.0035236	6148.3307	-1212.4474
13.920	.466174	-1496005.	76712.6529	-.0043893	5194.4607	-1280.6401
17.400	.449520	-1236799.	72136.0841	-.0051134	4294.4416	-1349.5719
20.880	.430585	-993938.	67395.5115	-.0057045	3451.1720	-1374.8951
24.360	.409816	-767726.	62580.2221	-.0061714	2665.7168	-1392.5126
27.840	.387632	-558379.	57716.6282	-.0065228	1938.8167	-1402.6563
31.320	.364418	-366019.	52830.1620	-.0067677	1270.8982	-1405.6576
34.800	.340529	-190681.	47944.9440	-.0069152	662.0877	-1401.9389
38.280	.316288	-32321.8851	43083.4845	-.0069743	112.2288	-1392.0034
41.760	.291988	109180.	38266.4199	-.0069540	379.0965	-1376.4245
45.240	.267888	234012.	33512.2896	-.0068630	812.5430	-1355.8343
48.720	.244221	342425.	28837.3543	-.0067103	1188.9768	-1330.9101
52.200	.221185	434720.	24255.4609	-.0065043	1509.4458	-1302.3619
55.680	.198951	511243.	19777.9619	-.0062537	1775.1504	-1270.9134
59.160	.177659	572375.	15435.0302	-.0059665	1987.4132	-1225.0244
62.640	.157424	618671.	11375.4106	-.0056509	2148.1637	-1108.0903
66.120	.138329	651548.	7718.5705	-.0053143	2262.3189	-993.5419
69.600	.120436	672392.	4454.5798	-.0049635	2334.6958	-882.3147
73.080	.103783	682552.	1570.4809	-.0046045	2369.9713	-775.2134
76.560	.088389	683323.	-949.2616	-.0042425	2372.6491	-672.9145
80.040	.074255	675945.	-3122.3231	-.0038823	2347.0308	-575.9714
83.520	.061368	661592.	-4968.0986	-.0035279	2297.1929	-484.8191
87.000	.049701	641367.	-6507.3041	-.0031826	2226.9684	-399.7817
90.480	.039217	616301.	-7761.6021	-.0028494	2139.9331	-321.0792
93.960	.029869	587346.	-8753.2544	-.0025304	2039.3964	-248.8359
97.440	.021605	555378.	-9504.8034	-.0022276	1928.3961	-183.0888
100.920	.014365	521193.	-10038.7831	-.0019424	1809.6970	-123.7961
104.400	.008086	485508.	-10377.4618	-.0016756	1685.7922	-70.8468
107.880	.002703	448966.	-10542.6146	-.0014280	1558.9083	-24.0686
111.360	-.001853	412132.	-10555.3267	-.0011998	1431.0123	16.7627
114.840	-.005648	375501.	-10435.8275	-.0009911	1303.8212	51.9150
118.320	-.008750	339498.	-10203.3522	-.0008016	1178.8132	81.6915
121.800	-.011227	304485.	-9876.0320	-.0006310	1057.2402	106.4236
125.280	-.013142	270761.	-9470.8097	-.0004785	940.1424	126.4628
128.760	-.014558	238568.	-9003.3800	-.0003436	828.3623	142.1749
132.240	-.015533	208097.	-8488.1520	-.0002252	722.5607	153.9332
135.720	-.016125	179491.	-7938.2315	-.0001225	623.2320	162.1131
139.200	-.016386	152847.	-7365.4228	-3.4444E-05	530.7201	167.0873
142.680	-.016365	128227.	-6780.2454	4.0037E-05	445.2343	169.2215
146.160	-.016107	105657.	-6191.9657	.0001020	366.8642	168.8703
149.640	-.015655	85131.3854	-5608.6405	.0001526	295.5951	166.3741
153.120	-.015045	66620.7452	-5037.1704	.0001928	231.3220	162.0569
156.600	-.014313	50072.6793	-4483.3621	.0002237	173.8635	156.2237
160.080	-.013488	35416.5450	-3951.9962	.0002464	122.9741	149.1590
163.560	-.012598	22566.7857	-3446.9006	.0002617	78.3569	141.1258
167.040	-.011667	11426.1167	-2971.0266	.0002707	39.6740	132.3650
170.520	-.010714	1888.4404	-2526.5271	.0002743	6.5571	123.0945
174.000	-.009758	-6158.5120	-2114.8351	.0002731	21.3837	113.5101
177.480	-.008813	-12830.8121	-1736.7420	.0002681	44.5514	103.7848

180.960	-.007892	-18246.2363	-1392.4738	.0002599	63.3550	94.0704
184.440	-.007005	-22522.4300	-1081.7656	.0002491	78.2029	84.4975
187.920	-.006159	-25775.3251	-803.9323	.0002363	89.4977	75.1768
191.400	-.005360	-28117.7989	-557.9360	.0002220	97.6312	66.2004
194.880	-.004614	-29658.5596	-342.4492	.0002067	102.9811	57.6426
198.360	-.003922	-30501.2455	-155.9137	.0001907	105.9071	49.5617
201.840	-.003286	-30743.7188	3.4059	.0001745	106.7490	42.0012
205.320	-.002707	-30477.5405	137.3724	.0001583	105.8248	34.9911
208.800	-.002185	-29787.6066	247.9325	.0001423	103.4292	28.5492
212.280	-.001717	-28751.9301	337.0768	.0001268	99.8331	22.6831
215.760	-.001302	-27441.5518	406.8058	.0001119	95.2832	17.3910
219.240	-.000938	-25920.5620	459.0994	9.7761E-05	90.0020	12.6629
222.720	-.000622	-24246.2200	495.8922	8.4468E-05	84.1883	8.4824
226.200	-.000350	-22469.1525	519.0516	7.2089E-05	78.0179	4.8276
229.680	-.000120	-20633.6208	530.3610	6.0667E-05	71.6445	1.6721
233.160	7.21E-05	-18777.8398	531.5060	5.0224E-05	65.2008	-1.0140
236.640	.000230	-16934.3393	524.0640	4.0761E-05	58.7998	-3.2629
240.120	.000356	-15130.3541	509.4977	3.2264E-05	52.5360	-5.1086
243.600	.000454	-13388.2355	489.1497	2.4707E-05	46.4869	-6.5857
247.080	.000528	-11725.8723	464.2414	1.8052E-05	40.7148	-7.7294
250.560	.000580	-10157.1151	435.8729	1.2253E-05	35.2678	-8.5744
254.040	.000613	-8692.1971	405.0246	7.2586E-06	30.1812	-9.1545
257.520	.000630	-7338.1441	372.5613	3.0108E-06	25.4797	-9.5025
261.000	.000634	-6099.1707	339.2367	-5.4992E-07	21.1777	-9.6495
264.480	.000626	-4977.0565	305.6997	-3.4850E-06	17.2814	-9.6247
267.960	.000610	-3971.5008	272.5005	-5.8562E-06	13.7899	-9.4553
271.440	.000586	-3080.4531	240.0984	-7.7249E-06	10.6960	-9.1666
274.920	.000556	-2300.4160	208.8694	-9.1507E-06	7.9876	-8.7811
278.400	.000522	-1626.7220	179.1142	-1.0191E-05	5.6483	-8.3196
281.880	.000485	-1053.7811	151.0662	-1.0902E-05	3.6590	-7.8000
285.360	.000446	-575.3012	124.8997	-1.1333E-05	1.9976	-7.2383
288.840	.000406	-184.4793	100.7376	-1.1535E-05	.6405533	-6.6480
292.320	.000366	125.8327	78.6594	-1.1550E-05	.4369192	-6.0406
295.800	.000326	362.9904	58.7083	-1.1421E-05	1.2604	-5.4256
299.280	.000286	534.4425	40.8980	-1.1183E-05	1.8557	-4.8102
302.760	.000248	647.6407	25.2197	-1.0870E-05	2.2488	-4.2003
306.240	.000211	709.9718	11.6477	-1.0510E-05	2.4652	-3.5997
309.720	.000175	728.7087	.1449785	-1.0129E-05	2.5302	-3.0110
313.200	.000140	710.9808	-9.3318	-9.7471E-06	2.4687	-2.4354
316.680	.000107	663.7594	-16.8280	-9.3829E-06	2.3047	-1.8728
320.160	7.49E-05	593.8579	-22.3873	-9.0496E-06	2.0620	-1.3222
323.640	4.39E-05	507.9435	-26.0487	-8.7576E-06	1.7637	-.7820099
327.120	1.39E-05	412.5586	-27.8439	-8.5137E-06	1.4325	-.2497062
330.600	-1.53E-05	314.1497	-27.7957	-8.3212E-06	1.0908	.2774467
334.080	-4.40E-05	219.1008	-25.9167	-8.1799E-06	.7607667	.8024311
337.560	-7.23E-05	133.7696	-22.2093	-8.0864E-06	.4644779	1.3282
341.040	-.000100	64.5238	-16.6661	-8.0338E-06	.2240408	1.8576
344.520	-.000128	17.7736	-9.2707	-8.0120E-06	.0617137	2.3927
348.000	-.000156	0.0000	0.0000	-8.0073E-06	0.0000	2.9353

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection = .50000000 in
Computed slope at pile head = -.00008384
Maximum bending moment = -2679772. lbs-in
Maximum shear force = 92794.92060 lbs
Depth of maximum bending moment = 0.00000 in
Depth of maximum shear force = 0.00000 in
Number of iterations = 6
Number of zero deflection points = 3

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = 1.000000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-4549584.	134391.	0.0000	15797.1674	-1019.0250
3.480	.995805	-4088452.	130627.	-.0022890	14196.0129	-1081.6400
6.960	.984069	-3640418.	126751.	-.0043370	12640.3414	-1146.1143
10.440	.965619	-3206265.	122647.	-.0061513	11132.8640	-1212.4481
13.920	.941256	-2786795.	118309.	-.0077393	9676.3700	-1280.6413
17.400	.911753	-2382833.	113731.	-.0091092	8273.7270	-1350.6939
20.880	.877856	-1995230.	108905.	-.0102693	6927.8806	-1422.6061
24.360	.840279	-1624854.	103826.	-.0112286	5641.8549	-1496.3778
27.840	.799705	-1272601.	98487.0270	-.0119964	4418.7518	-1572.0090
31.320	.756784	-939385.	92881.6018	-.0125825	3261.7517	-1649.4998
34.800	.712131	-626145.	87003.2729	-.0129974	2174.1131	-1728.8501
38.280	.666322	-333842.	80845.5690	-.0132518	1159.1726	-1810.0602
41.760	.619898	-63459.4181	74402.0183	-.0133570	220.3452	-1893.1299
45.240	.573357	183996.	67666.1493	-.0133251	638.8761	-1978.0592
48.720	.527156	407497.	60631.4900	-.0131684	1414.9201	-2064.8484
52.200	.481706	605991.	53291.5686	-.0128998	2104.1371	-2153.4973
55.680	.437373	778406.	45725.1208	-.0125330	2702.7996	-2195.0359
59.160	.394476	924238.	38230.3985	-.0120818	3209.1609	-2112.2758
62.640	.353284	1044490.	31032.3599	-.0115601	3626.7009	-2024.5280
66.120	.314018	1140224.	24145.9201	-.0109812	3959.1096	-1933.1960
69.600	.276855	1212545.	17581.1491	-.0103577	4210.2273	-1839.6609
73.080	.241928	1262588.	11343.3874	-.0097018	4383.9874	-1745.2597
76.560	.209330	1291495.	5533.6830	-.0090251	4484.3592	-1593.6509
80.040	.179114	1301103.	343.3076	-.0083381	4517.7180	-1389.3234
83.520	.151297	1293885.	-4153.8996	-.0076504	4492.6558	-1195.2784
87.000	.125867	1272192.	-7995.3332	-.0069704	4417.3321	-1012.4421
90.480	.102783	1238237.	-11221.2177	-.0063052	4299.4353	-841.5146
93.960	.081983	1194092.	-13873.8463	-.0056607	4146.1527	-682.9846
97.440	.063385	1141675.	-15996.8732	-.0050417	3964.1506	-537.1458
100.920	.046892	1082754.	-17634.6640	-.0044523	3759.5616	-404.1133
104.400	.032396	1018938.	-18831.7058	-.0038954	3537.9796	-283.8418
107.880	.019780	951685.	-19632.0799	-.0033732	3304.4620	-176.1433
111.360	.008919	882299.	-20078.9952	-.0028872	3063.5377	-80.7046
114.840	-.000315	811935.	-20214.3846	-.0024383	2819.2197	2.8946
118.320	-.008051	741607.	-20078.5606	-.0020266	2575.0234	75.1652
121.800	-.014420	672188.	-19709.9298	-.0016520	2333.9878	136.6916
125.280	-.019549	604426.	-19144.7627	-.0013137	2098.7001	188.1170

128.760	-.023563	538941.	-18417.0162	-.0010107	1871.3227	230.1280
132.240	-.026584	476243.	-17558.2054	-.0007417	1653.6222	263.4414
135.720	-.028726	416736.	-16597.3200	-.0005051	1446.9994	288.7916
139.200	-.030099	360726.	-15560.7826	-.0002991	1252.5203	306.9195
142.680	-.030807	308433.	-14472.4443	-.0001217	1070.9471	318.5623
146.160	-.030946	259998.	-13353.6125	2.8881E-05	902.7695	324.4445
149.640	-.030606	215492.	-12223.1080	.0001549	748.2348	325.2707
153.120	-.029868	174925.	-11097.3471	.0002583	607.3778	321.7183
156.600	-.028808	138254.	-9990.4438	.0003413	480.0489	314.4330
160.080	-.027493	105391.	-8914.3296	.0004059	365.9420	304.0235
163.560	-.025983	76210.3617	-7878.8860	.0004540	264.6193	291.0591
167.040	-.024333	50554.2594	-6892.0874	.0004876	175.5356	276.0666
170.520	-.022589	28241.4336	-5960.1509	.0005085	98.0605	259.5291
174.000	-.020794	9071.6091	-5087.6900	.0005184	31.4986	241.8852
177.480	-.018982	-7168.8889	-4277.8697	.0005189	24.8920	223.5288
180.960	-.017183	-20702.3641	-3532.5609	.0005115	71.8832	204.8096
184.440	-.015422	-31755.5125	-2852.4919	.0004976	110.2622	186.0346
187.920	-.013719	-40555.7076	-2237.3958	.0004784	140.8184	167.4689
191.400	-.012092	-47327.7872	-1686.1514	.0004551	164.3326	149.3382
194.880	-.010552	-52291.3210	-1196.9171	.0004287	181.5671	131.8309
198.360	-.009108	-55658.3303	-767.2573	.0004001	193.2581	115.1001
201.840	-.007767	-57631.4318	-394.2592	.0003701	200.1091	99.2667
205.320	-.006532	-58402.3741	-74.6408	.0003394	202.7860	84.4220
208.800	-.005405	-58150.9317	195.1505	.0003085	201.9130	70.6304
212.280	-.004385	-57044.1268	418.8493	.0002780	198.0699	57.9321
215.760	-.003470	-55235.7408	600.2933	.0002482	191.7908	46.3461
219.240	-.002657	-52866.0855	743.3536	.0002196	183.5628	35.8725
222.720	-.001942	-50061.9999	851.8743	.0001923	173.8264	26.4957
226.200	-.001319	-46937.0403	929.6213	.0001666	162.9758	18.1864
229.680	-.000783	-43591.8359	980.2387	.0001426	151.3605	10.9041
233.160	-.000327	-40114.5790	1007.2142	.0001204	139.2867	4.5991
236.640	5.52E-05	-36581.6250	1013.8508	.0001001	127.0195	-.7849963
240.120	.000370	-33058.1777	1003.2456	8.1630E-05	114.7853	-5.3099
243.600	.000623	-29599.0359	978.2750	6.5027E-05	102.7744	-9.0409
247.080	.000822	-26249.3836	941.5852	5.0228E-05	91.1437	-12.0452
250.560	.000973	-23045.6032	895.5871	3.7165E-05	80.0195	-14.3905
254.040	.001081	-20016.0972	842.4566	2.5755E-05	69.5003	-16.1443
257.520	.001152	-17182.1052	784.1373	1.5898E-05	59.6601	-17.3725
261.000	.001192	-14558.5015	722.3475	7.4868E-06	50.5504	-18.1389
264.480	.001204	-12154.5667	658.5890	4.0827E-07	42.2034	-18.5040
267.960	.001195	-9974.7222	594.1585	-5.4557E-06	34.6345	-18.5251
271.440	.001166	-8019.2236	530.1605	-1.0224E-05	27.8445	-18.2554
274.920	.001123	-6284.8052	467.5215	-1.4014E-05	21.8222	-17.7440
278.400	.001069	-4765.2741	407.0049	-1.6942E-05	16.5461	-17.0356
281.880	.001005	-3452.0508	349.2270	-1.9120E-05	11.9863	-16.1701
285.360	.000936	-2334.6543	294.6722	-2.0653E-05	8.1064	-15.1832
288.840	.000862	-1401.1321	243.7095	-2.1643E-05	4.8650	-14.1057
292.320	.000785	-638.4358	196.6076	-2.2184E-05	2.2168	-12.9643
295.800	.000707	-32.7430	153.5501	-2.2361E-05	.1136911	-11.7814
299.280	.000629	430.2727	114.6500	-2.2256E-05	1.4940	-10.5750
302.760	.000552	765.2207	79.9634	-2.1939E-05	2.6570	-9.3598
306.240	.000477	986.8177	49.5023	-2.1475E-05	3.4265	-8.1466
309.720	.000403	1109.7568	23.2466	-2.0919E-05	3.8533	-6.9430
313.200	.000331	1148.6140	1.1544	-2.0321E-05	3.9882	-5.7537
316.680	.000262	1117.7914	-16.8280	-1.9720E-05	3.8812	-4.5810
320.160	.000194	1031.4912	-30.7578	-1.9151E-05	3.5816	-3.4247
323.640	.000128	903.7169	-40.6888	-1.8638E-05	3.1379	-2.2828
327.120	6.42E-05	748.2968	-46.6654	-1.8200E-05	2.5983	-1.1520
330.600	1.54E-06	578.9255	-48.7183	-1.7849E-05	2.0102	-.0277988
334.080	-6.00E-05	409.2175	-46.8615	-1.7587E-05	1.4209	1.0949
337.560	-.000121	252.7695	-41.0910	-1.7411E-05	.8776719	2.2215
341.040	-.000181	123.2244	-31.3847	-1.7312E-05	.4278624	3.3568
344.520	-.000241	34.3318	-17.7047	-1.7270E-05	.1192077	4.5053
348.000	-.000301	0.0000	0.0000	-1.7261E-05	0.0000	5.6698

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.00012219
Maximum bending moment           =      -4549584. lbs-in
Maximum shear force              =   134391.39062 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              7
Number of zero deflection points =              3
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	477729.	25268.2441
4	y= .500000	M= 0.000	0.0000	.5000000	901337.	43757.9487
4	y= 1.000000	M= 0.000	0.0000	1.0000000	1629581.	65265.0695
5	y= .250000	S= 0.000	0.0000	.2500000	-1445137.	53279.7210
5	y= .500000	S= 0.000	0.0000	.5000000	-2679772.	92794.9206
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-4549584.	134391.

The analysis ended normally.

```
================================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.25)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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================================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Douglas\
Name of input data file:     Douglas Bent 2 12 inch Sq pile_3D(0.40)Row3.lpd
Name of output file:         Douglas Bent 2 12 inch Sq pile_3D(0.40)Row3.lpo
Name of plot output file:    Douglas Bent 2 12 inch Sq pile_3D(0.40)Row3.lpp
Name of runtime file:        Douglas Bent 2 12 inch Sq pile_3D(0.40)Row3.lpr


--------------------------------------------------------------------------------
                           Time and Date of Analysis
--------------------------------------------------------------------------------

               Date:  May 11, 2009     Time:  14: 5:40


--------------------------------------------------------------------------------
                                 Problem Title
--------------------------------------------------------------------------------

Douglas Road Bent 2/ 12-inch Square Concrete Pile/3D(0.40)Row3


--------------------------------------------------------------------------------
                                 Program Options
--------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Pile Length                                =     348.00 in
Depth of ground surface below top of pile =    -108.00 in
Slope angle of ground surface              =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
           in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   12.00000000    1728.0000     144.0000      3800000.
  2     348.0000   12.00000000    1728.0000     144.0000      3800000.


--------------------------------------------------------------------------------
                         Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using  3 layers

Layer  1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =     -108.000 in
Distance from top of pile to bottom of layer =      372.000 in
p-y subgrade modulus k for top of soil layer =       75.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       75.000 lbs/in**3

Layer  2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      372.000 in
Distance from top of pile to bottom of layer =      552.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  3 is stiff clay without free water
Distance from top of pile to top of layer    =      552.000 in
Distance from top of pile to bottom of layer =      870.000 in


(Depth of lowest layer extends  522.00 in below pile tip)


--------------------------------------------------------------------------------
                    Effective Unit Weight of Soil vs. Depth
--------------------------------------------------------------------------------
```

Distribution of effective unit weight of soil with depth
is defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-108.00	.06366
2	372.00	.06366
3	372.00	.02755
4	552.00	.02755
5	552.00	.02755
6	870.00	.02755

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 6 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-108.000	.00000	33.00	------	------
2	372.000	.00000	33.00	------	------
3	372.000	.00000	32.00	------	------
4	552.000	.00000	32.00	------	------
5	552.000	10.42000	.00	.00600	.0
6	870.000	10.42000	.00	.00600	.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

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p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.4000	1.0000
2	348.000	.4000	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

---

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)

Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	20140.5298	-.0048144	0.0000	-485.0896
3.480	.233246	67151.7291	18440.1646	-.0047966	233.1657	-492.1318
6.960	.216616	128344.	16718.1645	-.0047448	445.6373	-497.5234
10.440	.200222	183510.	14980.1247	-.0046621	637.1880	-501.3500
13.920	.184167	232605.	13232.0179	-.0045519	807.6570	-503.3091
17.400	.168541	275605.	11481.0719	-.0044172	956.9618	-502.9817
20.880	.153423	312513.	9735.2935	-.0042614	1085.1162	-500.3392
24.360	.138882	343363.	8002.7638	-.0040876	1192.2314	-495.3675
27.840	.124974	368213.	6291.5899	-.0038990	1278.5164	-488.0658
31.320	.111745	387152.	4629.6909	-.0036989	1344.2782	-467.0486
34.800	.099230	400435.	3077.3515	-.0034902	1390.4006	-425.1005
38.280	.087453	408570.	1669.8993	-.0032758	1418.6475	-383.7801
41.760	.076430	412058.	404.6298	-.0030583	1430.7565	-343.3863
45.240	.066167	411387.	-722.1432	-.0028401	1428.4260	-304.1845
48.720	.056663	407032.	-1714.9724	-.0026233	1413.3047	-266.4070
52.200	.047909	399450.	-2579.1606	-.0024096	1386.9809	-230.2528
55.680	.039893	389081.	-3320.6463	-.0022006	1350.9749	-195.8884
59.160	.032593	376339.	-3945.8928	-.0019978	1306.7319	-163.4486
62.640	.025988	361617.	-4461.7793	-.0018022	1255.6159	-133.0379
66.120	.020050	345285.	-4875.4983	-.0016149	1198.9056	-104.7317
69.600	.014748	327684.	-5194.4581	-.0014366	1137.7913	-78.5785
73.080	.010051	309131.	-5426.1913	-.0012678	1073.3728	-54.6015
76.560	.005924	289918.	-5578.2705	-.0011091	1006.6584	-32.8003
80.040	.002332	270307.	-5658.2307	-.0009606	938.5646	-13.1538
83.520	-.000762	250536.	-5673.4999	-.0008226	869.9178	4.3785
87.000	-.003394	230819.	-5631.3360	-.0006951	801.4551	19.8536
90.480	-.005600	211342.	-5538.7729	-.0005779	733.8272	33.3435
93.960	-.007416	192269.	-5402.5726	-.0004710	667.6014	44.9325
97.440	-.008878	173740.	-5229.1857	-.0003740	603.2650	54.7152
100.920	-.010019	155874.	-5024.7184	-.0002866	541.2294	62.7947
104.400	-.010873	138768.	-4794.9070	-.0002086	481.8343	69.2808
107.880	-.011471	122502.	-4545.0981	-.0001393	425.3525	74.2876
111.360	-.011842	107134.	-4280.2353	-7.8475E-05	371.9944	77.9324
114.840	-.012017	92711.0745	-4004.8518	-2.5518E-05	321.9135	80.3340
118.320	-.012020	79260.6283	-3723.0676	2.0052E-05	275.2105	81.6110
121.800	-.011877	66798.5237	-3438.5917	5.8755E-05	231.9393	81.8809
125.280	-.011611	55328.0299	-3154.7285	9.1117E-05	192.1112	81.2589
128.760	-.011243	44841.6134	-2874.3878	.0001177	155.7000	79.8565
132.240	-.010792	35322.2908	-2600.0983	.0001389	122.6468	77.7812
135.720	-.010276	26744.9291	-2334.0235	.0001553	92.8643	75.1354
139.200	-.009711	19077.4874	-2077.9798	.0001675	66.2413	72.0161
142.680	-.009110	12282.1900	-1833.4569	.0001758	42.6465	68.5142
146.160	-.008487	6316.6274	-1601.6393	.0001807	21.9327	64.7142
149.640	-.007853	1134.7801	-1383.4289	.0001827	3.9402	60.6941
153.120	-.007216	-3312.0375	-1179.4677	.0001821	11.5001	56.5250
156.600	-.006585	-7074.3148	-990.1619	.0001794	24.5636	52.2714
160.080	-.005967	-10203.5642	-815.7051	.0001748	35.4290	47.9911
163.560	-.005368	-12751.6223	-656.1016	.0001687	44.2765	43.7351
167.040	-.004793	-14770.0311	-511.1889	.0001614	51.2848	39.5481
170.520	-.004245	-16309.4970	-380.6600	.0001532	56.6302	35.4685
174.000	-.003727	-17419.4248	-264.0842	.0001442	60.4841	31.5290
177.480	-.003241	-18147.5233	-160.9274	.0001348	63.0122	27.7565
180.960	-.002788	-18539.4796	-70.5707	.0001251	64.3732	24.1726
184.440	-.002370	-18638.6955	7.6718	.0001153	64.7177	20.7943
187.920	-.001986	-18486.0841	74.5366	.0001054	64.1878	17.6338
191.400	-.001637	-18119.9205	130.7963	9.5713E-05	62.9164	14.6994
194.880	-.001320	-17575.7418	177.2454	8.6254E-05	61.0269	11.9955
198.360	-.001036	-16886.2922	214.6887	7.7122E-05	58.6330	9.5236
201.840	-.000783	-16081.5083	243.9301	6.8386E-05	55.8386	7.2818
205.320	-.000560	-15188.5385	265.7635	6.0100E-05	52.7380	5.2661
208.800	-.000365	-14231.7945	280.9641	5.2304E-05	49.4160	3.4699
212.280	-.000196	-13233.0283	290.2821	4.5026E-05	45.9480	1.8853
215.760	-5.17E-05	-12211.4309	294.4366	3.8284E-05	42.4008	.5023602
219.240	7.02E-05	-11183.7497	294.1108	3.2084E-05	38.8325	-.6896058
222.720	.000172	-10164.4199	289.9487	2.6427E-05	35.2931	-1.7024
226.200	.000254	-9165.7068	282.5523	2.1305E-05	31.8254	-2.5484
229.680	.000320	-8197.8557	272.4799	1.6704E-05	28.4648	-3.2404
233.160	.000370	-7269.2470	260.2446	1.2605E-05	25.2404	-3.7914
236.640	.000408	-6386.5532	246.3148	8.9868E-06	22.1755	-4.2143
240.120	.000433	-5554.8959	231.1138	5.8225E-06	19.2878	-4.5219
243.600	.000448	-4778.0010	215.0210	3.0844E-06	16.5903	-4.7268
247.080	.000454	-4058.3499	198.3729	7.4294E-07	14.0915	-4.8410
250.560	.000453	-3397.3256	181.4652	-1.2327E-06	11.7963	-4.8760
254.040	.000446	-2795.3519	164.5546	-2.8737E-06	9.7061	-4.8427
257.520	.000433	-2252.0255	147.8609	-4.2112E-06	7.8195	-4.7514
261.000	.000417	-1766.2399	131.5698	-5.2759E-06	6.1328	-4.6114
264.480	.000397	-1336.2998	115.8352	-6.0981E-06	4.6399	-4.4315
267.960	.000374	-960.0269	100.7822	-6.7066E-06	3.3334	-4.2196
271.440	.000350	-634.8556	86.5097	-7.1292E-06	2.2044	-3.9830
274.920	.000325	-357.9194	73.0931	-7.3923E-06	1.2428	-3.7278
278.400	.000298	-126.1279	60.5870	-7.5205E-06	.4379442	-3.4596
281.880	.000272	63.7664	49.0284	-7.5370E-06	.2214110	-3.1833
285.360	.000246	215.1097	38.4385	-7.4631E-06	.7469087	-2.9029
288.840	.000220	331.2980	28.8257	-7.3184E-06	1.1503	-2.6217
292.320	.000195	415.7363	20.1879	-7.1204E-06	1.4435	-2.3425
295.800	.000171	471.8057	12.5147	-6.8852E-06	1.6382	-2.0674
299.280	.000147	502.8385	5.7894	-6.6270E-06	1.7460	-1.7977
302.760	.000125	512.1001	-.0088506	-6.3580E-06	1.7781	-1.5346
306.240	.000103	502.7769	-4.9037	-6.0891E-06	1.7458	-1.2785
309.720	8.22E-05	477.9702	-8.9197	-5.8292E-06	1.6596	-1.0295
313.200	6.23E-05	440.6955	-12.0811	-5.5858E-06	1.5302	-.7873502
316.680	4.33E-05	393.8856	-14.4105	-5.3646E-06	1.3677	-.5513792
320.160	2.50E-05	340.3983	-15.9280	-5.1700E-06	1.1819	-.3207654
323.640	7.29E-06	283.0265	-16.6505	-5.0048E-06	.9827307	-.0944588
327.120	-9.86E-06	224.5106	-16.5909	-4.8703E-06	.7795508	.1287252
330.600	-2.66E-05	167.5537	-15.7579	-4.7665E-06	.5817838	.3500430
334.080	-4.30E-05	114.8360	-14.1557	-4.6916E-06	.3987360	.5707581
337.560	-5.93E-05	69.0303	-11.7843	-4.6429E-06	.2396887	.7920735
341.040	-7.54E-05	32.8170	-8.6399	-4.6159E-06	.1139480	1.0151
344.520	-9.14E-05	8.8965	-4.7151	-4.6049E-06	.0308907	1.2406
348.000	-.000107	0.0000	0.0000	-4.6025E-06	0.0000	1.4692

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection = .25000000 in
Computed slope at pile head = -.00481438
Maximum bending moment = 412057.85816 lbs-in

Maximum shear force = 20140.52979 lbs
Depth of maximum bending moment = 41.76000000 in
Depth of maximum shear force = 0.00000 in
Number of iterations = 5
Number of zero deflection points = 3

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	34959.4655	-.0092897	0.0000	-741.1091
3.480	.467672	117171.	32301.1693	-.0092586	406.8451	-786.6473
6.960	.435560	224816.	29518.2220	-.0091680	780.6116	-812.7477
10.440	.403863	322618.	26692.0145	-.0090229	1120.2021	-811.5095
13.920	.372761	410593.	23875.6053	-.0088286	1425.6686	-807.1165
17.400	.342415	488792.	21079.6076	-.0085903	1697.1959	-799.7788
20.880	.312972	557307.	18313.8425	-.0083131	1935.0925	-789.7414
24.360	.284556	616257.	15587.2252	-.0080021	2139.7804	-777.2800
27.840	.257277	665794.	12907.6671	-.0076624	2311.7837	-762.6959
31.320	.231226	706094.	10281.9950	-.0072989	2451.7157	-746.3111
34.800	.206477	737356.	7715.8877	-.0069164	2560.2653	-728.4632
38.280	.183088	759797.	5214.9879	-.0065197	2638.1830	-708.8355
41.760	.161100	773653.	2788.1791	-.0061133	2686.2942	-685.8822
45.240	.140539	779202.	470.5537	-.0057018	2705.5640	-646.0865
48.720	.121415	776928.	-1646.9089	-.0052895	2697.6659	-570.8460
52.200	.103724	767740.	-3507.5693	-.0048802	2665.7637	-498.4990
55.680	.087449	752515.	-5122.1327	-.0044773	2612.8996	-429.4110
59.160	.072562	732090.	-6502.4670	-.0040839	2541.9788	-363.8846
62.640	.059025	707258.	-7661.3874	-.0037025	2455.7567	-302.1616
66.120	.046793	678767.	-8612.4494	-.0033352	2356.8286	-244.4258
69.600	.035812	647315.	-9369.7520	-.0029839	2247.6225	-190.8056
73.080	.026025	613553.	-9947.7518	-.0026497	2130.3929	-141.3781
76.560	.017370	578079.	-10361.0897	-.0023340	2007.2185	-96.1724
80.040	.009781	541440.	-10624.4323	-.0020373	1879.9999	-55.1739
83.520	.003190	504133.	-10752.3258	-.0017603	1750.4613	-18.3281
87.000	-.002471	466604.	-10759.0657	-.0015030	1620.1521	14.4546
90.480	-.007271	429250.	-10658.5812	-.0012656	1490.4506	43.2952
93.960	-.011280	392420.	-10464.3334	-.0010479	1362.5697	68.3415
97.440	-.014565	356418.	-10189.2294	-.0008495	1237.5625	89.7643
100.920	-.017192	321503.	-9845.5494	-.0006698	1116.3300	107.7530
104.400	-.019227	287893.	-9444.8883	-.0005084	999.6284	122.5120
107.880	-.020730	255767.	-8998.1098	-.0003643	888.0785	134.2572
111.360	-.021762	225266.	-8515.3132	-.0002368	782.1741	143.2121
114.840	-.022379	196500.	-8005.8115	-.0001251	682.2918	149.6050
118.320	-.022633	169546.	-7478.1198	-2.8069E-05	588.7003	153.6661
121.800	-.022574	144452.	-6939.9542	5.5136E-05	501.5705	155.6245
125.280	-.022249	121244.	-6398.2390	.0001255	420.9848	155.7061
128.760	-.021700	99920.5737	-5859.1211	.0001841	346.9464	154.1317
132.240	-.020967	80464.1303	-5327.9928	.0002319	279.3893	151.1145
135.720	-.020086	62837.7441	-4809.5185	.0002699	218.1866	146.8592
139.200	-.019089	46989.8819	-4307.6681	.0002990	163.1593	141.5605
142.680	-.018005	32856.3738	-3825.7539	.0003202	114.0846	135.4018
146.160	-.016860	20362.6351	-3366.4697	.0003343	70.7036	128.5547
149.640	-.015678	9425.7448	-2931.9342	.0003422	32.7283	121.1783
153.120	-.014479	-43.6273	-2523.7349	.0003447	.1514835	113.4190
156.600	-.013279	-8139.4498	-2142.9726	.0003425	28.2620	105.4099
160.080	-.012095	-14958.7167	-1790.3079	.0003364	51.9400	97.2710
163.560	-.010938	-20599.9926	-1466.0055	.0003270	71.5278	89.1096
167.040	-.009819	-25162.1150	-1169.9795	.0003148	87.3685	81.0202
170.520	-.008747	-28743.0502	-901.8366	.0003005	99.8023	73.0849
174.000	-.007727	-31438.8977	-660.9177	.0002846	109.1628	65.3742
177.480	-.006766	-33343.0374	-446.3384	.0002674	115.7744	57.9472
180.960	-.005866	-34545.4131	-257.0268	.0002494	119.9494	50.8526
184.440	-.005030	-35131.9437	-91.7588	.0002310	121.9859	44.1290
187.920	-.004259	-35184.0543	50.8082	.0002123	122.1669	37.8060
191.400	-.003552	-34778.3186	172.1052	.0001938	120.7581	31.9049
194.880	-.002910	-33986.2022	273.6235	.0001756	118.0076	26.4390
198.360	-.002330	-32873.8993	356.8895	.0001579	114.1455	21.4151
201.840	-.001811	-31502.2515	423.4422	.0001408	109.3828	16.8337
205.320	-.001350	-29926.7415	474.8134	.0001245	103.9123	12.6900
208.800	-.000944	-28197.5506	512.5098	.0001091	97.9082	8.9746
212.280	-.000591	-26359.6732	537.9989	9.4667E-05	91.5266	5.6743
215.760	-.000285	-24453.0784	552.6957	8.1203E-05	84.9065	2.7722
219.240	-2.54E-05	-22512.9113	557.9528	6.8757E-05	78.1698	.2491583
222.720	.000193	-20569.7267	555.0521	5.7341E-05	71.4227	-1.9162
226.200	.000374	-18649.7484	545.1984	4.6949E-05	64.7561	-3.7469
229.680	.000520	-16775.1461	529.5146	3.7562E-05	58.2470	-5.2668
233.160	.000635	-14964.3265	509.0394	2.9151E-05	51.9595	-6.5006
236.640	.000723	-13232.2315	484.7253	2.1679E-05	45.9452	-7.4731
240.120	.000786	-11590.6383	457.4385	1.5102E-05	40.2453	-8.2090
243.600	.000828	-10048.4594	427.9600	9.3676E-06	34.8905	-8.7327
247.080	.000851	-8612.0365	396.9875	4.4229E-06	29.9029	-9.0676
250.560	.000859	-7285.4265	365.1380	2.1028E-07	25.2966	-9.2367
254.040	.000853	-6070.6760	332.9516	-3.3289E-06	21.0787	-9.2613
257.520	.000836	-4968.0834	300.8953	-6.2540E-06	17.2503	-9.1619
261.000	.000809	-3976.4449	269.3676	-8.6242E-06	13.8071	-8.9575
264.480	.000775	-3093.2850	238.7034	-1.0498E-05	10.7406	-8.6656
267.960	.000736	-2315.0690	209.1792	-1.1931E-05	8.0384	-8.3024
271.440	.000692	-1637.3979	181.0179	-1.2978E-05	5.6854	-7.8823
274.920	.000646	-1055.1846	154.3946	-1.3692E-05	3.6638	-7.4184
278.400	.000597	-562.8113	129.4419	-1.4120E-05	1.9542	-6.9222
281.880	.000547	-154.2691	106.2546	-1.4310E-05	.5356565	-6.4038
285.360	.000498	176.7209	84.8955	-1.4304E-05	.6136143	-5.8716
288.840	.000448	436.6038	65.3999	-1.4142E-05	1.5160	-5.3328
292.320	.000399	631.9040	47.7802	-1.3859E-05	2.1941	-4.7934
295.800	.000351	769.1543	32.0310	-1.3487E-05	2.6707	-4.2579
299.280	.000305	854.8399	18.1325	-1.3057E-05	2.9682	-3.7298
302.760	.000261	895.3566	6.0549	-1.2593E-05	3.1089	-3.2114
306.240	.000218	896.9818	-4.2384	-1.2118E-05	3.1145	-2.7043
309.720	.000176	865.8573	-12.7873	-1.1651E-05	3.0064	-2.2089
313.200	.000137	807.9825	-19.6322	-1.1208E-05	2.8055	-1.7250
316.680	9.83E-05	729.2171	-24.8119	-1.0800E-05	2.5320	-1.2518
320.160	6.13E-05	635.2914	-28.3612	-1.0439E-05	2.2059	-.7879687
323.640	2.56E-05	531.8230	-30.3092	-1.0130E-05	1.8466	-.3315543
327.120	-9.16E-06	424.3394	-30.6781	-9.8761E-06	1.4734	.1195194
330.600	-4.31E-05	318.3032	-29.4826	-9.6794E-06	1.1052	.5675534
334.080	-7.65E-05	219.1403	-26.7292	-9.5369E-06	.7609039	1.0149

337.560	-.000110	132.2682	-22.4162	-9.4438E-06	.4592647	1.4638
341.040	-.000142	63.1235	-16.5348	-9.3920E-06	.2191787	1.9163
344.520	-.000175	17.1861	-9.0695	-9.3708E-06	.0596740	2.3741
348.000	-.000207	0.0000	0.0000	-9.3662E-06	0.0000	2.8382

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

```
Pile-head deflection             =      .50000000 in
Computed slope at pile head      =     -.00928966
Maximum bending moment           =   779202.42650 lbs-in
Maximum shear force              =    34959.46551 lbs
Depth of maximum bending moment  =    45.24000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              6
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	52324.6561	-.0174629	0.0000	-741.1091
3.480	.939229	177602.	49666.3597	-.0174158	616.6744	-786.6474
6.960	.878786	345678.	46847.2372	-.0172771	1200.2704	-833.5379
10.440	.818980	503659.	43862.5829	-.0170521	1748.8160	-881.7807
13.920	.760104	650961.	40707.6909	-.0167461	2260.2828	-931.3756
17.400	.702428	786985.	37377.8555	-.0163651	2732.5852	-982.3229
20.880	.646203	911111.	33868.3708	-.0159151	3163.5810	-1034.6223
24.360	.591658	1022708.	30174.5310	-.0154027	3551.0708	-1088.2741
27.840	.539000	1121126.	26291.6301	-.0148346	3892.7988	-1143.2781
31.320	.488410	1205698.	22214.9621	-.0142180	4186.4519	-1199.6345
34.800	.440043	1275742.	17977.4561	-.0135605	4429.6604	-1235.7138
38.280	.394029	1330821.	13758.2233	-.0128698	4620.9071	-1189.1326
41.760	.350469	1371499.	9705.3339	-.0121537	4762.1508	-1140.1143
45.240	.309439	1398370.	5826.1383	-.0114197	4855.4526	-1089.3085
48.720	.270988	1412049.	2125.7248	-.0106750	4902.9491	-1037.3659
52.200	.235141	1413165.	-1393.0681	-.0099264	4906.8243	-984.9289
55.680	.201901	1402354.	-4729.6064	-.0091803	4869.2833	-932.6219
59.160	.171247	1380247.	-7846.6233	-.0084429	4792.5255	-858.7671
62.640	.143138	1347741.	-10615.8658	-.0077201	4679.6566	-732.7516
66.120	.117515	1306361.	-12958.9544	-.0070168	4535.9754	-613.8510
69.600	.094301	1257547.	-14901.2960	-.0063374	4366.4818	-502.4372
73.080	.073407	1202648.	-16469.4066	-.0056854	4175.8608	-398.7758
76.560	.054731	1142920.	-17690.5528	-.0050639	3968.4712	-303.0324
80.040	.038162	1079522.	-18592.4170	-.0044750	3748.3391	-215.2804
83.520	.023585	1013516.	-19202.7891	-.0039204	3519.1544	-135.5082
87.000	.010876	945870.	-19549.2845	-.0034012	3284.2717	-63.6271
90.480	-8.73E-05	877453.	-19659.0908	-.0029180	3046.7134	.5201112
93.960	-.009433	809043.	-19558.7418	-.0024711	2809.1770	57.1517
97.440	-.017286	741325.	-19273.9208	-.0020603	2574.0438	106.5385
100.920	-.023772	674896.	-18829.2911	-.0016850	2343.3906	148.9958
104.400	-.029014	610273.	-18248.3539	-.0013444	2119.0026	184.8761
107.880	-.033130	547888.	-17553.3323	-.0010376	1902.3887	214.5615
111.360	-.036235	488102.	-16765.0807	-.0007630	1694.7971	238.4567
114.840	-.038440	431203.	-15903.0171	-.0005194	1497.2326	256.9821
118.320	-.039850	377417.	-14985.0789	-.0003052	1310.4742	270.5685
121.800	-.040564	326907.	-14027.6975	-.0001185	1135.0932	279.6506
125.280	-.040675	279784.	-13045.7929	4.2242E-05	971.4715	284.6624
128.760	-.040270	236108.	-12052.7843	.0001789	819.8198	286.0322
132.240	-.039430	195896.	-11060.6166	.0002934	680.1958	284.1791
135.720	-.038228	159126.	-10079.7996	.0003875	552.5216	279.5088
139.200	-.036733	125741.	-9119.4586	.0004630	436.6007	272.4113
142.680	-.035006	95654.7857	-8187.3950	.0005216	332.1347	263.2575
146.160	-.033102	68756.7277	-7290.1546	.0005652	238.7386	252.3979
149.640	-.031072	44915.3094	-6433.1026	.0005953	155.9559	240.1608
153.120	-.028959	23982.3339	-5620.5025	.0006136	83.2720	226.8508
156.600	-.026801	5796.6121	-4855.5998	.0006215	20.1271	212.7484
160.080	-.024633	-9812.6410	-4140.7067	.0006204	34.0717	198.1097
163.560	-.022483	-23022.7068	-3477.2878	.0006117	79.9400	183.1656
167.040	-.020376	-34014.5638	-2866.0456	.0005966	118.1061	168.1230
170.520	-.018331	-42970.3840	-2307.0053	.0005762	149.2027	153.1645
174.000	-.016365	-50071.3209	-1799.5970	.0005516	173.8588	138.4495
177.480	-.014492	-55495.5790	-1342.7348	.0005236	192.6930	124.1150
180.960	-.012721	-59416.7551	-934.8935	.0004931	206.3082	110.2766
184.440	-.011060	-62002.4379	-574.1804	.0004610	215.2862	97.0298
187.920	-.009513	-63413.0509	-258.4033	.0004277	220.1842	84.4513
191.400	-.008083	-63800.9247	14.8665	.0003940	221.5310	72.6003
194.880	-.006771	-63309.5798	248.2356	.0003603	219.8249	61.5199
198.360	-.005575	-62073.2046	444.4354	.0003271	215.5320	51.2386
201.840	-.004494	-60216.3097	606.2734	.0002947	209.0844	41.7718
205.320	-.003524	-57853.5419	736.5905	.0002634	200.8804	33.1231
208.800	-.002661	-55089.6399	838.2224	.0002335	191.2835	25.2860
212.280	-.001899	-52019.5141	913.9661	.0002051	180.6233	18.2449
215.760	-.001233	-48728.4358	966.5513	.0001784	169.1960	11.9765
219.240	-.000657	-45292.3171	998.6159	.0001535	157.2650	6.4514
222.720	-.000165	-41778.0693	1012.6860	.0001304	145.0627	1.6348
226.200	.000251	-38244.0229	1011.1596	.0001092	132.7917	-2.5120
229.680	.000595	-34740.3981	996.2946	8.9873E-05	120.6264	-6.0311
233.160	.000876	-31309.8122	970.1991	7.2371E-05	108.7146	-8.9664
236.640	.001099	-27987.8125	934.8256	5.6658E-05	97.1799	-11.3632
240.120	.001270	-24803.4262	891.9679	4.2669E-05	86.1230	-13.2676
243.600	.001396	-21779.7157	843.2605	3.0325E-05	75.6240	-14.7252
247.080	.001481	-18934.3332	790.1794	1.9536E-05	65.7442	-15.7811
250.560	.001532	-16280.0667	734.0463	1.0205E-05	56.5280	-16.4793
254.040	.001552	-13825.3713	676.0325	2.2274E-06	48.0048	-16.8619
257.520	.001547	-11574.8803	617.1664	-4.5033E-06	40.1906	-16.9692
261.000	.001521	-9529.8928	558.3400	-1.0096E-05	33.0899	-16.8391
264.480	.001477	-7688.8336	500.3176	-1.4658E-05	26.6973	-16.5071
267.960	.001419	-6047.6822	443.7448	-1.8298E-05	20.9989	-16.0060
271.440	.001350	-4600.3700	389.1578	-2.1120E-05	15.9735	-15.3658
274.920	.001272	-3339.1441	336.9934	-2.3224E-05	11.5943	-14.6137
278.400	.001188	-2254.8961	287.5988	-2.4706E-05	7.8295	-13.7740
281.880	.001100	-1337.4563	241.2417	-2.5658E-05	4.6439	-12.8681

285.360	.001010	-575.8540	198.1197	-2.6165E-05	1.9995	-11.9147
288.840	.000918	41.4569	158.3704	-2.6307E-05	.1439475	-10.9297
292.320	.000827	526.4043	122.0804	-2.6156E-05	1.8278	-9.9266
295.800	.000736	891.1366	89.2941	-2.5781E-05	3.0942	-8.9161
299.280	.000647	1147.8915	60.0223	-2.5240E-05	3.9857	-7.9068
302.760	.000560	1308.8919	34.2498	-2.4589E-05	4.5448	-6.9050
306.240	.000476	1386.2700	11.9428	-2.3875E-05	4.8134	-5.9151
309.720	.000394	1392.0139	-6.9444	-2.3139E-05	4.8334	-4.9396
313.200	.000315	1337.9371	-22.4636	-2.2416E-05	4.6456	-3.9795
316.680	.000238	1235.6672	-34.6675	-2.1734E-05	4.2905	-3.0343
320.160	.000164	1096.6511	-43.6051	-2.1116E-05	3.8078	-2.1023
323.640	9.12E-05	932.1757	-49.3178	-2.0578E-05	3.2367	-1.1809
327.120	2.04E-05	753.3989	-51.8370	-2.0131E-05	2.6160	-.2668753
330.600	-4.89E-05	571.3901	-51.1814	-1.9780E-05	1.9840	.6436571
334.080	-.000117	397.1763	-47.3563	-1.9524E-05	1.3791	1.5547
337.560	-.000185	241.7905	-40.3529	-1.9354E-05	.8395504	2.4702
341.040	-.000252	116.3199	-30.1495	-1.9259E-05	.4038885	3.3938
344.520	-.000319	31.9498	-16.7126	-1.9220E-05	.1109367	4.3285
348.000	-.000386	0.0000	0.0000	-1.9212E-05	0.0000	5.2764

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.01746285
Maximum bending moment           =       1413165. lbs-in
Maximum shear force              =    52324.65607 lbs
Depth of maximum bending moment  =    52.20000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              7
Number of zero deflection points =              3
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	-1248909.	42669.8696	0.0000	4336.4893	-485.0896
3.480	.248848	-1103526.	40883.3444	-.0006234	3831.6878	-513.3315
6.960	.245661	-964360.	39051.8247	-.0011713	3348.4720	-539.3417
10.440	.240696	-831725.	37133.7602	-.0016473	2887.9354	-562.9942
13.920	.234197	-705909.	35137.6365	-.0020547	2451.0728	-584.2033
17.400	.226395	-587167.	33072.0372	-.0023974	2038.7758	-602.9228
20.880	.217511	-475728.	30945.6379	-.0026790	1651.8319	-619.1458
24.360	.207749	-371786.	28767.0733	-.0029036	1290.9229	-632.9028
27.840	.197302	-275509.	26544.8344	-.0030751	956.6276	-644.2460
31.320	.186347	-187034.	24287.7550	-.0031977	649.4228	-652.9261
34.800	.175046	-106466.	22005.3609	-.0032754	369.6735	-658.7946
38.280	.163549	-33876.4458	19707.4724	-.0033126	117.6265	-661.8309
41.760	.151990	30698.0397	17403.9504	-.0033135	106.5904	-662.0323
45.240	.140488	87255.0492	15128.2358	-.0032822	302.9689	-645.8496
48.720	.129146	135991.	12947.9424	-.0032231	472.1894	-607.1925
52.200	.118055	177373.	10904.1990	-.0031400	615.8775	-567.3727
55.680	.107291	211884.	9000.2631	-.0030369	735.7076	-526.8434
59.160	.096918	240015.	7237.8700	-.0029171	833.3839	-486.0263
62.640	.086988	262259.	5617.3461	-.0027840	910.6228	-445.3093
66.120	.077541	279111.	4137.7286	-.0026406	969.1364	-405.0455
69.600	.068610	291058.	2796.8890	-.0024895	1010.6179	-365.5519
73.080	.060215	298578.	1591.6582	-.0023333	1036.7279	-327.1095
76.560	.052370	302136.	517.9520	-.0021741	1049.0830	-289.9631
80.040	.045083	302183.	-429.1043	-.0020139	1049.2451	-254.3222
83.520	.038353	299149.	-1255.0544	-.0018546	1038.7129	-220.3618
87.000	.032175	293447.	-1965.9935	-.0016976	1018.9146	-188.2239
90.480	.026538	285466.	-2568.4551	-.0015442	991.2014	-158.0184
93.960	.021428	275571.	-3069.3042	-.0013955	956.8436	-129.8259
97.440	.016825	264104.	-3475.6370	-.0012525	917.0266	-103.6987
100.920	.012710	251381.	-3794.6869	-.0011159	872.8490	-79.6633
104.400	.009059	237693.	-4033.7391	-.0009863	825.3216	-57.7230
107.880	.005846	223306.	-4200.0522	-.0008641	775.3670	-37.8593
111.360	.003044	208460.	-4300.7881	-.0007497	723.8204	-20.0349
114.840	.000628	193372.	-4342.9497	-.0006432	671.4313	-4.1959
118.320	-.001433	178233.	-4333.3266	-.0005448	618.8658	9.7264
121.800	-.003164	163212.	-4278.4487	-.0004543	566.7092	21.8126
125.280	-.004594	148455.	-4184.5471	-.0003717	515.4699	32.1538
128.760	-.005751	134088.	-4057.5222	-.0002968	465.5827	40.8490
132.240	-.006660	120215.	-3902.9193	-.0002295	417.4131	48.0033
135.720	-.007348	106923.	-3725.9095	-.0001693	371.2621	53.7264
139.200	-.007839	94282.6544	-3531.2781	-.0001159	327.3703	58.1307
142.680	-.008155	82345.7997	-3323.4170	-6.9145E-05	285.9229	61.3297
146.160	-.008320	71151.6724	-3106.3231	-2.8471E-05	247.0544	63.4368
149.640	-.008353	60725.7906	-2883.6015	6.4751E-06	210.8534	64.5641
153.120	-.008275	51081.8057	-2658.4715	3.6102E-05	177.3674	64.8210
156.600	-.008102	42222.8288	-2433.7773	6.0827E-05	146.6070	64.3136
160.080	-.007851	34142.7157	-2212.0011	8.1063E-05	118.5511	63.1440
163.560	-.007538	26827.3013	-1995.2790	9.7219E-05	93.1504	61.4089
167.040	-.007175	20255.5737	-1785.4191	.0001097	70.3319	59.2002
170.520	-.006774	14400.7844	-1583.9206	.0001189	50.0027	56.6035
174.000	-.006347	9231.4865	-1391.9950	.0001251	32.0538	53.6985
177.480	-.005903	4712.4994	-1210.5876	.0001288	16.3628	50.5586
180.960	-.005451	805.7971	-1040.3996	.0001303	2.7979	47.2506
184.440	-.004996	-2528.6816	-881.9106	.0001298	8.7801	43.8350
187.920	-.004547	-5332.3005	-735.4007	.0001278	18.5149	40.3660
191.400	-.004107	-7647.0705	-600.9726	.0001243	26.5523	36.8915
194.880	-.003682	-9515.0695	-478.5725	.0001198	33.0384	33.4533
198.360	-.003274	-10977.9350	-368.0112	.0001143	38.1178	30.0876
201.840	-.002886	-12076.4278	-268.9836	.0001082	41.9320	26.8248
205.320	-.002520	-12850.0609	-181.0869	.0001016	44.6183	23.6905
208.800	-.002179	-13336.7927	-103.8387	9.4688E-05	46.3083	20.7050
212.280	-.001861	-13572.7784	-36.6928	8.7557E-05	47.1277	17.8846
215.760	-.001569	-13592.1749	20.9456	8.0359E-05	47.1951	15.2410
219.240	-.001302	-13426.9970	69.7064	7.3199E-05	46.6215	12.7825
222.720	-.001060	-13107.0182	110.2422	6.6168E-05	45.5105	10.5139
226.200	-.000842	-12659.7115	143.2170	5.9340E-05	43.9573	8.4371
229.680	-.000647	-12110.2282	169.2967	5.2776E-05	42.0494	6.5513

233.160	-.000474	-11481.4063	189.1407	4.6525E-05	39.8660	4.8533
236.640	-.000323	-10793.8086	203.3942	4.0622E-05	37.4785	3.3383
240.120	-.000191	-10065.7824	212.6823	3.5095E-05	34.9506	1.9996
243.600	-7.86E-05	-9313.5399	217.6046	2.9960E-05	32.3387	.8292988
247.080	1.70E-05	-8551.2543	218.7316	2.5226E-05	29.6919	-.1816150
250.560	9.69E-05	-7791.1680	216.6010	2.0895E-05	27.0527	-1.0429
254.040	.000162	-7043.7113	211.7158	1.6964E-05	24.4573	-1.7647
257.520	.000215	-6317.6259	204.5426	1.3424E-05	21.9362	-2.3578
261.000	.000256	-5620.0946	195.5108	1.0260E-05	19.5142	-2.8329
264.480	.000286	-4956.8707	185.0124	7.4575E-06	17.2114	-3.2007
267.960	.000308	-4332.4083	173.4024	4.9959E-06	15.0431	-3.4717
271.440	.000321	-3749.9900	160.9996	2.8542E-06	13.0208	-3.6563
274.920	.000328	-3211.8510	148.0879	1.0094E-06	11.1523	-3.7642
278.400	.000328	-2719.2980	134.9178	-5.6224E-07	9.4420	-3.8048
281.880	.000324	-2272.8228	121.7083	-1.8851E-06	7.8917	-3.7869
285.360	.000315	-1872.2080	108.6490	-2.9835E-06	6.5007	-3.7185
288.840	.000303	-1516.6258	95.9022	-3.8814E-06	5.2661	-3.6073
292.320	.000288	-1204.7289	83.6054	-4.6026E-06	4.1831	-3.4599
295.800	.000271	-934.7324	71.8737	-5.1695E-06	3.2456	-3.2825
299.280	.000252	-704.4878	60.8023	-5.6039E-06	2.4461	-3.0804
302.760	.000232	-511.5482	50.4688	-5.9261E-06	1.7762	-2.8584
306.240	.000211	-353.2251	40.9355	-6.1552E-06	1.2265	-2.6205
309.720	.000189	-226.6371	32.2521	-6.3089E-06	.7869342	-2.3700
313.200	.000167	-128.7505	24.4575	-6.4031E-06	.4470505	-2.1097
316.680	.000145	-56.4129	17.5821	-6.4521E-06	.1958781	-1.8417
320.160	.000122	-6.3789	11.6498	-6.4688E-06	.0221490	-1.5677
323.640	9.95E-05	24.6695	6.6793	-6.4639E-06	.0856580	-1.2889
327.120	7.71E-05	40.1092	2.6864	-6.4468E-06	.1392681	-1.0059
330.600	5.47E-05	43.3668	-.3154293	-6.4246E-06	.1505791	-.7192592
334.080	3.23E-05	37.9138	-2.3134	-6.4031E-06	.1316452	-.4289789
337.560	1.01E-05	27.2658	-3.2946	-6.3858E-06	.0946728	-.1349733
341.040	-1.21E-05	14.9831	-3.2459	-6.3746E-06	.0520247	.1630002
344.520	-3.43E-05	4.6745	-2.1527	-6.3694E-06	.0162308	.4652334
348.000	-5.64E-05	0.0000	0.0000	-6.3682E-06	0.0000	.7719778

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

Pile-head deflection	=	.25000000	in
Computed slope at pile head	=	-.00003852	
Maximum bending moment	=	-1248909.	lbs-in
Maximum shear force	=	42669.86964	lbs
Depth of maximum bending moment	=	0.00000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	5	
Number of zero deflection points	=	3	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)

Specified deflection at pile head = .500000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-2321994.	74535.1521	0.0000	8062.4775	-741.1091
3.480	.497859	-2067374.	71797.5450	-.0011631	7178.3837	-786.6472
6.960	.491905	-1822282.	68978.4985	-.0021938	6327.3684	-833.5375
10.440	.482590	-1587284.	65993.8463	-.0030973	5511.4033	-881.7799
13.920	.470347	-1362965.	62838.9576	-.0038791	4732.5171	-931.3745
17.400	.455591	-1149925.	59509.1267	-.0045450	3992.7951	-982.3214
20.880	.438715	-948781.	56034.7408	-.0051011	3294.3798	-1014.4521
24.360	.420088	-759923.	52473.8376	-.0055539	2638.6222	-1032.0440
27.840	.400060	-583563.	48860.3817	-.0059099	2026.2621	-1044.6548
31.320	.378955	-419855.	45211.4740	-.0061758	1457.8297	-1052.4186
34.800	.357076	-268892.	41543.6450	-.0063583	933.6515	-1055.5291
38.280	.334702	-130711.	37872.6567	-.0064642	453.8583	-1054.2343
41.760	.312086	-5297.9351	34213.3213	-.0065002	18.3956	-1048.8320
45.240	.289460	107414.	30579.3405	-.0064731	372.9637	-1039.6627
48.720	.267033	207534.	26983.1660	-.0063897	720.6051	-1027.1042
52.200	.244988	295216.	23435.8842	-.0062565	1025.0568	-1011.5635
55.680	.223488	370648.	19947.1260	-.0060800	1286.9723	-993.4699
59.160	.202671	434048.	16525.0040	-.0058668	1507.1124	-973.2668
62.640	.182655	485662.	13204.5375	-.0056231	1686.3266	-935.0473
66.120	.163535	525952.	10091.1796	-.0053550	1826.2220	-854.2389
69.600	.145384	555897.	7256.9889	-.0050683	1930.1968	-774.6064
73.080	.128259	576461.	4696.8226	-.0047683	2001.5993	-696.7536
76.560	.112197	588587.	2403.5633	-.0044596	2043.7033	-621.2115
80.040	.097220	593189.	368.3705	-.0041464	2059.6854	-548.4395
83.520	.083338	591150.	-1419.0715	-.0038326	2052.6056	-478.8261
87.000	.070546	583313.	-2970.3131	-.0035214	2025.3912	-412.6920
90.480	.058829	570477.	-4297.9066	-.0032156	1980.8230	-350.2928
93.960	.048165	553399.	-5415.1858	-.0029178	1921.5251	-291.8217
97.440	.038521	532787.	-6336.0565	-.0026300	1849.9560	-237.4143
100.920	.029860	509300.	-7074.8020	-.0023538	1768.4037	-187.1520
104.400	.022138	483547.	-7645.9023	-.0020908	1678.9817	-141.0665
107.880	.015309	456085.	-8063.8693	-.0018418	1583.6277	-99.1444
111.360	.009320	427422.	-8343.0976	-.0016077	1484.1048	-61.3317
114.840	.004119	398017.	-8497.7315	-.0013889	1382.0029	-27.5384
118.320	-.000347	368278.	-8541.5474	-.0011859	1278.7430	2.3568
121.800	-.004134	338568.	-8487.8531	-.0009986	1175.5822	28.5020
125.280	-.007297	309203.	-8349.4010	-.0008269	1073.6199	51.0681
128.760	-.009890	280456.	-8138.3177	-.0006707	973.8050	70.2441
132.240	-.011965	252560.	-7866.0465	-.0005294	876.9438	86.2336
135.720	-.013574	225708.	-7543.3040	-.0004027	783.7088	99.2506
139.200	-.014768	200058.	-7180.0490	-.0002899	694.6473	109.5167
142.680	-.015592	175735.	-6785.4627	-.0001903	610.1910	117.2571
146.160	-.016092	152832.	-6367.9404	-.0001032	530.6653	122.6983
149.640	-.016310	131414.	-5935.0916	-2.7899E-05	456.2991	126.0654
153.120	-.016286	111523.	-5493.7497	3.6476E-05	387.2339	127.5794
156.600	-.016056	93177.6435	-5049.9887	9.0719E-05	323.5335	127.4557
160.080	-.015655	76375.4526	-4609.1464	.0001356	265.1925	125.9019
163.560	-.015112	61097.9846	-4175.8538	.0001721	212.1458	123.1168
167.040	-.014457	47311.5101	-3754.0685	.0002008	164.2761	119.2886
170.520	-.013715	34969.6680	-3347.1119	.0002226	121.4225	114.5945
174.000	-.012908	24015.6113	-2957.7098	.0002382	83.3875	109.1998
177.480	-.012057	14384.0076	-2588.0346	.0002484	49.9445	103.2572

180.960	-.011179	6002.8905	-2239.7488	.0002538	20.8434	96.9070
184.440	-.010290	-1204.6440	-1914.0497	.0002551	4.1828	90.2764
187.920	-.009403	-7318.8956	-1611.7139	.0002528	25.4128	83.4799
191.400	-.008530	-12422.1727	-1333.1410	.0002476	43.1325	76.6195
194.880	-.007680	-16597.5573	-1078.3973	.0002399	57.6304	69.7850
198.360	-.006861	-19927.8179	-847.2570	.0002302	69.1938	63.0543
201.840	-.006078	-22494.4660	-639.2428	.0002190	78.1058	56.4941
205.320	-.005336	-24376.9482	-453.6640	.0002066	84.6422	50.1604
208.800	-.004640	-25651.9677	-289.6523	.0001933	89.0693	44.0992
212.280	-.003991	-26392.9283	-146.1956	.0001795	91.6421	38.3472
215.760	-.003391	-26669.4891	-22.1691	.0001655	92.6024	32.9324
219.240	-.002839	-26547.2251	83.6361	.0001514	92.1779	27.8752
222.720	-.002337	-26087.3815	172.4871	.0001374	90.5812	23.1886
226.200	-.001883	-25346.7147	245.6857	.0001238	88.0094	18.8796
229.680	-.001476	-24377.4090	304.5478	.0001106	84.6438	14.9492
233.160	-.001113	-23227.0620	350.3851	9.7989E-05	80.6495	11.3940
236.640	-.000794	-21938.7290	384.4891	8.6020E-05	76.1761	8.2060
240.120	-.000515	-20551.0177	408.1181	7.4761E-05	71.3577	5.3739
243.600	-.000273	-19098.2267	422.4855	6.4255E-05	66.3133	2.8832
247.080	-6.73E-05	-17610.5186	428.7506	5.4527E-05	61.1476	.7174277
250.560	.000106	-16114.1222	428.0119	4.5591E-05	55.9518	-1.1420
254.040	.000250	-14631.5560	421.3008	3.7444E-05	50.8040	-2.7149
257.520	.000367	-13181.8684	409.5788	3.0073E-05	45.7704	-4.0219
261.000	.000459	-11780.8876	393.7342	2.3459E-05	40.9059	-5.0842
264.480	.000530	-10441.4781	374.5818	1.7570E-05	36.2551	-5.9230
267.960	.000582	-9173.7981	352.8626	1.2372E-05	31.8535	-6.5593
271.440	.000616	-7985.5542	329.2453	7.8254E-06	27.7276	-7.0139
274.920	.000636	-6882.2509	304.3280	3.8856E-06	23.8967	-7.3064
278.400	.000643	-5867.4314	278.6413	5.0716E-07	20.3730	-7.4560
281.880	.000640	-4942.9072	252.6518	-2.3574E-06	17.1629	-7.4805
285.360	.000627	-4108.9751	226.7654	-4.7560E-06	14.2673	-7.3967
288.840	.000606	-3364.6198	201.3325	-6.7364E-06	11.6827	-7.2200
292.320	.000580	-2707.7012	176.6515	-8.3455E-06	9.4017	-6.9645
295.800	.000548	-2135.1254	152.9745	-9.6288E-06	7.4136	-6.6430
299.280	.000513	-1642.9985	130.5117	-1.0630E-05	5.7049	-6.2667
302.760	.000474	-1226.7642	109.4359	-1.1390E-05	4.2596	-5.8458
306.240	.000434	-881.3246	89.8880	-1.1949E-05	3.0602	-5.3886
309.720	.000391	-601.1435	71.9812	-1.2342E-05	2.0873	-4.9026
313.200	.000348	-380.3353	55.8055	-1.2602E-05	1.3206	-4.3938
316.680	.000304	-212.7372	41.4320	-1.2759E-05	.7386708	-3.8669
320.160	.000259	-91.9684	28.9170	-1.2840E-05	.3193347	-3.3257
323.640	.000214	-11.4752	18.3051	-1.2867E-05	.0398444	-2.7730
327.120	.000169	35.4354	9.6334	-1.2861E-05	.1230397	-2.2107
330.600	.000125	55.5731	2.9332	-1.2837E-05	.1929623	-1.6400
334.080	8.00E-05	55.8503	-1.7668	-1.2807E-05	.1939248	-1.0612
337.560	3.55E-05	43.2761	-4.4389	-1.2781E-05	.1502642	-.4744855
341.040	-8.94E-06	24.9556	-5.0549	-1.2763E-05	.0866515	.1204391
344.520	-5.33E-05	8.0937	-3.5856	-1.2754E-05	.0281033	.7240174
348.000	-9.77E-05	0.0000	0.0000	-1.2752E-05	0.0000	1.3367

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection = .50000000 in
Computed slope at pile head = -.00006747
Maximum bending moment = -2321994. lbs-in
Maximum shear force = 74535.15207 lbs
Depth of maximum bending moment = 0.00000 in
Depth of maximum shear force = 0.00000 in
Number of iterations = 6
Number of zero deflection points = 3

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = 1.000000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-3954235.	108435.	0.0000	13729.9839	-741.1091
3.480	.996354	-3581644.	105698.	-.0019969	12436.2625	-786.6472
6.960	.986102	-3218578.	102879.	-.0037989	11175.6196	-833.5376
10.440	.969914	-2865608.	99894.0595	-.0054111	9950.0269	-881.7803
13.920	.948440	-2523316.	96739.1691	-.0068391	8761.5131	-931.3752
17.400	.922314	-2192303.	93409.3352	-.0080886	7612.1637	-982.3224
20.880	.892144	-1873187.	89899.8520	-.0091659	6504.1209	-1034.6220
24.360	.858519	-1566600.	86206.0134	-.0100774	5439.5839	-1088.2738
27.840	.822005	-1273193.	82323.1133	-.0108299	4420.8089	-1143.2780
31.320	.783143	-993631.	78246.4455	-.0114306	3450.1087	-1199.6345
34.800	.742448	-728598.	73971.3038	-.0118870	2529.8531	-1257.3434
38.280	.700409	-478791.	69492.9820	-.0122069	1662.4688	-1316.4047
41.760	.657488	-244927.	64806.7737	-.0123987	850.4394	-1376.8184
45.240	.614114	-27735.8797	59907.9726	-.0124709	96.3051	-1438.5845
48.720	.570690	172033.	54791.8722	-.0124327	597.3366	-1501.7031
52.200	.527583	353616.	49453.7661	-.0122934	1227.8318	-1566.1740
55.680	.485128	516231.	43888.9476	-.0120629	1792.4693	-1631.9975
59.160	.443625	659083.	38125.2973	-.0117515	2288.4813	-1680.4452
62.640	.403338	781583.	32373.4594	-.0113697	2713.8307	-1625.2087
66.120	.364492	884402.	26820.4785	-.0109283	3070.8399	-1566.1596
69.600	.327277	968254.	21478.0998	-.0104373	3361.9922	-1504.1730
73.080	.291848	1033889.	16355.0312	-.0099068	3589.8940	-1440.1193
76.560	.258326	1082085.	11456.9816	-.0093461	3757.2388	-1374.8517
80.040	.226799	1113630.	6838.5490	-.0087643	3866.7711	-1279.4198
83.520	.197327	1129681.	2639.6169	-.0081698	3922.5037	-1133.7595
87.000	.169937	1132002.	-1062.9172	-.0075705	3930.5618	-994.1336
90.480	.144636	1122283.	-4291.2327	-.0069731	3896.8166	-861.2201
93.960	.121404	1102135.	-7069.6377	-.0063837	3826.8570	-735.5644
97.440	.100205	1073078.	-9424.1185	-.0058073	3725.9670	-617.5855
100.920	.080985	1036543.	-11381.9143	-.0052483	3599.1075	-507.5845
104.400	.063677	993860.	-12971.1190	-.0047103	3450.9041	-405.7516
107.880	.048202	946264.	-14220.3126	-.0041962	3285.6388	-312.1758
111.360	.034472	894887.	-15158.2237	-.0037083	3107.2465	-226.8536
114.840	.022392	840763.	-15813.4236	-.0032484	2919.3150	-149.6981
118.320	.011863	784826.	-16214.0524	-.0028176	2725.0888	-80.5484
121.800	.002782	727913.	-16387.5780	-.0024167	2527.4754	-19.1790
125.280	-.004957	670768.	-16360.5864	-.0020461	2329.0556	34.6914

128.760	-.011459	614043.	-16158.6036	-.0017057	2132.0946	81.3908
132.240	-.016828	558304.	-15805.9464	-.0013950	1938.5561	121.2858
135.720	-.021168	504034.	-15325.6037	-.0011135	1750.1176	154.7733
139.200	-.024578	451638.	-14739.1429	-.0008603	1568.1873	182.2731
142.680	-.027156	401449.	-14066.6433	-.0006342	1393.9216	204.2209
146.160	-.028992	353734.	-13326.6521	-.0004341	1228.2434	221.0614
149.640	-.030177	308696.	-12536.1625	-.0002586	1071.8609	233.2430
153.120	-.030792	266482.	-11710.6108	-.0001061	925.2862	241.2120
156.600	-.030916	227190.	-10863.8918	2.4673E-05	788.8544	245.4081
160.080	-.030620	190870.	-10008.3887	.0001355	662.7421	246.2603
163.560	-.029973	157532.	-9155.0175	.0002278	546.9850	244.1829
167.040	-.029035	127151.	-8313.2821	.0003032	441.4959	239.5731
170.520	-.027863	99671.2473	-7491.3389	.0003633	346.0807	232.8080
174.000	-.026506	75011.0869	-6696.0702	.0004096	260.4552	224.2430
177.480	-.025012	53066.5989	-5933.1620	.0004435	184.2590	214.2100
180.960	-.023419	33716.2792	-5207.1881	.0004665	117.0704	203.0164
184.440	-.021765	16824.5698	-4521.6954	.0004799	58.4186	190.9449
187.920	-.020079	2245.2791	-3879.2923	.0004850	7.7961	178.2523
191.400	-.018389	-10175.3046	-3281.7363	.0004829	35.3309	165.1706
194.880	-.016718	-20595.6058	-2730.0219	.0004747	71.5125	151.9066
198.360	-.015085	-29176.2569	-2224.4659	.0004615	101.3064	138.6428
201.840	-.013506	-36077.8881	-1764.7909	.0004442	125.2704	125.5382
205.320	-.011993	-41459.2018	-1350.2056	.0004237	143.9556	112.7292
208.800	-.010557	-45475.3192	-979.4806	.0004007	157.9004	100.3311
212.280	-.009204	-48276.3864	-651.0205	.0003758	167.6263	88.4390
215.760	-.007941	-50006.4218	-362.9316	.0003498	173.6334	77.1293
219.240	-.006770	-50802.3904	-113.0841	.0003231	176.3972	66.4612
222.720	-.005692	-50793.4873	100.8304	.0002961	176.3663	56.4782
226.200	-.004709	-50100.6107	281.2468	.0002694	173.9605	47.2094
229.680	-.003817	-48836.0093	430.6793	.0002432	169.5695	38.6713
233.160	-.003016	-47103.0830	551.6792	.0002178	163.5524	30.8689
236.640	-.002302	-44996.3222	646.7984	.0001934	156.2372	23.7974
240.120	-.001670	-42601.3658	718.5573	.0001702	147.9214	17.4433
243.600	-.001117	-39995.1636	769.4168	.0001483	138.8721	11.7862
247.080	-.000638	-37246.2252	801.7559	.0001278	129.3272	6.7995
250.560	-.000228	-34414.9427	817.8526	.0001088	119.4963	2.4516
254.040	.000119	-31553.9708	819.8691	9.1329E-05	109.5624	-1.2927
257.520	.000408	-28708.6536	809.8401	7.5361E-05	99.6828	-4.4712
261.000	.000644	-25917.4839	789.6648	6.0886E-05	89.9913	-7.1238
264.480	.000832	-23212.5869	761.1019	4.7867E-05	80.5993	-9.2916
267.960	.000977	-20620.2149	725.7670	3.6252E-05	71.5980	-11.0158
271.440	.001084	-18161.2483	685.1326	2.5975E-05	63.0599	-12.3373
274.920	.001157	-15851.6920	640.5297	1.6962E-05	55.0406	-13.2965
278.400	.001202	-13703.1618	593.1517	9.1307E-06	47.5804	-13.9322
281.880	.001221	-11723.3558	544.0600	2.3930E-06	40.7061	-14.2815
285.360	.001219	-9916.5045	494.1895	-3.3412E-06	34.4323	-14.3797
288.840	.001198	-8283.7968	444.3572	-8.1640E-06	28.7632	-14.2596
292.320	.001162	-6823.7786	395.2695	-1.2167E-05	23.6937	-13.9517
295.800	.001113	-5532.7210	347.5317	-1.5442E-05	19.2108	-13.4838
299.280	.001054	-4404.9579	301.6567	-1.8075E-05	15.2950	-12.8811
302.760	.000987	-3433.1903	258.0747	-2.0152E-05	11.9208	-12.1660
306.240	.000914	-2608.7578	217.1426	-2.1753E-05	9.0582	-11.3582
309.720	.000836	-1921.8781	179.1530	-2.2954E-05	6.6732	-10.4749
313.200	.000754	-1361.8531	144.3439	-2.3824E-05	4.7287	-9.5304
316.680	.000670	-917.2449	112.9068	-2.4428E-05	3.1849	-8.5369
320.160	.000584	-576.0216	84.9956	-2.4823E-05	2.0001	-7.5040
323.640	.000497	-325.6753	60.7338	-2.5062E-05	1.1308	-6.4395
327.120	.000410	-153.3146	40.2216	-2.5189E-05	.5323423	-5.3491
330.600	.000322	-45.7330	23.5426	-2.5242E-05	.1587952	-4.2366
334.080	.000234	10.5420	10.7689	-2.5251E-05	.0366042	-3.1046
337.560	.000146	29.2187	1.9659	-2.5241E-05	.1014539	-1.9546
341.040	5.84E-05	24.2244	-2.8045	-2.5227E-05	.0841124	-.7869566
344.520	-2.93E-05	9.6997	-3.4805	-2.5218E-05	.0336794	.3984193
348.000	-.000117	0.0000	0.0000	-2.5215E-05	0.0000	1.6019

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.00009873
Maximum bending moment           =      -3954235. lbs-in
Maximum shear force              =   108435.36663 lbs
Depth of maximum bending moment  =        0.00000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =              7
Number of zero deflection points =              3
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	412058.	20140.5298
4	y= .500000	M= 0.000	0.0000	.5000000	779202.	34959.4655
4	y= 1.000000	M= 0.000	0.0000	1.0000000	1413165.	52324.6561
5	y= .250000	S= 0.000	0.0000	.2500000	-1248909.	42669.8696
5	y= .500000	S= 0.000	0.0000	.5000000	-2321994.	74535.1521
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-3954235.	108435.

The analysis ended normally.

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Douglass Bent 2/Existing 10-inch Square Concrete Pile

DESIGNER : AB

DATE : 05/04/2009

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 40.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 0.69 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 40.00 FT.
MODULUS OF ELASTICITY = 0.380E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 9.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

SOIL DEPTH FT.	EARTH TYPE	LATERAL PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	1.00	110.00	33.00	8.00
40.00	SAND	1.00	110.00	33.00	8.00
40.00	SAND	1.00	47.60	32.00	8.00
60.00	SAND	1.00	47.60	32.00	8.00
60.00	CLAY	0.00	47.60	0.00	0.00
81.50	CLAY	0.00	47.60	0.00	0.00

UNIT FRICTION KSF	UNIT BEARING KSF	MAXIMUM SHEAR STRENGTH KSF	MAXIMUM SHEAR STRENGTH KSF	UNDISTURB BLOW COUNT	REMOLDED UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00
9999.00	99999.00	1.50	0.00	0.00	0.00	0.00

****
* COMPUTATION RESULT *
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PILE PENETR- ATION FT.	FED. HWY. METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP	ARMY CORPS METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP	LAMBDA 2 METHOD TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC- ITY KIP
0.0	0.0	2.5	2.5	0.0	3.0	3.0	0.0	0.6	0.6
1.0	0.0	4.8	4.8	0.0	5.7	5.7	0.0	1.3	1.3
2.0	0.0	7.1	7.1	0.0	8.5	8.5	0.0	1.9	1.9
3.0	0.0	9.5	9.5	0.0	11.3	11.3	0.0	2.5	2.5
4.0	0.0	11.8	11.8	0.0	14.1	14.1	0.0	3.1	3.1
5.0	0.0	14.1	14.1	0.0	16.9	16.9	0.0	3.7	3.7
6.0	0.0	16.4	16.4	0.0	19.7	19.7	0.0	4.3	4.3
7.0	0.0	18.8	18.8	0.0	22.5	22.5	0.0	4.9	4.9
8.0	0.0	21.1	21.1	0.0	25.3	25.3	0.0	5.5	5.5
9.0	0.9	23.4	24.3	1.0	28.0	29.0	0.0	6.1	6.1
10.0	2.7	25.7	28.4	3.1	30.0	33.1	4.1	6.8	10.8
11.0	4.7	28.1	32.7	5.8	30.7	36.5	5.2	7.4	12.6
12.0	6.9	30.4	37.3	8.5	30.7	39.2	6.4	8.0	14.4
13.0	9.3	32.7	41.9	11.2	30.7	41.8	7.7	8.6	16.3
14.0	11.8	34.2	46.0	13.8	30.7	44.5	9.1	9.2	18.3
15.0	14.6	34.7	49.3	16.5	30.7	47.2	11.6	9.8	21.4
16.0	17.6	34.7	52.3	19.2	30.7	49.9	12.8	10.4	23.3
17.0	20.7	34.7	55.4	21.9	30.7	52.6	14.4	11.0	25.4
18.0	24.0	34.7	58.8	24.6	30.7	55.2	16.4	11.6	28.1
19.0	27.6	34.7	62.3	27.3	30.7	57.9	18.6	12.3	30.9
20.0	31.3	34.7	66.0	29.9	30.7	60.6	20.9	12.9	33.8
21.0	35.2	34.7	69.9	32.6	30.7	63.3	23.3	13.5	36.8
22.0	39.3	34.7	74.0	35.3	30.7	66.0	25.9	14.1	39.9
23.0	43.6	34.7	78.3	38.0	30.7	68.6	28.5	14.7	43.2
24.0	48.1	34.7	82.8	40.7	30.7	71.3	31.3	15.3	46.6
25.0	52.8	34.7	87.5	43.3	30.7	74.0	34.2	15.9	50.1
26.0	57.6	34.7	92.3	46.0	30.7	76.7	37.2	16.5	53.7
27.0	62.7	34.7	97.4	48.7	30.7	79.4	40.3	17.1	57.5
28.0	67.9	34.7	102.7	51.4	30.7	82.0	43.6	17.8	61.3
29.0	73.4	34.7	108.1	54.1	30.7	84.7	46.9	18.4	65.3
30.0	79.0	34.7	113.7	56.7	30.7	87.4	50.4	19.0	69.4
31.0	84.8	34.7	119.5	59.4	30.7	90.1	54.0	19.6	73.6
32.0	90.8	34.7	125.5	62.1	30.7	92.8	57.7	20.2	77.9
33.0	97.0	34.7	131.8	64.8	30.7	95.4	61.6	20.8	82.4
34.0	103.4	34.7	138.1	67.5	30.7	98.1	65.5	21.4	86.9
35.0	110.0	34.7	144.7	70.1	30.7	100.8	69.6	22.0	91.6
36.0	116.8	34.7	151.5	72.8	30.7	103.5	73.8	22.6	96.4
37.0	123.7	34.7	158.5	75.5	30.7	106.2	78.1	23.3	101.3
38.0	130.9	34.0	164.9	78.2	30.4	108.5	82.5	23.9	106.4
39.0	138.2	28.5	166.7	80.9	27.8	108.6	87.0	24.4	111.4
40.0	145.8	22.9	168.7	83.5	25.2	108.8	91.7	24.7	116.4

```
**********************
*  API RP-2A (1994)  *
**********************
```

PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	0.6	0.6
1.00	0.0	1.3	1.3
2.00	0.0	1.9	1.9
3.00	0.0	2.5	2.5
4.00	0.0	3.1	3.1
5.00	0.0	3.7	3.7
6.00	0.0	4.3	4.3
7.00	0.0	4.9	4.9
8.00	0.0	5.5	5.5
9.00	0.9	6.1	7.0
10.00	2.7	6.8	9.5
11.00	4.8	7.4	12.1
12.00	7.0	8.0	15.0
13.00	9.5	8.6	18.0
14.00	12.1	9.2	21.3
15.00	14.9	9.8	24.7
16.00	17.9	10.4	28.4
17.00	21.2	11.0	32.2
18.00	24.6	11.6	36.2
19.00	28.2	12.3	40.4
20.00	32.0	12.9	44.8
21.00	36.0	13.5	49.5
22.00	40.2	14.1	54.3
23.00	44.5	14.7	59.3
24.00	49.1	15.3	64.4
25.00	53.9	15.9	69.8
26.00	58.9	16.5	75.4
27.00	64.0	17.1	81.2
28.00	69.4	17.8	87.2
29.00	75.0	18.4	93.3
30.00	80.7	19.0	99.7
31.00	86.7	19.6	106.3
32.00	92.8	20.2	113.0
33.00	99.1	20.8	119.9
34.00	105.3	21.4	126.8
35.00	111.6	22.0	133.6
36.00	117.9	22.6	140.5
37.00	124.1	23.3	147.4
38.00	130.4	23.9	154.3
39.00	136.7	24.4	161.0
40.00	142.8	24.7	167.6

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

```
**************************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
```

```
**************************************************
```

T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
		0.0000E+00	0.0000E+00	
		0.0000E+00	0.1000E-01	
		0.0000E+00	0.2000E-01	
		0.0000E+00	0.4000E-01	
		0.0000E+00	0.6000E-01	
		0.0000E+00	0.8000E-01	
		0.0000E+00	0.9000E-01	
		0.0000E+00	0.1000E+00	
		0.0000E+00	0.5000E+00	
		0.0000E+00	0.2000E+01	
2	10	0.2002E+02		
		0.0000E+00	0.0000E+00	
		0.8326E+00	0.1000E-01	
		0.1665E+01	0.2000E-01	
		0.3331E+01	0.4000E-01	
		0.4996E+01	0.6000E-01	
		0.6661E+01	0.8000E-01	
		0.7494E+01	0.9000E-01	
		0.8326E+01	0.1000E+00	
		0.8326E+01	0.5000E+00	
		0.8326E+01	0.2000E+01	
3	10	0.3996E+02		
		0.0000E+00	0.0000E+00	
		0.1285E+01	0.1000E-01	
		0.2569E+01	0.2000E-01	
		0.5139E+01	0.4000E-01	
		0.7708E+01	0.6000E-01	
		0.1028E+02	0.8000E-01	
		0.1156E+02	0.9000E-01	
		0.1285E+02	0.1000E+00	
		0.1285E+02	0.5000E+00	
		0.1285E+02	0.2000E+01	
4	10	0.4000E+02		
		0.0000E+00	0.0000E+00	
		0.1285E+01	0.1000E-01	
		0.2569E+01	0.2000E-01	
		0.5139E+01	0.4000E-01	
		0.7708E+01	0.6000E-01	
		0.1028E+02	0.8000E-01	
		0.1156E+02	0.9000E-01	
		0.1285E+02	0.1000E+00	
		0.1285E+02	0.5000E+00	
		0.1285E+02	0.2000E+01	
5	10	0.5002E+02		
		0.0000E+00	0.0000E+00	
		0.1285E+01	0.1000E-01	
		0.2569E+01	0.2000E-01	
		0.5139E+01	0.4000E-01	
		0.7708E+01	0.6000E-01	
		0.1028E+02	0.8000E-01	
		0.1156E+02	0.9000E-01	
		0.1285E+02	0.1000E+00	
		0.1285E+02	0.5000E+00	

```
 0.1285E+02      0.2000E+01
6         10      0.5996E+02
 0.0000E+00      0.0000E+00
 0.1285E+01      0.1000E-01
 0.2569E+01      0.2000E-01
 0.5139E+01      0.4000E-01
 0.7708E+01      0.6000E-01
 0.1028E+02      0.8000E-01
 0.1156E+02      0.9000E-01
 0.1285E+02      0.1000E+00
 0.1285E+02      0.5000E+00
 0.1285E+02      0.2000E+01
7         10      0.6000E+02
 0.0000E+00      0.0000E+00
 0.3854E+01      0.2037E-01
 0.6424E+01      0.3947E-01
 0.9635E+01      0.7257E-01
 0.1156E+02      0.1019E+00
 0.1285E+02      0.1273E+00
 0.1156E+02      0.2546E+00
 0.1156E+02      0.3820E+00
 0.1156E+02      0.6366E+00
 0.1156E+02      0.2546E+01
8         10      0.7078E+02
 0.0000E+00      0.0000E+00
 0.3854E+01      0.2037E-01
 0.6424E+01      0.3947E-01
 0.9635E+01      0.7257E-01
 0.1156E+02      0.1019E+00
 0.1285E+02      0.1273E+00
 0.1156E+02      0.2546E+00
 0.1156E+02      0.3820E+00
 0.1156E+02      0.6366E+00
 0.1156E+02      0.2546E+01
9         10      0.8146E+02
 0.0000E+00      0.0000E+00
 0.3854E+01      0.2037E-01
 0.6424E+01      0.3947E-01
 0.9635E+01      0.7257E-01
 0.1156E+02      0.1019E+00
 0.1285E+02      0.1273E+00
 0.1156E+02      0.2546E+00
 0.1156E+02      0.3820E+00
 0.1156E+02      0.6366E+00
 0.1156E+02      0.2546E+01
```

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.1545E+01	0.6366E-02
0.3091E+01	0.1273E-01
0.6181E+01	0.2546E-01
0.1236E+02	0.1655E+00
0.1854E+02	0.5348E+00
0.2225E+02	0.9295E+00
0.2473E+02	0.1273E+01
0.2473E+02	0.1910E+01
0.2473E+02	0.2546E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.2177E+00	0.2732E-03	0.2427E-01	0.1000E-03
0.2177E+01	0.2732E-02	0.2427E+00	0.1000E-02
0.1095E+02	0.1369E-01	0.1214E+01	0.5000E-02
0.2199E+02	0.2745E-01	0.2427E+01	0.1000E-01
0.1010E+03	0.1291E+00	0.7264E+01	0.5000E-01
0.1510E+03	0.2274E+00	0.9471E+01	0.1000E+00
0.1595E+03	0.6381E+00	0.1796E+02	0.5000E+00
0.1643E+03	0.1144E+01	0.2276E+02	0.1000E+01
0.1663E+03	0.2147E+01	0.2473E+02	0.2000E+01

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Pier Protection Wall/24-inch Dia CIDH Pile/Douglass Rd/Cutoff 6'bsg

PROPOSED DEPTH = 50.0 FT

NUMBER OF LAYERS = 3

WATER TABLE DEPTH = 34.0 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 2.00

SOIL INFORMATION

LAYER NO 1----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA	= 0.120E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.330E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA	= 0.713E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.330E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.340E+02

LAYER NO 2----SAND

AT THE TOP

SKIN FRICTION COEFFICIENT- BETA	= 0.713E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.320E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.340E+02

AT THE BOTTOM

SKIN FRICTION COEFFICIENT- BETA	= 0.428E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.320E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.630E+02

LAYER NO 3----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.150E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.630E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.150E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.110E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.790E+02

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	2.000	FT.
DIAMETER OF BASE	=	2.000	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	6.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	4.524	SQ.IN.
ELASTIC MODULUS, Ec	=	0.380E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.

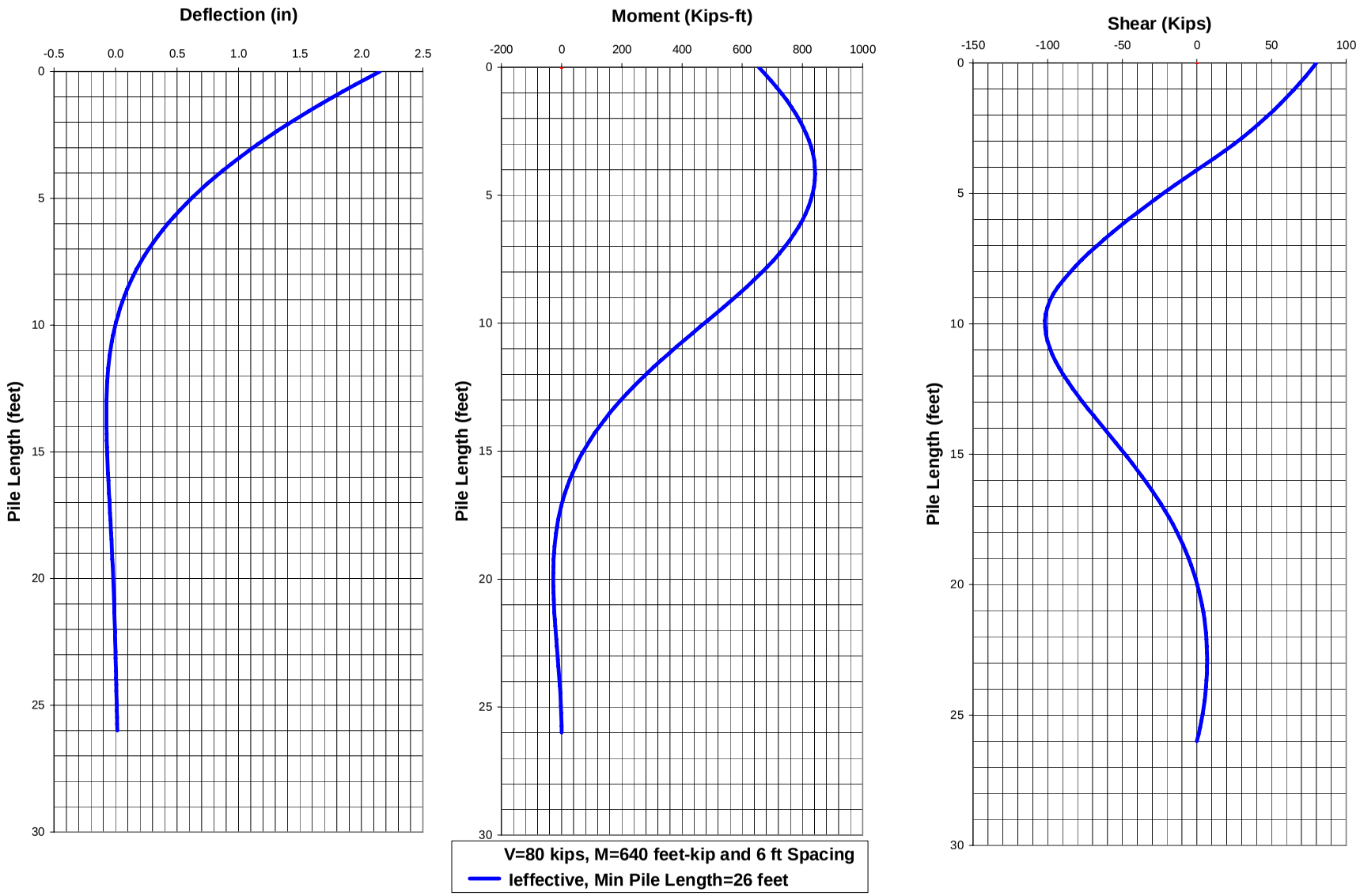
PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
7.0	0.81	2.76	12.75	15.51	9.14	7.76	19.05
8.0	0.93	5.86	14.01	19.86	12.86	9.93	21.34
9.0	1.05	9.26	15.26	24.53	16.89	12.26	23.42
10.0	1.16	12.97	16.52	29.49	21.23	14.75	25.34
11.0	1.28	16.97	17.78	34.75	25.86	17.37	27.15
12.0	1.40	21.25	19.03	40.29	30.77	20.14	28.85
13.0	1.51	25.81	20.29	46.10	35.95	23.05	30.47
14.0	1.63	30.62	21.55	52.17	41.39	26.08	32.02
15.0	1.75	35.69	22.80	58.49	47.09	29.25	33.51
16.0	1.86	40.99	24.06	65.06	53.03	32.53	34.94
17.0	1.98	46.54	24.87	71.41	58.97	35.70	36.10
18.0	2.09	52.31	25.14	77.45	64.88	38.72	36.97
19.0	2.21	58.29	25.14	83.43	70.86	41.72	37.73
20.0	2.33	64.49	25.14	89.63	77.06	44.81	38.51
21.0	2.44	70.88	25.14	96.02	83.45	48.01	39.29
22.0	2.56	77.47	25.14	102.61	90.04	51.31	40.08
23.0	2.68	84.25	25.14	109.39	96.82	54.70	40.87
24.0	2.79	91.21	25.14	116.35	103.78	58.17	41.66
25.0	2.91	98.34	25.14	123.48	110.91	61.74	42.44
26.0	3.03	105.63	25.14	130.77	118.20	65.38	43.22
27.0	3.14	113.08	25.14	138.22	125.65	69.11	43.99
28.0	3.26	120.68	25.14	145.82	133.25	72.91	44.75
29.0	3.37	128.43	25.14	153.57	141.00	76.79	45.51
30.0	3.49	136.32	25.14	161.46	148.89	80.73	46.25
31.0	3.61	144.34	22.15	166.48	155.41	83.24	46.15
32.0	3.72	152.48	18.56	171.04	161.76	85.52	45.93
33.0	3.84	160.74	16.76	177.50	169.12	88.75	46.22
34.0	3.96	169.12	16.76	185.88	177.50	92.94	46.98
35.0	4.07	177.47	16.76	194.23	185.85	97.11	47.69
36.0	4.19	185.78	16.76	202.54	194.16	101.27	48.35
37.0	4.31	194.06	16.76	210.82	202.44	105.41	48.96
38.0	4.42	202.31	16.76	219.07	210.69	109.53	49.54
39.0	4.54	210.52	16.76	227.28	218.90	113.64	50.08
40.0	4.65	218.69	16.76	235.45	227.07	117.73	50.58
41.0	4.77	226.83	16.76	243.59	235.21	121.79	51.05
42.0	4.89	234.92	16.76	251.68	243.30	125.84	51.49
43.0	5.00	242.97	16.76	259.73	251.35	129.87	51.91
44.0	5.12	250.98	16.76	267.74	259.36	133.87	52.29
45.0	5.24	258.94	16.76	275.70	267.32	137.85	52.65
46.0	5.35	266.86	16.76	283.62	275.24	141.81	52.98
47.0	5.47	274.73	16.76	291.49	283.11	145.74	53.29
48.0	5.59	282.54	16.76	299.30	290.92	149.65	53.58
49.0	5.70	290.31	16.76	307.07	298.69	153.54	53.85
50.0	5.82	298.03	16.76	314.79	306.41	157.39	54.10

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6212E+00	0.3304E-03	0.5517E-02	0.1000E-03
0.6212E+01	0.3304E-02	0.5517E-01	0.1000E-02
0.1558E+02	0.8265E-02	0.1379E+00	0.2500E-02
0.3140E+02	0.1660E-01	0.2758E+00	0.5000E-02
0.4724E+02	0.2495E-01	0.4137E+00	0.7500E-02
0.6276E+02	0.3327E-01	0.5517E+00	0.1000E-01
0.1389E+03	0.7877E-01	0.1379E+01	0.2500E-01
0.2089E+03	0.1350E+00	0.2758E+01	0.5000E-01
0.2433E+03	0.1760E+00	0.4137E+01	0.7500E-01
0.2649E+03	0.2111E+00	0.5517E+01	0.1000E+00
0.2996E+03	0.3792E+00	0.9581E+01	0.2500E+00
0.3026E+03	0.6316E+00	0.1334E+02	0.5000E+00
0.3041E+03	0.8827E+00	0.1519E+02	0.7500E+00
0.3045E+03	0.1133E+01	0.1598E+02	0.1000E+01
0.3031E+03	0.2533E+01	0.1661E+02	0.2400E+01



LATERAL LOAD CAPACITIES OF
2-FOOT DIAMETER CIDH PILE WITH 6 FEET PILE SPACING
DOUGLASS OH PROTECTION WALL
SR 57 NORTHBOUND WIDENING

Project Name:	SR 57 Northbound Widening
Project No.:	602231-002
Date:	2/8/10

Figure B6

```
==============================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.25)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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                             All Rights Reserved

==============================================================================

This program is licensed to:

Tae Kuk Kim
Leighton

Path to file locations:      P:\Leighton Consulting\602000\602231.002 SR 57 Phase
2\ENG\Lpile\Impact Wall\
Name of input data file:     Impact Wall Douglass 24 inr2r1.lpd
Name of output file:         Impact Wall Douglass 24 inr2r1.lpo
Name of plot output file:    Impact Wall Douglass 24 inr2r1.lpp
Name of runtime file:        Impact Wall Douglass 24 inr2r1.lpr

------------------------------------------------------------------------------
                           Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  February 11, 2010     Time:  15:55:58


------------------------------------------------------------------------------
                                Problem Title
------------------------------------------------------------------------------

Impact Wall/24-inch dia CIDH /26-ft long CIDH/Ieffective 0.47ft4/0.9 p
multiplier/

------------------------------------------------------------------------------
                                Program Options
------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Pile Length                                =     312.00 in
Depth of ground surface below top of pile =     -72.00 in
Slope angle of ground surface              =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
           in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   24.00000000    9745.9200     452.3800      3800000.
  2     312.0000   24.00000000    9745.9200     452.3800      3800000.


------------------------------------------------------------------------------
                        Soil and Rock Layering Information
------------------------------------------------------------------------------

The soil profile is modelled using  4 layers

Layer  1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      -72.000 in
Distance from top of pile to bottom of layer =      408.000 in
p-y subgrade modulus k for top of soil layer =       75.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       75.000 lbs/in**3

Layer  2 is stiff clay without free water
Distance from top of pile to top of layer    =      408.000 in
Distance from top of pile to bottom of layer =      528.000 in

Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      528.000 in
Distance from top of pile to bottom of layer =      648.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      648.000 in
Distance from top of pile to bottom of layer =      912.000 in


(Depth of lowest layer extends  600.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-72.00	.06366
2	408.00	.06366
3	408.00	.02755
4	528.00	.02755
5	528.00	.02755
6	648.00	.02755
7	648.00	.02755
8	912.00	.02755

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-72.000	.00000	33.00	------	------
2	408.000	.00000	33.00	------	------
3	408.000	10.42000	.00	.00600	.0
4	528.000	10.42000	.00	.00600	.0
5	528.000	.00000	32.00	------	------
6	648.000	.00000	32.00	------	------
7	648.000	10.42000	.00	.00600	.0
8	912.000	10.42000	.00	.00600	.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.9000	1.0000
2	312.000	.9000	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 80000.000 lbs
Bending moment at pile head = 7860000.000 in-lbs
Axial load at pile head = 35000.000 lbs

Non-zero moment at pile head for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment) condition.

Computed Values of Load Distribution and Deflection for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 80000.000 lbs
Specified moment at pile head = 7860000.000 in-lbs
Specified axial load at pile head = 35000.000 lbs

Non-zero moment for this load case indicates the pile-head may rotate under the applied pile-head loading, but is not a free-head (zero moment)condition.

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	2.150	7860000.	80000.0000	-.0328995	9755.2646	-1109.4002
3.120	2.049	8107757.	76444.8731	-.0322268	10060.3237	-1169.5273
6.240	1.949	8344054.	72702.8492	-.0315339	10351.2732	-1229.2060
9.360	1.852	8568310.	68775.5975	-.0308215	10627.3951	-1288.2631
12.480	1.757	8779945.	64665.3281	-.0300907	10887.9792	-1346.5250
15.600	1.664	8978393.	60374.7923	-.0293427	11132.3245	-1403.8185
18.720	1.574	9163093.	55907.2823	-.0285785	11359.7423	-1459.9700
21.840	1.486	9333496.	51266.6314	-.0277994	11569.5573	-1514.8062
24.960	1.400	9489068.	46441.8833	-.0270065	11761.1104	-1577.9810
28.080	1.317	9629192.	41384.3776	-.0262012	11933.6427	-1664.0098
31.200	1.237	9753029.	36055.4060	-.0253847	12086.1213	-1751.9976
34.320	1.159	9859721.	30448.8903	-.0245586	12217.4904	-1841.9227
37.440	1.084	9948393.	24558.8198	-.0237242	12326.6708	-1933.7635
40.560	1.011	1.0018E+07	18379.2514	-.0228832	12412.5608	-2027.4983
43.680	.940933	1.0068E+07	11904.3097	-.0220371	12474.0362	-2123.1054
46.800	.873500	1.0097E+07	5207.2840	-.0211877	12509.9503	-2169.8598
49.920	.808722	1.0105E+07	-1517.4359	-.0203367	12519.7425	-2140.8580
53.040	.746599	1.0092E+07	-8149.2044	-.0194859	12503.7603	-2110.2756

56.160	.687130	1.0059E+07	-14679.5923	-.0186371	12462.3704	-2075.8705
59.280	.630304	1.0005E+07	-21097.2431	-.0177920	12395.9856	-2038.0082
62.400	.576108	9930842.	-27391.9670	-.0169522	12305.0602	-1997.0712
65.520	.524522	9837464.	-33554.7907	-.0161195	12190.0858	-1953.4568
68.640	.475522	9724981.	-39577.9987	-.0152955	12051.5863	-1907.5740
71.760	.429078	9593838.	-45455.1662	-.0144817	11890.1127	-1859.8411
74.880	.385156	9444503.	-51180.6997	-.0136798	11706.2388	-1810.3727
78.000	.343716	9277458.	-56743.7074	-.0128912	11500.5591	-1755.6578
81.120	.304715	9093238.	-62125.9951	-.0121173	11273.7313	-1694.5266
84.240	.268104	8892439.	-67307.3763	-.0113597	11026.4902	-1626.8716
87.360	.233830	8675721.	-72267.2720	-.0106197	10759.6490	-1552.5487
90.480	.201837	8443810.	-76984.5647	-.0098986	10474.1010	-1471.3569
93.600	.172063	8197499.	-81437.3771	-.0091976	10170.8219	-1383.0100
96.720	.144444	7937650.	-85602.7333	-.0085179	9850.8734	-1287.0902
99.840	.118911	7665198.	-89456.0368	-.0078607	9515.4082	-1182.9762
102.960	.095393	7381161.	-92970.2378	-.0072269	9165.6773	-1069.7168
106.080	.073815	7086642.	-96023.1590	-.0066175	8803.0413	-887.2840
109.200	.054100	6783422.	-98439.5624	-.0060332	8429.6902	-661.6925
112.320	.036167	6473697.	-100174.	-.0054748	8048.3314	-449.9804
115.440	.019937	6159533.	-101269.	-.0049427	7661.5058	-252.2441
118.560	.005325	5842857.	-101770.	-.0044371	7271.5872	-68.4965
121.680	-.007751	5525460.	-101718.	-.0039582	6880.7813	101.3277
124.800	-.019374	5208998.	-101159.	-.0035061	6491.1274	257.3665
127.920	-.029628	4894994.	-100134.	-.0030805	6104.4992	399.8246
131.040	-.038596	4584837.	-98684.6828	-.0026811	5722.6078	528.9683
134.160	-.046359	4279788.	-96853.1063	-.0023077	5347.0045	645.1192
137.280	-.052996	3980978.	-94678.8288	-.0019598	4979.0851	748.6484
140.400	-.058588	3689420.	-92200.5820	-.0016367	4620.0937	839.9714
143.520	-.063209	3406004.	-89455.7414	-.0013378	4271.1283	919.5418
146.640	-.066935	3131508.	-86480.2158	-.0010624	3933.1458	987.8464
149.760	-.069839	2866599.	-83308.3520	-.0008097	3606.9679	1045.3996
152.880	-.071988	2611841.	-79972.8568	-.0005790	3293.2875	1092.7383
156.000	-.073451	2367695.	-76504.7346	-.0003692	2992.6749	1130.4170
159.120	-.074292	2134532.	-72933.2394	-.0001796	2705.5845	1159.0030
162.240	-.074572	1912631.	-69285.8419	-9.1005E-06	2432.3614	1179.0723
165.360	-.074349	1702190.	-65588.2098	.0001432	2173.2489	1191.2047
168.480	-.073679	1503329.	-61864.2006	.0002782	1928.3946	1195.9807
171.600	-.072613	1316097.	-58135.8669	.0003970	1697.8581	1193.9768
174.720	-.071202	1140475.	-54423.4724	.0005004	1481.6175	1185.7632
177.840	-.069490	976385.	-50745.5183	.0005896	1279.5763	1171.8997
180.960	-.067523	823694.	-47118.7788	.0006654	1091.5702	1152.9333
184.080	-.065338	682219.	-43558.3456	.0007289	917.3736	1129.3957
187.200	-.062974	551731.	-40077.6792	.0007808	756.7061	1101.8007
190.320	-.060466	431963.	-36688.6684	.0008223	609.2382	1070.6422
193.440	-.057843	322614.	-33401.6938	.0008541	474.5980	1036.3928
196.560	-.055136	223350.	-30225.6986	.0008771	352.3762	999.5016
199.680	-.052371	133814.	-27168.2620	.0008921	242.1316	960.3937
202.800	-.049570	53625.3677	-24235.6773	.0009000	143.3967	919.4684
205.920	-.046755	-17613.2351	-21433.0324	.0009015	99.0555	877.0989
209.040	-.043944	-80313.6446	-18764.2930	.0008974	176.2575	833.6315
212.160	-.041155	-134898.	-16232.3866	.0008883	243.4669	789.3854
215.280	-.038401	-181798.	-13839.2885	.0008750	301.2133	744.6519
218.400	-.035695	-221447.	-11586.1070	.0008580	350.0324	699.6952
221.520	-.033047	-254282.	-9473.1694	.0008380	390.4626	654.7520
224.640	-.030466	-280742.	-7500.1069	.0008154	423.0422	610.0317
227.760	-.027959	-301261.	-5665.9381	.0007909	448.3068	565.7175
230.880	-.025531	-316270.	-3969.1517	.0007649	466.7875	521.9661
234.000	-.023186	-326196.	-2407.7864	.0007378	479.0084	478.9091
237.120	-.020927	-331456.	-979.5089	.0007101	485.4854	436.6534
240.240	-.018755	-332463.	318.3110	.0006822	486.7251	395.2824
243.360	-.016670	-329619.	1488.5280	.0006543	483.2232	354.8567
246.480	-.014672	-323317.	2534.1526	.0006268	475.4644	315.4155
249.600	-.012759	-313943.	3458.2856	.0005999	463.9213	276.9775
252.720	-.010929	-301869.	4264.0567	.0005740	449.0549	239.5424
255.840	-.009178	-287460.	4954.5668	.0005492	431.3140	203.0922
258.960	-.007502	-271072.	5532.8348	.0005256	411.1356	167.5924
262.080	-.005898	-253050.	6001.7487	.0005036	388.9454	132.9935
265.200	-.004360	-233731.	6364.0216	.0004831	365.1583	99.2328
268.320	-.002883	-213444.	6622.1522	.0004642	340.1791	66.2356
271.440	-.001463	-192510.	6778.3904	.0004471	314.4037	33.9171
274.560	-9.34E-05	-171245.	6834.7082	.0004318	288.2195	2.1841
277.680	.001231	-149956.	6792.7765	.0004183	262.0073	-29.0634
280.800	.002517	-128949.	6653.9464	.0004065	236.1417	-59.9302
283.920	.003768	-108524.	6419.2377	.0003965	210.9929	-90.5241
287.040	.004991	-88979.6988	6089.3322	.0003882	186.9279	-120.9538
290.160	.006190	-70611.6700	5664.5746	.0003815	164.3116	-151.3268
293.280	.007371	-53716.0666	5144.9790	.0003762	143.5083	-181.7473
296.400	.008538	-38589.1703	4530.2430	.0003723	124.8828	-212.3142
299.520	.009695	-25528.6704	3819.7685	.0003696	108.8016	-243.1182
302.640	.010845	-14834.5450	3012.6904	.0003679	95.6341	-274.2396
305.760	.011991	-6809.8412	2107.9129	.0003670	85.7534	-305.7460
308.880	.013135	-1761.3285	1104.1542	.0003667	79.5373	-337.6891
312.000	.014279	0.0000	0.0000	.0003666	77.3686	-370.1021

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

```
Pile-head deflection             =     2.15045246 in
Computed slope at pile head      =     -.03289946
Maximum bending moment           =      10105198. lbs-in
Maximum shear force              =  -101769.59763 lbs
Depth of maximum bending moment  =    49.92000000 in
Depth of maximum shear force     =      118.56000 in
Number of iterations             =             18
Number of zero deflection points =              2
```

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

```
Type 1 = Shear and Moment,          y = pile-head displacment in
Type 2 = Shear and Slope,           M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness,  V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment,     S = Pile-head Slope, radians
Type 5 = Deflection and Slope,      R = Rot. Stiffness of Pile-head in-lbs/rad
```

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
1	V= 80000.	M= 7.86E+06	35000.0000	2.1505	1.0105E+07	-101770.

The analysis ended normally.

APPENDIX C

State of California | Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. JON HAMAGUCHI
Office of Special Funded Projects

Date: December 3, 2009
File: 12-ORA-57-PM 12.98
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Douglas OH (widen)
Bridge No. 55-0337

Subject: Review of the Draft Foundation Report

On October 28, 2009, we received a draft Foundation Report for the right widening of Douglas OH Bridge No. 55-0337. The proposed bridge widening is part of the northbound SR-57 widening between Katella Avenue and Lincoln Avenue. The following comments are based on review of the subject report dated October 19, 2009, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

3.3 Table 2

- In second column Station No. should be changed to stationing.
- As built groundwater and bottom elevation of borings should not be modified.

3.4.2 Corrosion Potential

- Representative samples from native soil below fill material have not been tested for corrosion evaluation. Also test results from 10 to 20 feet interval in Boring A-09-004 indicates a borderline corrosive environment.

4.1 Response Spectra

- 2008 USGS Deaggregated Hazard (Beta) curve should be used as design curve since there is a difference of about 16.7% between USGS and ARS online probabilistic data.
- QC/QA sheets should be included for all faults listed in calculated Spectra.

4.4 Table 9 – Pile Data Table

- Based on as built records and Driven Pile Program output, abutment piles are too short (10 to 12 feet). It should be noted that at both abutment locations piles shall be predrilled to original ground (elev. $\pm$ 171) and the axial capacity for the predrilled section should be ignored.

- Tension in the foot note should be deleted since no design tip is provided.

Plans

- In General Plan, Foundation Plan and LOTB sheets (current and as built) and other Plan sheets, the word "Road" after Douglass should be deleted and add "(widen)" to read Douglass OH (widen). Also post mile 12.98 should be indicated in all plan sheets.

- In Foundation Plan, as built bottom of footing elevations should not be modified. Also Pile Data Table is different than Tables 9 – Pile Data Table in the report.

- In Index to Plans, General notes for seismic design and ARS Curve should be revised.

- Battered driven piles are not indicated in both abutment layout sheets.

Log of Test Borings

- Boring and CPT can not have the same number (i.e. A-09-004 and CPT-09-004). Corrections should also be made in the report, tables and test results.

- The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets.

- The laboratory test symbols should be attached to the boring stick.

- Add bridge name to both Soil Legend sheets (2 of 4 and 3 of 4).

- Remove the North Arrow inside the new title block in as built LOTB and place it out side or relocate the title block.

- Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NAVD88.

<u>BORING A-09-004</u>

- In clayey sand with gravel at elevation 200, "gray, moist, coarse sand, fine gravel" in the first line should be deleted. Also the word "wet" should be deleted unless a perched zone exists must be defined.

- In silty lean clay at elevation 188, medium stiff should be changed to soft.

- Silty lean clay (CL) at elevation 179, the word "silty" should be deleted since the symbol for silty lean clay is (CL-ML). Also stiff should be changed to medium stiff.
- Delete the word "wet" at elevation 173 unless it is defining a perched water.
- In silty lean clay at elevation 142, consistency should be medium stiff.
- Clayey sand at elevation 140, describes which layer, it is not defined.
- The symbol for poorly graded sand with silt (SP) at elevation 138, should be (SP-SM).
- Change silty sand with clay (SM) at elevation 133, to silty clayey sand (SC-SM).
- The relative density of poorly graded sand at elevation 128, should be dense. Also change loose to "medium dense" at elevation 123.
- The symbol for sandy lean clay at elevation 108, should be (CL).
- Consistency of silty lean clay (CL-ML) at elevation 98, should be very stiff.
- Consistency of silty lean clay (CL-ML) at bottom of the boring should be hard.
- Delete the sentence "Free groundwater encountered at 72 feet below existing grade during drilling" (also applies to Boring A-09-005).

BORING A-09-005

- Consistency of silty lean clay with sand at elevation 111, should be very stiff to stiff.
- Delete the words "with clay" from sandy silt with clay (ML) at elevation 101, since sandy silt with clay is not a standard soil's group name. Also change "loose" to stiff.

Appendix B

TABLE 3

- Pile type HP120x42 is provided in Table 3 whereas in Pile Data Table it is HP10x42.

TABLE 4

- Permanent load per support should be provided (see Table 5 MTD 3-1).
- Total loads per support should be rounded up to nearest 10 kips.
- Compression load per support in Strength Limit State and Extreme Event Limit State does not apply to abutments and should not be provided (see Table 4 MTD 3-1).

TABLE 5

- Provided design loads in second column, replace concrete pile with HP steel pile at Abutment 3, and Abut 2 should be changed to Abut 3.
- Total load per support should be rounded up to nearest 10 kips and provide permanent load per support.

TABLE 6

- Round up Service Limit State load per support to nearest 10 kips.
- Specified tip elevation should be changed to 137 instead of 160.
- Tension in the foot note should be deleted since no design tip is provided.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 12/3/2009

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
No. 2663
Exp. 6-30-2010
GEOTECHNICAL
STATE OF CALIFORNIA

c: OGDS1 - LA. File
OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Douglass OH Bridge # 55-0337 Widening, dated October 19, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	3.3 Table 2	Faramarz Gerami	In second column Station No. should be changed to stationing. As built groundwater and bottom elevation of borings should not be modified.	We will revise our report accordingly.
2	3.4.2	Faramarz Gerami	Representative samples from native soil below fill material have not been tested for corrosion evaluation. Also test results from 10 to 20 feet interval in Boring A-09-004 indicates a borderline corrosive environment.	We have performed additional tests on two available samples and will include the test results in our report. The tests confirm that the soils are not considered corrosive.
3	4.1	Faramarz Gerami	2008 USGS Deaggregated Hazard (Beta) curve should be used as design curve since there is a difference of about 16.7% between USGS and ARS online probabilistic data. QC/QA sheets should be included for all faults listed in calculated Spectra.	We will revise our report to incorporate this. We will include the QA/QC sheets.
4	4.4 (Table 9)	Faramarz Gerami	Based on as built records and Driven Pile Program output, abutment piles are too short (10 to 12 feet). It should be noted that at both abutment locations piles shall be predrilled to original ground (elev. ± 171) and the axial capacity for the predrilled section should be ignored. Tension in the footnote should be deleted since no design tip is provided.	We have performed analysis using both *Driven* and *APile* programs. Only skin friction was used to calculate the pile capacity and skin friction of pre-drilled segment through existing fill was ignored. The results, to be included in our report, showed comparable results from the two programs. We will comply.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Douglass OH Bridge # 55-0337 Widening, dated October 19, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
5	Plans	Faramarz Gerami	In General Plan, Foundation Plan and LOTB sheets (current and as built) and other Plan sheets, the word "Road" after Douglass should be deleted and add "(widen)" to read Douglass OH (widen). Also post mile 12.98 should be indicated in all plan sheets. In Foundation Plan, as built bottom of footing elevations should not be modified. Also Pile Data Table is different than Table 9 - Pile Data Table in the report. In Index to Plans, General notes for seismic design and ARS Curve should be revised. Battered driven piles are not indicated in both abutment layout sheets.	We understand HDR will revise the plans accordingly.
6	Log of Test Borings (LOTB)	Faramarz Gerami	Boring and CPT can not have the same number (i.e. A-09-004 and CPT-09-004). Corrections should also be made in the report, tables and test results. The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets. The laboratory test symbols should be attached to the boring stick. Add bridge name to both Soil Legend sheets (2 of 4 and 3 of 4). Remove the North Arrow inside the new title block in as built LOTB and place it outside or relocate the title block. Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as-built LOTB for conversion of NGVD29 to NAVD88.	We will revise the CPT numbering to CPT-09-006 in the LOTB and report. We will remove the boxes. We will revise our LOTBs accordingly. We cannot move the North Arrow on the as-built LOTB since it is a tiff file (graphic file). Per our phone conversation, we will add a new North Arrow. We will add the note on the as-built LOTB.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Douglass OH Bridge # 55-0337 Widening, dated October 19, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
7	Boring A-09-004	Faramarz Gerami	In clayey sand with gravel at elevation 200, "gray, moist, coarse sand, fine gravel" in the first line should be deleted. Also the word "wet" should be deleted unless a perched zone exists must be defined. In silty lean clay at elevation 188, medium stiff should be changed to soft. Silty lean clay (CL) at elevation 179, the word "silty" should be deleted since the symbol for silty lean clay is (CL-ML). Also stiff should be changed to medium stiff. Delete the word "wet" at elevation 173 unless it is defining a perched water. In silty lean clay at elevation 142, consistency should be medium stiff.	We will revise our LOTBs accorodingly.
			Clayey sand at elevation 140, describes which layer, it is not defined.	The Clayey Sand layer is between elevations 137 to 140 and the graphic of this layer will be added.
			The symbol for poorly graded sand with silt (SP) at elevation 138 should be (SP-SM). Change silty sand with clay (SM) at elevation 133, to silty clayey sand (SC-SM). The relative density of poorly graded sand at elevation 128, should be dense. Also change loose to "medium dense" at elevation 123. The symbol for sandy lean clay at elevation 108, should be (CL). Consistency of silty lean clay (CL-ML) at elevation 98, should be very stiff. Consistency of silty lean clay (CL-ML) at bottom of the boring should be hard.	We will revise our LOTBs accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Douglass OH Bridge # 55-0337 Widening, dated October 19, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			Delete the sentence "Free groundwater encountered at 72 feet below existing grade during drilling" (also applies to Boring A-09-005).	
8	Boring A-09-005	Faramarz Gerami	Consistency of silty lean clay with sand at elevation 111, should be very stiff to stiff. Delete the words "with clay" from sandy silt with clay (ML) at elevation 101, since sandy silt with clay is not a standard soil's group name. Also change "loose" to stiff.	We will revise our LOTBs accordingly.
9	Appendix B Table 3	Faramarz Gerami	Pile type HP120x42 is provided in Table 3 whereas in Pile Data Table it is HP10x42.	Table 3 will be revised to say HP 10x42.
10	Appendix B Table 4	Faramarz Gerami	Permanent load per support should be provided (see Table 5 MTD 3-1). Total loads per support should be rounded up to nearest 10 kips. Compression load per support in Strength Limit State and Extreme Event Limit State does not apply to abutments and should not be provided (see Table 4 MTD 3-1).	We will revise our report accordingly.
11	Appendix B Table 5	Faramarz Gerami	Provided design loads in second column, replace concrete pile with HP steel pile at Abutment 3, and Abut 2 should be changed to Abut 3. Total load per support should be rounded up to nearest 10 kips and provide permanent load per support.	We will revise our report accordingly.
12	Appendix B Table 6	Faramarz Gerami	Round up Service Limit State load per support to nearest 10 kips. Specified tip elevation should be changed to 137 instead of 160. Tension in the foot note should be deleted since no design tip is provided.	We will revise our report accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

State of California | Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: March 15, 2010
File: 12-ORA-57-PM 12.98
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Douglas OH (widen)
Bridge No. 55-0337

Subject: 2nd Review of the Foundation Report

On February 22, 2010, we received a Foundation Report for the right widening of Douglas OH Bridge No. 55-0337. The proposed bridge widening is part of the northbound SR-57 widening between Katella Avenue and Lincoln Avenue. The following comments are based on review of the subject report revised February 15, 2010, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

4.2 Table 5 – As Built Foundation Data

- As Built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified.

- Nominal Resistance and Allowable Capacity at all support locations should be 180 kips and 90 kips, respectively.

4.4 Table 9 – Pile Data Table

- Concrete and steel Piles may need to be extended about 3 feet at Abutment1, 5 feet at Abutment 3 and 10 to 12 feet at Bent 2.

Plans

- In Index to Plans, "Non-liquefaction Case" (under General Notes for Seismic Loading) should be deleted since "No" is checked for liquefaction.

- As mentioned in previous review comments "in Foundation Plan, as built bottom of footing elevations should not be modified". Also delete "tension" in the foot note of Pile Data Table (similar to Table 9 in the report).

- The reason for not extending the protection wall for entire length of the Bent 2 footing.

- As mentioned in previous review "battered driven piles are not indicated in both abutment layout sheets".

Log of Test Borings (LOTB)

- Bottom of footing elevations (as built and/or widening) should not be shown on LOTB.
- Names and directions of nearest cities is not shown on the Plan View of revised LOTB.
- Same font (similar to other borings) should also be used for CPT-09-006.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
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Branch C

Reviewed by: Date: 3/15/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
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SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MARCH 15, 2010
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Douglass OH Bridge # 55-0337 Widening, dated February 15, 2010.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	4.2 Table 5 –As Built Foundation Data	Faramarz Gerami	As Built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified. Nominal Resistance and Allowable Capacity at all support locations should be 180 kips and 90 kips, respectively.	We have revised Page 14 of our report accordingly. We have revised Page 14 of our report accordingly.
2	4.4 Table 9 – Pile Data Table	Faramarz Gerami	Concrete and steel Piles may need to be extended about 3 feet at Abutment 1, 5 feet at Abutment 3 and 10 to 12 feet at Bent 2.	We have revised Page 17 of our report accordingly.
3	Plans	Faramarz Gerami	In Index to Plans, "Non-liquefaction Case" (under General Notes for Seismic Loading) should be deleted since "No" is checked for liquefaction. As mentioned in previous review comments "in Foundation Plan, as built bottom of footing elevations should not be modified". Also delete "tension" in the foot note of Pile Data Table (similar to Table 9 in the report). The reason for not extending the protection wall for entire length of the Bent 2 footing. As mentioned in previous review "battered driven piles are not indicated in both abutment layout sheets".	HDR has revised plans accordingly. Protection wall is for protecting Bent 2 column; Therefore, protection wall was not extended for the entire length of Bent 2 footing. Existing foundation system does not have battered pile and battered pile is not planned for the project.
4	Log of Test Borings (LOTB)	Faramarz Gerami	Bottom of footing elevations (as built and/or widening) should not be shown on LOTB. Names and directions of nearest cities is not shown on the Plan View of revised LOTB. Same font (similar to other borings) should also be used for CPT-09-006.	We have revised our LOTB accordingly.

State of California | Business, Transportation and Housing Agency

Memorandum

Flex your power!
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To: MR. SUDHAKAR VATTI/SEYED MOAKHAR
Office of Special Funded Projects

Date: March 4, 2010
File: 12-ORA-57-PM 12.98
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Protection Wall At Bent 2
Douglas OH Br. # 55-0337

Subject: Review of the Foundation Report

On February 23, 2010, we received a Foundation Report for a protection wall at Bent 2 of Douglas OH Bridge No. 55-0337. The proposed protection wall is part of the bridge widening. The following comments are based on review of the subject report dated February 15, 2010, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

Cover Sheet

- Delete the word "Pier" before protection wall on cover sheet and in the report text.

1.2 Project Description

- In 3rd para., Cast-In-Place-Drilled-Hall should be corrected to "Cast-In-Drilled Hole".

3.4.2 Corrosion Potential

- Please explain how the test results at depths of 25.0 and 45.0 feet were obtained in Boring A-09-005 (Appendix A), while the same boring in bridge report shows test results only between 1.5 to 5.0 depth.

4.3 Foundation Type

- The reason for not using the same pile type as bridge widening, CIDH piles could undermine the existing Bent 2 piles.

4.4 Axial Pile Capacity

- Existing piles at Bent 2 should be protected and a minimum of 3 pile diameter maintained between the existing and new pile centers.

5.1 CIDH Pile Construction

- Based on As Built and current boring results, caving should be anticipated and plan to prevent it before drilling the pile borings including construction sequencing.

As Built Log of Test Borings

- The name of the structure in new title block (sheet 4 of 4) should be "Douglass OH Protection Wall", same as other Log of Test Boring sheets.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

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Reviewed by: Date: 3/4/2010

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SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MARCH 4, 2010
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Protection Wall at Bent 2 of Douglass OH Bridge # 55-0337 Widening, dated February 15, 2010.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Cover Sheet	Faramarz Gerami	Delete the word "pier" before protection wall on cover sheet and in the report text.	We have revised the cover sheet, cover letter, and Pages 1, 2, 14 and 15 of our report accordingly.
2	1.2 Description	Faramarz Gerami	In 3rd paragraph, Cast-In-Place-Drilled-Hall should be corrected to Cast-In-Place-Drilled-Hole.	We have revised Page 2 of our report accordingly.
3	3.4.2 Corrosion Potential	Faramarz Gerami	Please explain how the test results at depths of 25.0 and 45.0 feet were obtained in Boring A-09-005 (Appendix A), while the same boring in bridge report shows test results are only between 1.5 and 5.0 depth.	Per your previous comments, we performed two additional corrosivity tests. The test results were also presented in our Douglass OH report (last page of the laboratory test results).
4	4.3 Foundation Type	Faramarz Gerami	The reason for not using the same pile type as bridge widening, CIDH piles could undermine the existing Bent 2 piles.	Due to the limited overhead clearance and magnitude of the proposed lateral load, driven piles are not feasible.
5	4.4 Axial Pile Capacity	Faramarz Gerami	Existing piles at Bent 2 should be protected and a minimum of 3 pile diameter maintained between the existing and new pile centers.	Due to the limited space between existing railroad track and bent 2, minimum 3 pile diameter cannot be maintained. The axial load on the proposed CIDH pile is relatively minor and the pile length is governed by the lateral load. The lateral load on the protection wall from the derailed train is less than the lateral capacity of bent 2 piles. As such, the potential impact to the bent 2 piles are considered minor.
6	5.1 CIDH Pile Construction	Faramarz Gerami	Based on As Built and current boring results, caving should be anticipated and plan to prevent it before drilling the pile borings including construction sequencing.	We have revised Page 17 of our report accordingly.
7	As Built Log of Test Borings	Faramarz Gerami	The name of the structure in new title block (sheet 4 of 4) should be "Douglas OH Protection Wall", same as other Log of Test Borings sheets.	We have revised our LOTB accordingly.

State of California **Business, Transportation and Housing Agency**

Memorandum

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To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: June 7, 2010
File: 12-ORA-57-PM 12.98
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Douglas OH (widen)
Bridge No. 55-0337

Subject: 3rd Review of the Foundation Report-Addendum

On March 26, 2010, we received an addendum to Foundation Report for the proposed right widening of Douglas OH Bridge No. 55-0337. The subject report including responses dated May 20, 2010, is prepared by Leighton Consulting, Inc.

We have no further comments after reviewing the referenced submittal and responses to previous review comments dated March 15, 2010. Any questions should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
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Reviewed by: Date: 6/7/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
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State of California **Business, Transportation and Housing Agency**

Memorandum

Flex your power!
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To: MR. SUDHAKAR VATTI/SEYED MOAKHAR
Office of Special Funded Projects

Date: June 7, 2010
File: 12-ORA-57-PM 12.98
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Protection Wall At Bent 2
Douglas OH Br. # 55-0337

Subject: 2nd Review of the Foundation Report-Addendum

On May 26, 2010, we received an addendum to Foundation Report for the proposed protection wall at Bent 2 of the Douglas OH Bridge No. 55-0337. The subject report including responses dated May 20, 2010, is prepared by Leighton Consulting, Inc.

We have no further comments after reviewing the referenced submittal and responses to our previous review comments dated March 4, 2010. Any questions should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
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Reviewed by: Date: 6/7/2010

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Leighton Consulting, Inc.
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T R A N S M I T T A L

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: August 5, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail		Draft Report	X	Your Use
X	Courier/Overnight	X	Final Report		As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Foundation Report for Proposed Widening of Katella Avenue Undercrossing (Bridge No. 55-0401), Northbound State Route 57, Orange County, California

LEIGHTON CONSULTING, INC.

By: Djan Chandra

Distribution (4) Addressee

17781 Cowan ■ Irvine, CA 92614-6009
949.250.1421 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

FOUNDATION REPORT FOR
PROPOSED WIDENING OF KATELLA AVENUE UNDERCROSSING
(BRIDGE NO. 55-0401), NORTHBOUND STATE ROUTE 57,
ORANGE COUNTY, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 57
PROJECT POST MILES: 12.2/15.2, EA # 0F0401

Prepared For:

HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

August 5, 2010

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

August 5, 2010

Project No. 602231-002

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Attention: Mr. Scott Bacsikin

Subject: Foundation Report for Proposed Widening of Katella Avenue Undercrossing (Bridge No. 55-0401), Northbound State Route 57, Orange County, California

In response to your request, Leighton Consulting, Inc. has performed a geotechnical exploration for the proposed widening of Katella Avenue undercrossing (Bridge No. 55-0401) at northbound State Route 57 (SR-57) in Orange County, California. The bridge widening is part of the proposed widening of northbound SR-57 from approximately 0.3 mile south of Katella Avenue to approximately 0.3 miles north of Lincoln Avenue. This project is sponsored by OCTA and Leighton Consulting has been retained as the geotechnical consultant by HDR Engineering, Inc. The purpose of our study was to evaluate the subsurface conditions at the project site and to provide geotechnical recommendations for design and construction of the foundations of the proposed undercrossing widening.

Based on the available borings, SR-57 at this location is underlain by approximately 3 to 4 feet of man-made fill consisting mainly of sand and silt. The fill is further underlain by alluvium consisting predominantly of loose to medium dense, poorly graded sand and silt with varying contents of clay to a depth of 45 feet. The soils below 45 feet to 60 feet consist predominantly of medium stiff and stiff silty clay and medium dense to dense sandy silt. The soils below 60 feet to the maximum depth explored (81½ feet) generally consist of dense to very dense sand and silty sand. Groundwater was encountered during our field exploration borings at a depth of 49 feet below the existing grade of Katella Avenue.

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The existing bridge is supported on 12-inch square precast concrete piles. The bridge widening will also be supported on the same pile type and size.

This report summarizes the results of our geotechnical exploration and presents geotechnical recommendations for design and construction of the proposed structure. The *General Plan* and foundation layout of the proposed bridge widening are included at the end of the text of the attached report. A draft version of this report was issued on July 13, 2009 and subsequently revised on October 15, 2009 and February 15, 2010 to incorporate review comments from Caltrans and additional design information from HDR. An addendum report responding to Caltrans final review comments was issued on May 20, 2010 and approved by Caltrans. Caltrans review comments and our responses are included in Appendix C of this report.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/gv

Distribution: (4) Addressee

Leighton

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1.0 INTRODUCTION

1.1 Project Overview

The California Department of Transportation (Caltrans), District 12, in cooperation with the Orange County Transportation Authority (OCTA), proposes to widen northbound State Route 57 (SR-57) between approximately 0.3 miles south of Katella Avenue (Post Mile 12.2) and 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project segment of SR-57 is approximately 3 miles long, passing through the City of Anaheim in Orange County, California. The purpose of the proposed project is to improve both existing and future mobility, reduce congestion and improve mainline merge and diverge movements.

This segment of SR-57 is relatively flat with elevations ranging from 186 feet at Katella Avenue to 200 feet at Lincoln Avenue. Elevations used throughout this report are referenced to mean sea level (msl). The southern portion of this segment is higher than the surrounding areas while the northern portion is lower. SR-57 was constructed in 1974 and currently has four general purpose lanes and a high-occupancy vehicle (HOV) lane in each direction. Six grade separations exist within this segment; namely at Katella Avenue, Douglass Road, Ball Road, Wagner Avenue, South Street and Lincoln Avenue. The project consists of widening of approximately 3 miles of northbound SR-57 by approximately 35 feet to provide standard lane widths, an additional general purpose lane (fifth lane) and a standard 10-foot wide inside shoulder.

1.2 Project Description

As part of the northbound SR-57 widening project, the existing bridge at Katella Avenue will be widened easterly. The approximate location of the project site is shown in Figure 1, *Site Location Map*.

Based on the as-built plan (Caltrans, 1974), the existing Katella Avenue undercrossing (Bridge No. 55-0401) was constructed in 1974 and is supported on two abutments and one bent. The as-built elevations of the bridge range from 187.9 to 190.2 feet from north to south. The as-built plan was based on the old datum (NGVD29) and approximately 1.84 feet should be added to the as-built elevations to convert them to the current elevations (Datum NAVD88). The elevation of Katella Avenue is approximately 162 feet. The existing bridge, approximately 198 feet long and currently 182 feet wide, will be widened easterly by approximately 17 feet. The widened portion of the bridge will be supported on a pile foundation system similar in type and layout to the existing

foundation system. The *General Plan* and *Foundation Plan* of the proposed bridge widening prepared by HDR are included at the end of the text of this report.

1.3 Purpose and Scope

The purpose of this report is to review existing geotechnical data and perform subsurface exploration, laboratory testing and geotechnical analysis to provide geotechnical design recommendations for the proposed project.

Our scope of work for this project included the following tasks:

- *Literature Review*: We reviewed various documents pertinent to the project site including the as-built Log of Test Borings (LOTBs) prepared by Caltrans for the existing Bridge No. 55-0401. The as-built LOTBs are presented in Sheet 4 of 4 of the attached LOTBs. A list of references used in preparation of this report is presented in Section 6.0.

- *Site Reconnaissance:* We performed a site reconnaissance to visually evaluate the accessibility of the site for drilling equipment and locate and mark the proposed boring locations.

- *Subsurface Exploration*: We performed a subsurface exploration that included drilling, logging and sampling of two 8-inch diameter hollow-stem auger borings to a maximum depth of 81½ feet below ground surface. We also advanced one Cone Penetration Test (CPT) to a depth of 72½ feet below the existing grade where refusal was encountered. Logs of the borings and CPT are included in Sheet 1 of 4 of the attached LOTBs.

- *Laboratory Testing*: Laboratory testing was performed on selected soil samples collected from our field exploration to evaluate the engineering properties of the soils. The laboratory test results are included in Appendix A.

- *Seismic Analysis*: Based upon the encountered subsurface conditions and regional seismicity of the area, we performed ground motion analysis for the project site for use in structural analysis and design.

- *Geotechnical Design and Analysis*: Geotechnical analysis was performed on the collected data to develop recommendations for design and construction. Results of the analysis are included in Appendix B.

- *Report Preparation*: Relevant geotechnical data were compiled in this report along with our findings and recommendations for the proposed project.

2.0 GEOTECHNICAL FIELD AND LABORATORY INVESTIGATIONS

2.1 Subsurface Exploration

Our field exploration consisted of advancing two 8-inch diameter hollow-stem borings and to a maximum depth of 81½ feet and one CPT to 72½ feet below the existing grade of Katella Avenue. Borings A-09-001 and A-09-002 were located near the abutments of the proposed bridge widening. CPT-09-003 was located near the proposed bent location. The approximate location of these borings and CPT are shown in the LOTBs.

Standard Penetration Test (SPT) was performed within the hollow-stem borings using a 140-pound automatic hammer falling freely for 30 inches. The samplers were driven for a total penetration of 18 inches and the blow counts were recorded for the last 12 inches of penetration. Relatively undisturbed samples were collected from the borings using the Modified California Ring sampler. The field sampling procedures were conducted in accordance with ASTM Standard Specifications D 1586 and D 3550 for SPT and split-barrel sampling of soil. In addition to driven samples, representative bulk soil samples were also collected from the borings.

The test borings were logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. All samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the borings were backfilled with soil cutting mixed with cement, tamped and capped with rapid set concrete, where pavement and/or decorative landscaping cobbles were penetrated. The CPT was performed in accordance with ASTM D 5778. Geotechnical logs of the borings and CPT are included in the LOTBs.

2.2 Geotechnical Laboratory Testing

Laboratory tests were performed on representative soil samples to determine the geotechnical engineering properties of subsurface materials. The following laboratory tests were performed:

- In-situ moisture content and density;
- Atterberg Limits;
- Grain-size distribution;

- Percent passing No. 200 sieve;
- Direct shear; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests, except corrosivity tests, were performed in general accordance with ASTM procedures. The corrosivity tests were performed in accordance with Caltrans procedures. Results of the laboratory tests are presented in Appendix A.

3.0 GEOTECHNICAL FINDINGS

3.1 Geologic Setting

The subject site is located in the Tustin Plain within the southeastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. In general, the Tustin Plain consists of approximately 1,400 feet of unconsolidated to semi-consolidated Quaternary-age alluvial sediments. Underlying the Quaternary alluvial deposits are Tertiary-age bedrock units consisting of sandstone, siltstone, shale and conglomerate on the order of 31,000 feet in thickness.

The site lies near the lower reaches of the Santa Ana River. The surface distribution of Holocene sediments, as recorded in early editions of regional soil survey maps (Eckmann et al., 1916), suggests that the Santa Ana River has recently wandered back and forth across the Orange County coastal plain from Alamitos Bay to Newport Bay. Historical accounts and documents further support the process of widespread sheet flooding being the dominant depositional process associated with the Santa Ana River prior to the construction of Prado Dam in 1941 (California Department of Water Resources, 1957). Currently, the Santa Ana River is located approximately 1,000 feet from the Katella Avenue undercrossing. Geology map of the area is presented in Figure 2.

3.2 Subsurface Earth Materials

Our borings and CPT were located on Katella Avenue. The subsurface soils encountered in our borings and CPT consist of 3 to 4 feet of man-made fill underlain by alluvial deposits. The fill is likely to be associated with the construction of Katella Avenue and SR-57 and consists of sand and silt. The alluvium consists mainly of loose to medium dense sand, silty sand and silt with varying contents of clay to a depth of 45 feet. The soils below 45 feet to 60 feet are generally medium stiff and stiff silty clay and medium dense to dense sandy silt. The soils below 60 feet to the maximum depth explored (81½ feet) are dense to very dense sand and silty sand.

We have performed direct shear tests on representative samples collected from our borings. The cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils were found to range from 0 to 100 psf and 29 to 33 degrees, respectively. The test results are presented in Appendix A. Based on these

test results, SPT blowcounts, and soil types, the shear strength parameters and unit weights selected for design are presented in Table 1.

Table 1 – Generalized Soil Profile and Design Parameters

Depth below Street Grade[1] (feet)	Elevation (feet)	Generalized Soil Type	Total Unit Weight (pcf)	Friction angle[2] (degrees)	Undrained Cohesion[2] (psf)
0 to 4	162 to 158	**Fill**: Sand	110	32	-
		Clayey Silt		28	500
4 to 45	158 to 117	**Alluvium**: Sand/ Silty Sand/ Silt	120	32	-
45 to 60	117 to 102	Silty Clay/ Sandy Silt	110	-	1,200
60 to 82	102 to 80	Sand/ Silty Sand	120	35	-

[1]Katella Avenue level
[2]Ultimate shear strength parameters based on SPT blow counts (NAFVAC, 1986) and laboratory test results.

3.3 Groundwater

Groundwater was encountered during our field exploration at a depth of 49 feet below the existing grade of Katella Avenue (elevations of 113 and 115 feet). Groundwater was also encountered in Borings B-2 through B-4, B-6 and B-7 by Caltrans in 1961 and 1969 at depths ranging from 42 to 49 feet (elevation of 109 to 117.5 feet). The historically high groundwater table is on the order of 30 feet below Katella Avenue street grade (CDMG, 1997), corresponding to elevation of 132. The freeway is approximately 26 feet higher than Katella Avenue. The groundwater data from the borings are summarized in Table 2. Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff.

Table 2 – Groundwater Tables

Boring Number	SR-57 Station	Offset	Time of Drilling	Total Depth (feet)	Bottom Elevation of Boring[1] (feet)	Groundwater Table	
						Depth below Existing Grade (feet)	Elevations[1] (feet)
A-09-001[2]	268+20	112' RT	2009	69.0	95.0	49.0	115.0
A-09-002[2]	269+40	110' RT	2009	81.5	80.5	49.0	113.0
B-1[3]	268+68	15' LT	1961	65.0	94.5	Not Encountered	
B-2[3]	268+00	90' RT	1969	70.0	88.0	42.0	109.0
B-3[3]	269+10	14' LT	1961	60.0	99.5	42.0	117.5
B-4[3]	268+60	113' LT	1961	56.0	103.0	42.0	117.0
B-5[3]	269+90	85' RT	1969	59.7	100.0	Not Encountered	
B-6[3]	269+10	115' LT	1961	61.0	98.5	42.5	117.0
B-7[3]	267+90	5' RT	1969	53.0	105.0	Not Encountered	
B-8[3]	269+90	0'	1969	59.0	101.0	49.0	112.0

[1]Elevations used by Caltrans were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).
[2]Borings by Leighton Consulting
[3]Borings by Caltrans

3.4 Engineering Properties of Subsurface Materials

Engineering properties of the subsurface materials were modeled based on results of geotechnical field and laboratory tests performed during our exploration. Results of these laboratory tests that are applicable to the proposed project are presented in Appendix A. These test results are briefly discussed below:

3.4.1 Shear Strength

Based on direct shear test results, the cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils ranges from 0 to 100 psf and 29 to 33 degrees, respectively. The shear strength parameters used for design are presented in Table 1.

3.4.2 Corrosion Potential

Representative samples of the subsurface soils were subjected to analytical testing to evaluate the potential for corrosion to concrete and ferrous metals. The test results are included in Appendix A and indicate the tested soils exhibited sulfate concentration of 80 to 113 parts per million (ppm), minimum resistivity of 2,285 to 4,300 ohm-cm, chloride concentration of 57 to 85 ppm, and pH level of 7.5 to 7.8. Caltrans specifications define a corrosive soil as a material in which any of the conditions exist: a chloride content greater than 500 ppm; soluble sulfate content greater than 2,000 ppm; or a pH of 5.5 or less. Based on the guidelines established by Caltrans, the subsurface soils at the bridge location are not considered corrosive.

3.4.3 Expansion Potential

Based on our borings and previous borings, the near-surface soils consisted of sand and clayey silt. It is our opinion that the on-site near-surface soils are considered to have low expansion potential.

3.5 Faulting and Seismicity

Our review of available in-house literature indicates that there are no known active or potentially active faults that have been mapped at the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in southern California. According to the California Geological Survey fault database, the closest active faults that could affect the site are the San Joaquin Hills Blind Thrust, Puente Hills Blind Thrust, and Whittier faults located approximately 12.6 kilometers (km), 13.4 km and 13.5 km, respectively, from the site. Other known regional active faults that could affect the site include the Newport-Inglewood (L.A. Basin), Elsinore (Glen Ivy), and Newport-Inglewood (Offshore) faults. The locations of these faults with respect to the site are shown in Figure 3.

We have performed seismic analysis for the site following Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). Distance of faults to the site was estimated using Caltrans ARS online program and peak ground acceleration for each fault was estimated using Caltrans excel

worksheet. The estimated peak ground accelerations caused by various faults near the site are summarized in the following table.

Table 3 – Peak Bedrock Accelerations

Fault	Maximum Magnitude	Distance (km)	Peak Bedrock Acceleration
Peralta Hills	6.2	3.8	0.38g
Compton-Los Alamitos Blind Thrust	6.8	11.7	0.38g
Puente Hills Blind Thrust	7.3	12.3	0.33g
Elsinore fault zone (Whittier Section)	7.6	13.8	0.28g
Elsinore fault zone (Chino Section)	7.6	17.1	0.31g

As shown in the table above, the Peralta Hills fault is the nearest fault to the site at a distance of approximately 3.8 km. A maximum earthquake magnitude of 6.2 has been estimated for this fault, resulting in a peak horizontal ground acceleration of about 0.38g at the site. This fault, however, is not included in the latest California Geological Survey fault database.

We have also performed probabilistic seismic analysis using Caltrans ARS online program and USGS deaggregation hazard online program. The peak ground acceleration was calculated to be 0.48g with a deaggregated moment magnitude (Mw) of 6.6. We have used this ground acceleration and earthquake magnitude in our liquefaction analysis.

3.6 Seismic Hazards

3.6.1 Fault Rupture

Based on available literature and reports, no known active faults are known to traverse the project site, and the site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. As such, the principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in the region as discussed in Section 3.5.

3.6.2 Liquefaction

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading.

The site is located within an area designated as potentially liquefiable on the *California Seismic Hazard Zone Map* (CDMG, 1998). We have performed liquefaction analysis of the soil profiles encountered at Borings A-09-001 and A-09-002 and the profile obtained from the interpretation of the field data collected from CPT-09-003. Based on our borings and CPT, the subsurface soils below the historically high groundwater table of 30 feet below the street grade consist predominantly of medium dense to very dense sand and silt and medium stiff to stiff clay to the maximum depth explored.

The liquefaction analysis was performed using procedures outlined by Youd et al. (2001) and in accordance with the guidelines provided in the Special Publication 117. The historically high groundwater level of 30 feet below the existing grade of Katella Avenue and a peak ground acceleration of 0.48g with a moment magnitude (Mw) of 6.6 were used in the analysis.

The results of our evaluation for the borings indicated that the subsurface soils below the historically high groundwater table are not susceptible to liquefaction. The results for CPT-09-003 indicated that thin layers of the soils at the depths of 35 and 45 feet below grade are potentially susceptible to liquefaction. These layers, however, are only a few inches thick and the cumulative liquefaction settlement of these layers was estimated to be less than ¼ inch. Such subsurface condition indicates a low susceptibility to liquefaction. Results of the analysis are presented in Appendix B.

3.6.3 Seismically-Induced Settlement

Seismically-induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). This settlement occurs primarily within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event. The

seismically-induced settlement was estimated to be on the order of ½ to 1½ inches. The magnitude of the estimated settlement is considered relatively minor.

3.6.4 Seiches and Tsunami

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Based on the absence of enclosed bodies of water near the site and the inland location of the site, seiches and tsunami risks at the site are considered negligible.

4.0 GEOTECHNICAL AND FOUNDATION DESIGN RECOMMENDATIONS

Based upon our evaluation of the soils and geologic information, we conclude that the proposed project is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in the design and construction of the project. The recommendations in this report are considered minimum and may be superseded by more stringent requirements of the structural engineer and/or the governing agencies. Leighton should be notified, in a timely manner, of changes in the project plans that might impact recommendations in this report.

4.1 Response Spectra

Caltrans design ARS curve was developed following Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). The ARS curve was first generated using Caltrans ARS online program and then checked against Caltrans deterministic and probabilistic excel worksheets. For the probabilistic approach, the difference between the ARS curve by the online program and the excel worksheet was found to be less than 10 percent. The next step was to input the spectral accelerations from USGS deaggregation hazard online program into the probabilistic excel worksheet to account for basin effects and near-source factors. The difference between the probabilistic ARS curve by Caltrans online program and the USGS online program adjusted for basin effects and near-source factors was greater than 10 percent. Therefore, per Caltrans guidelines, the latter ARS curve is recommended as the design curve. The ARS curves and the digitized values for the site are provided in Figure 4.

4.2 As-Built Foundation Data

Based on the as-built plan for the Katella Avenue undercrossing (Caltrans, 1974), we have summarized the as-built foundation types and characteristics in Table 4. The nominal resistance shown in the table was calculated using the computer program *APILE* (Reese et al., 2004) considering the skin friction only. The computer printouts are included in Appendix B. Elevations in Table 4 were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).

Table 4 – As-Built Bridge Foundation Data (Caltrans, 1974)

Structure[1]	Pile Size and Type	Pile Cutoff Elevation (feet)	Pile Tip Elevation (feet)	Nominal Resistance[2] (kips)	Allowable Capacity[3] (kips)
Abutment 1[4]	12-inch Square Precast Concrete Pile	173 (east) 175 (center) 178 (west)	100.6	280[6]	140
Bent 2[5]	12-inch Square Precast Concrete Pile	153.6	101.8	280	140
Abutment 3[4]	12-inch Square Precast Concrete Pile	171 (east) 173 (center) 176.7 (west)	101.3	280[6]	140

[1]Elevations of SR-57 and Katella Avenue are approximately 188 to 190 feet and 162 feet, respectively.

[2]A minimum factor of safety of 2.0 should be applied to calculate the allowable capacity.

[3]Design load of 70 tons (Class 70 precast concrete pile) per the as-built plan.

[4]Abutments 1 and 3 are supported on a single row of 20 piles with minimum pile spacing of 9 times the pile width.

[5]Bent 2 consists of 6 isolated columns supported on 3 by 4 pile group with minimum pile spacing of 3 times the pile width.

[6]The upper 13 to 20 feet of pile capacity within the existing fill was ignored.

4.3 Foundation Type

The subsurface conditions in conjunction with the magnitude of structural load associated with the proposed structure indicate a shallow foundation system is not feasible. Consequently, and for continuity of structural support, the proposed widening of the overcrossing structure will require a deep foundation system. We understand that a pile foundation system consisting of 12-inch square precast concrete piles, the same foundation system as the existing bridge, will be used for the proposed widening. As a result, the recommendations presented in this report are based upon this pile type. Recommendations for other alternates can be provided upon request.

4.4 Axial Capacities of Precast Concrete Driven Piles

Soil strength data collected from the exploratory soil borings performed as part of this geotechnical exploration were used to estimate pile design tip elevations for the axial compressive load demands provided by the structural engineer. Design of the precast concrete driven piles has been performed using the software package *APILE* (Reese et al., 2004) and *Driven* (FHWA, 2001) on the basis of skin friction only. The results of the analysis are included in Appendix B. Based on the provided information, we understand that the minimum center-to-center spacing of the piles will be 3.3 times the pile width for Abutments 1 and 3 and 3 times the pile width for Bent 2.

General information and design loads from the structural engineer are presented in the tables in Appendix B. Table 5 summarizes the structural loads provided by the structural engineer and the corresponding recommended pile tip elevations. The design tip elevations for compression and specified tip elevations were lowered to match the as-built pile tip elevations per Caltrans review comments dated March 15, 2010. It should be noted that the driven pile capacities shown are based on soil strengths alone. The actual structural capacities may be limited to lesser values by the strength of pile materials and connections. The piles and related connections should be evaluated for structural capacity as part of the structural design.

Table 5 – Pile Data Table

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (feet)	Specified Tip Elevation (feet)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abutment 1	12-inch square precast concrete pile (Class 140)	230	-	102 (a) 125 (c) 154 (d)	102	230
Bent 2	12-inch square precast concrete pile (Class 140)	230	70	103 (a) 128 (b) 115 (c) 135 (d)	103	230
Abutment 3	12-inch square precast concrete pile (Class 140)	240	-	103 (a) 125 (c) 152 (d)	103	240

Design tip elevations for the abutments are controlled by: (a) Compression, (c) Settlement, and (d) Lateral Load.

Design tip elevations for the bent are controlled by: (a) Compression, (b) Tension, (c) Settlement, and (d) Lateral Load.

The specified tip elevation shall not be raised above the design tip elevations for tension, lateral, and tolerable settlement.

Settlements of piles generally result from settlement of the supporting soils and elastic compression of piles. The settlement due to the axial load is expected to be less than ½ inch.

4.5 Lateral Pile Capacity

The lateral capacities of piles were calculated using the computer program *LPILE* (Reese and Wang, 2000) for both fixed-head and free-head conditions considering lateral displacements of ¼, ½ and 1 inch at the pile head. The results of the analysis are summarized in Tables 6 and 7 and the computer printouts of the analysis are included in Appendix B.

Table 6 – Lateral Capacities of 12-inch Square Precast Concrete Pile Abutments 1 and 3

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	10	27	5.0
½	14	45	6.0
1	21	75	6.5

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	22	74	4.2
½	32	121	4.6
1	46	195	5.1

Table 7 – Lateral Capacities of 12-inch Square Precast Concrete Pile Bent 2 - Leading Row (Row 1)

Free Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
¼	30	42	3.0
½	53	82	3.0
1	80	152	3.6

Fixed Head			
Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft) at Top of Pile	Depth to Zero Moment (feet)
¼	63	131	3.0
½	113	249	3.0
1	164	429	3.3

Lateral pile capacities of Bent 2 shown in Table 7 are for the leading row (furthest row from the applied load). Per Section 10 of *California Amendments to AASHTO LRFD Bridge Design Specifications* (Caltrans, 2008c), p-multipliers should be applied to calculate lateral capacities of piles where the center-to-center pile spacing is less than 8

times the width of the piles. Therefore, the lateral pile capacities for other rows of piles for Bent 2 should be obtained by applying the values shown in Table 7 with group reduction factors presented in Table 8.

Table 8 – Group Reduction Factors for Lateral Capacities of Bent 2

	Group Reduction Factor[(1)]	
	Row 2	Row 3 and Beyond
Shear	0.76	0.59
Maximum Moment	0.85	0.71
Depth to Maximum Moment	1.20	1.20
Depth to Zero Moment	1.13	1.20

[(1)]Based on minimum center-to-center spacing of 3 times the pile width

For Bent 2, per the structural engineer's request, soil spring constants were calculated based on the results of the *LPILE* analysis. The analysis was based upon the pile tip elevations presented in Table 5. Results of the analysis are summarized in Table 9.

Table 9 – Spring Constants for Bent 2 Pile Group

Spring Constants	Lateral Displacement (inches)					
	Free Head Condition			Fixed Head Condition		
	¼	½	1	¼	½	1
K_δ (K_{11}, Longitudinal Direction, lbs/inch)	1.33E+06	1.17E+06	8.83E+05	2.78E+06	2.50E+06	1.81E+06
K_δ (K_{22}, Transverse Direction, lbs/inch)	1.12E+06	9.87E+05	7.45E+05	2.35E+06	2.11E+06	1.53E+06
k_v (K_{33}, lbs/inch)	1.69E+06					
k_θ (K_{44}, Longitudinal Direction, lbs-inches/radian)	8.94E+10					
k_θ (K_{55}, Transverse Direction, lbs-inches/radian)	3.28E+10					

K_δ**:** Translational Stiffness, K_v: Axial Stiffness, and K_θ: Rotational Stiffness

4.6 Lateral Resistance of Pile Cap

Passive earth pressure developed against the pile caps can be used to resist a portion of the lateral loads transferred from the substructure to the soil during a seismic event. The earth pressure resisting the pile cap can be assumed to have a trapezoidal distribution that increases linearly from the top of the pile cap to the bottom of the pile cap. An equivalent passive fluid pressure of 400 pound per square foot (psf) per foot and 150 psf/foot may be used to calculate the passive pressure for level and sloping ground in front of the pile cap, respectively.

Development of full passive earth pressure in clayey soil requires a lateral pile cap displacement equal to 3 percent of the pile cap thickness. Development of full passive earth pressure in sandy soil requires a lateral pile cap displacement equal to 0.2 percent of the pile cap thickness (NAVFAC, 1986). Soil surrounding and above pile caps should be placed and compacted in accordance with Section 19-3 of Caltrans *Standard Specifications* (Caltrans, 2006a) and in accordance with Section 5.4 of this report. Pile caps should be backfilled with material with low expansion potential (Expansion Index or EI < 50 and Sand Equivalent > 20).

4.7 Lateral Earth Pressure and Load Resistance

Earth retaining structures including abutment walls and wing walls may be designed using a lateral "equivalent-fluid" earth pressure of 39 pcf for an Active condition. This value does not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design. The design value indicated above is based upon drained conditions. Proper drainage should be provided behind the walls in accordance with Caltrans *Standard Plan B-03* (Caltrans 2006d) to prevent buildup of hydrostatic pressure behind the walls. In addition to the above lateral pressures from retained earth, lateral pressures from other superimposed loads, such as those from adjacent structures or vehicles, should be added per the Section 6 of Caltrans *Trenching and Shoring Manual*.

For seismic loading, an inverted triangular pressure distribution of 18 pcf (equivalent fluid pressure) may be used in addition to the static earth pressures. These seismic earth pressures may be assumed to act at 0.6H from the bottom of the wall and are applicable for both cantilever and braced conditions. Forces resulting from wall inertia effects are expected to be relatively minor for non-gravity walls and may be ignored in estimating

the seismic lateral earth pressure. A maximum passive pressure of 5.0 ksf may be used for seismic design of abutment walls per Caltrans *Seismic Design Criteria* (2006b).

4.8 Allowable Bearing Capacity

We understand that a cantilever wing wall is proposed perpendicular to Abutments 1 and 3. An allowable soil bearing pressure of 2,500 psf may be used for design of the wing wall footings having a minimum width of 12 inches and a minimum embedment of 24 inches below the lowest adjacent ground surface. The bottom edge of the wing wall footings should have a minimum horizontal distance of 5 feet from the slope face.

4.9. Approach Fill

Based on the existing topography at the site, widening of northbound SR-57 will require imported fill. The imported material within the upper 4 feet of roadway finished grade should have low expansion potential and a minimum R-value of 40 and should be non-corrosive. Class 3 aggregate subbase can be used for the imported material within the upper 4 feet of finished grade.

The abutments should be backfilled in accordance with Sections 19-3.06 and 19-3.065 of Caltrans *Standard Specifications*. The zone shown in Figure 5.4 of *Caltrans Guidelines for Structures Foundation Reports* (Caltrans, 2006c) should consist of material free of organic material and construction debris, with EI less than 50 and SE greater than 20.

The slopes of the existing embankments should be benched into a minimum of 6 feet horizontally as the new fill is brought up in layers. Excavated material should be recompacted along with the new embankment material. All materials and placement should conform to Sections 19-6 and 19-7 of Caltrans *Standard Specifications*.

Based on our borings, the subsurface soils consisted of sandy materials. Due to the nature of sandy soils, immediate settlement is expected to occur during or within a short period after placement of the embankment/approach fill. The immediate settlement of the subsurface soil below the street grade was estimated using the Schmertmann's method. The settlement was estimated to be on the order of ½ inches.

4.10 Structure Approach Slab

Structure approach slab provides a smooth transition between freeway pavement and bridge structure. Design of the structure approach slab should be in accordance with *Memo to Designer 5-3* (Caltrans, 1992). Structure approach slab should extend the full width of the widening including shoulder and, per *Highway Design Manual* (Caltrans, 2008b), it is recommended that dowel bars be placed at the transverse joint between the structure approach slab and new rigid pavement to ensure load transfer at the joint.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Driven Pile Construction Consideration

Vibrations associated with pile driving may potentially cause distress to adjacent improvements. Noise during pile driving may also cause disturbance to people occupying the adjacent buildings. The pile driving contractors should be informed about the potential concerns so that they can use equipment and/or implement measures that will minimize noise and vibration during the pile driving. The conditions of existing adjacent improvements should be documented by surveying, video tapes, photographs, and other means before, during and after the pile driving. The noise and vibration associated with pile driving should be addressed before the commencement of the pile driving program. The installation of pile should be in accordance with Section 49 of Caltrans *Standard Specifications* Section 49-1.06 of Caltrans *Standard Specifications* should be followed for the abutment piles extending through more than five feet of fill. Pile drivability analysis should be performed prior to the pile installation to aid in selection of the hammer type and develop pile driving acceptance criteria.

5.2 Groundwater Control

Based on the current and previous field explorations, groundwater levels are expected to be approximately 49 feet below the existing street grade. However, localized perched groundwater may exist at shallower depths on a seasonal basis. Relatively shallow groundwater inflow may be controlled by a system of collection ditches and sump pumps.

5.3 Temporary Excavations

Excavations for pile caps or other appurtenant structures that are 5 feet or deeper should be laid back or shored in accordance with OSHA requirements before personnel are allowed to enter. For temporary excavations greater than 5 feet in depth that cannot be adequately sloped for stability, some form of temporary external support will be required. In consideration of the type of construction, the most practical method is expected to be excavation bracing. The lateral earth pressure for this type of shoring is estimated as 25H pcf where H is the depth of excavation and the resulting lateral pressure distribution is rectangular pressure. This above lateral pressure is only appropriate for level backfill and a drained condition behind the shoring. Shoring should also be designed to resist lateral surcharge from adjacent vehicular traffic, construction equipment, and existing structures.

5.4 Earthwork

Onsite soils to be used as compacted structural fill should be free of organic material and/or construction debris. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches for structural fill placement, moisture-conditioned as necessary to within three percent above optimum, and compacted to a minimum of 90 percent of the maximum density as determined by Caltrans Test Method 216. Embankment fill within 150 feet of bridge abutment should be compacted to a minimum of 95 percent relative compaction. Crushed aggregate base should be compacted to a minimum of 95 percent relative compaction. Subgrade within a depth of 30 inches below the finished grade should also be compacted to at least 95 percent relative compaction. Earthwork should be in accordance with Section 19 of Caltrans *Standard Specifications.*

5.5 Slope Paving

Based on the provided plan, full slope paving is proposed at each abutment area. Slope paving can be constructed of either shotcrete or Portland cement concrete. The slope should be no steeper than 1:1½ (vertical:horizontal). The subgrade receiving slope paving should be evenly graded and compacted at or near the optimum moisture to provide firm and non-yielding support and to prevent absorption of water from the concrete or mortar, but should not contain free surface water. Slope paving should be in accordance with Section 72-6 of Caltrans *Standard Specifications.*

5.6 Additional Geotechnical Services

The proposed construction involves various activities that would require geotechnical observation and testing. These include:

- Placement of compacted fill;
- Driven pile installation; and
- Footing excavation, if any.

These and other soils related activities should be observed and tested by a qualified representative of the geotechnical engineer.

Geotechnical recommendations presented in this report are based on the conditions encountered at the test boring locations and information gained from review of as-built plans as well as our understanding of the current project plan. Our recommendations should be revised, as necessary, based on the actual soil condition and any modification of the current plans, and incorporated into the final design plans and specifications. Conclusions and recommendations presented in this report should be reviewed and verified by the geotechnical engineer during site construction and revised accordingly, if exposed geotechnical conditions vary from our current understanding and interpretations.

6.0 REFERENCES

The following references were used in preparation of this report:

AASHTO LRFD Bridge Design Specifications, 2007, Customary U.S. Units 4th Edition.

Bryant, W.A., and Hart, E.W, Interim Revision 2007, Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps: California Geological Survey, Special Publications 42.

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Reese, L.C., and Wang, S.T., 2000, Computer Program LPILE Plus, A Program for the Analysis of Piles and Drilled Shafts under Lateral Loads, Ensoft, Inc., Austin, Texas.

Reese, L.C, Wang, S.T., and Arrellaga, J., 2004, APILE Plus, A Program for the Analysis of the Axial Capacity of Driven Piles, Version 4.00, User's Manual.

Youd, T.L, Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Finn, L., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J.P., Liao, S.C., Marcuson, W.F. III, Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R.B., and Stokoe, K.H. II, 2001, "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils", Journal of Geotechnical and Geoenvironmental Engineering, , Vol. 127, No. 10, October 2001.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ERIC A. JOHNSON No. C57355 Exp. 12/31/11 CIVIL STATE OF CALIFORNIA

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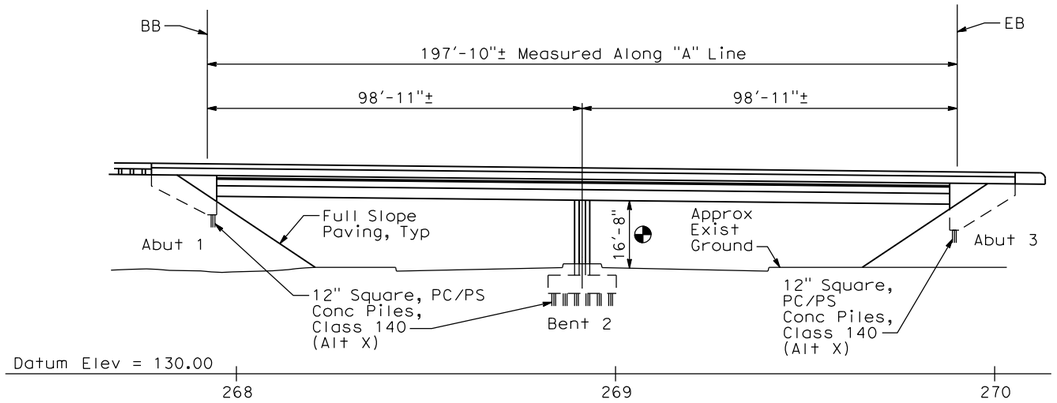
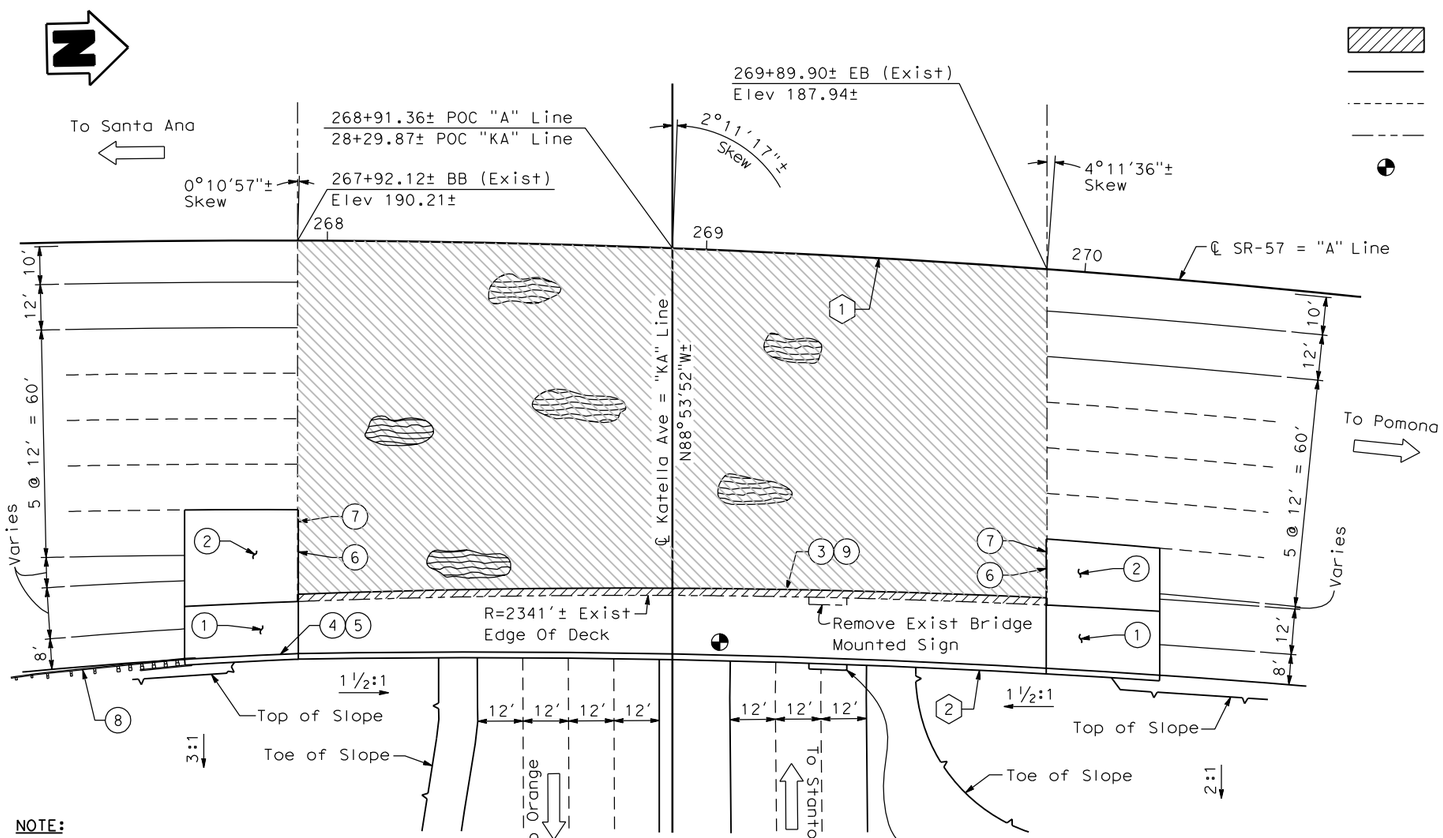
3230 EL CAMINO REAL, SUITE 200
IRVINE, CA 92602-1377



ELEVATION

SCALE 1"=20'



PLAN

SCALE 1"=20'

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

LEGEND

1. Structure Approach Slab Type N(30D)
2. Structure Approach Slab Type R(30D)
3. Remove Exist Type 9 Barrier And Overhang And Salvage Metal Railing
4. Paint "KATELLA AVENUE UNDERCROSSING"
5. Paint "BRIDGE No. 55-0401" And Year Constructed
6. Joint Seal Replacement (Exist)
7. Paving Notch Extension
8. Metal Beam Guard Railing, See "Road Plans"
9. Exist Fiber Optic Lines (To Be Relocated)

Indicates Limits Of Clean And Treat Existing NB Portion Of The Bridge Deck With High Molecular Weight Methacrylate.

Indicates Removal Of Unsound Concrete And Place Rapid Setting Concrete Patch. Actual Area Is Included In The Deck Repair Table On "General Plan No. 2" Sheet.

Indicates Bridge Removal (Portion)

Indicates New Construction

Indicates Foundation or Hidden Lines

Indicates Existing Structure

Min Vert Clearance 16'-8" (Structure)

CURVE DATA

(1) "A" Line	(2) Edge Of Deck
R = 2800'±	R = 2695.50'
Δ = 44°09'31"±	Δ = 4°49'41"
T = 1135.78'±	T = 113.64'±
L = 2158.00'±	L = 227.14'±

Notes:

1. For General Notes See "Index To Plans" Sheet.
2. For Pile Data Table See "Foundation Plan" Sheet.

DESIGN OVERSIGHT	DESIGN	BY Z. Daniel	CHECKED W. Chu	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE
SIGN OFF DATE	DETAILS	BY E. Gray	CHECKED W. Chu	LAYOUT BY Z. Daniel	CHECKED W. Chu
	QUANTITIES	BY Z. Daniel	CHECKED J. Ramirez	SPECIFICATIONS BY E. Johnson	PLANS AND SPECS COMPARED

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

CU 12231
EA 0F0401

BRIDGE NO. 55-0401
POST MILES 12.54

KATELLA AVENUE UC (WIDEN)

GENERAL PLAN NO. 1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 1 OF 23

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LEGEND

(3) Remove Exist Type 9 Barrier And Overhang And Salvage Metal Railing

(9) Exist Fiber Optic Lines (To Be Relocated)

Indicates Bridge Removal (Portion)

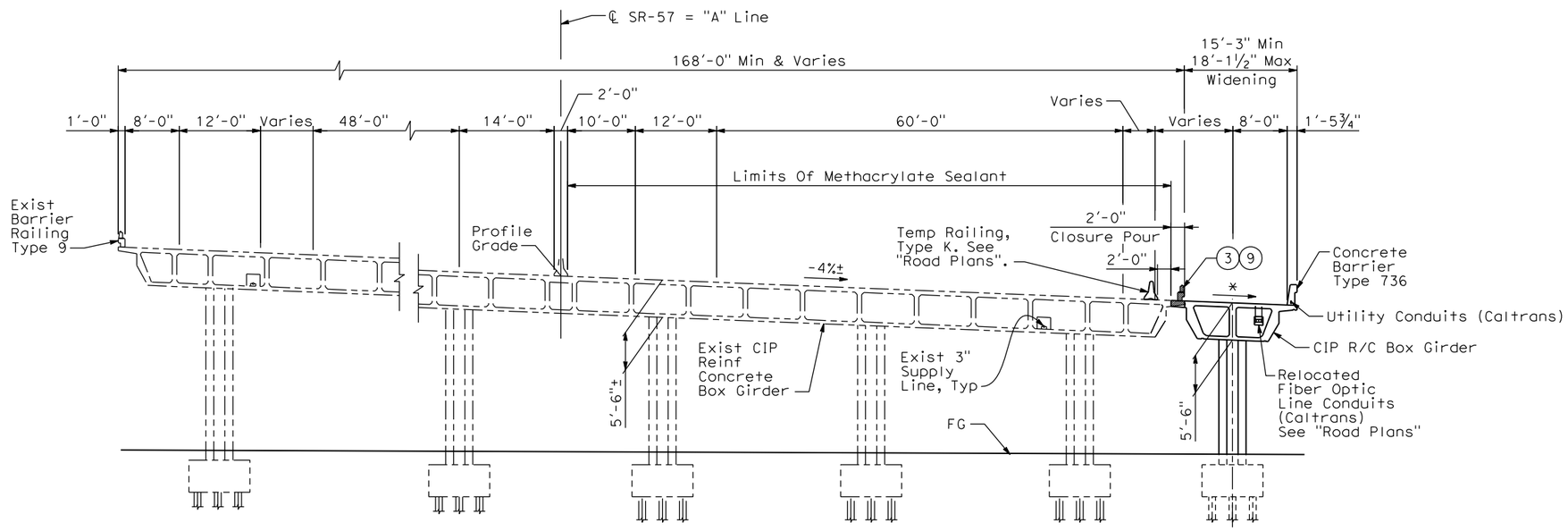
Indicates New Construction

Indicates Foundation or Hidden Lines

Indicates Existing Structure

DECK REPAIR TABLE

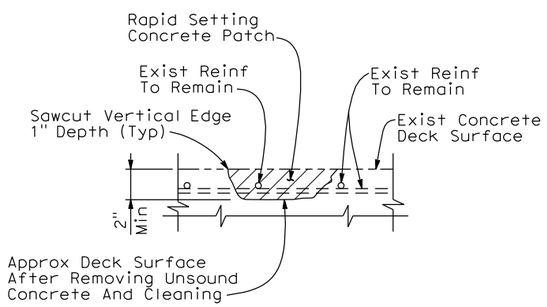
BRIDGE NAME	BRIDGE NUMBER	TOTAL DECK AREA (SQ FT)	APPROXIMATE AREA DAMAGED (%)	APPROXIMATE DEPTH (INCHES)	REMOVE UNSOUND CONCRETE (CF)	RAPID SETTING CONCRETE PATCH (CF)
Katella Ave UC	55-0401	17,773	2	2	60	60



TYPICAL SECTION

SCALE 1"=10'

* Match Existing

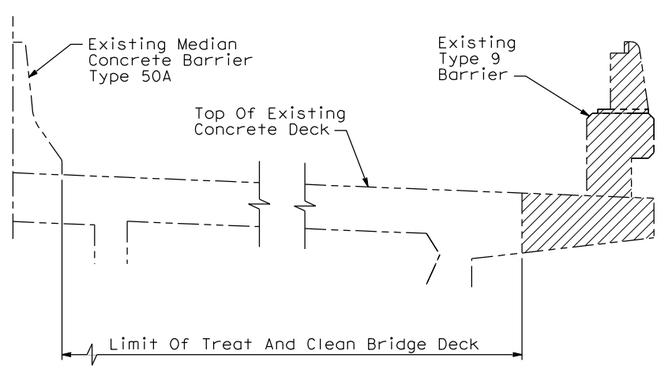


DECK DAMAGE REPAIR DETAIL

Location Will Be Determined By The Engineer. Reinforcement May Be Encountered During Deck Concrete Removal And Is To Remain Undamaged.

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.



TYPICAL LIMITS OF DECK WORK

NO SCALE

Deck Repair Notes:

1. Existing Reinforcement Shall Be Protected In Place During Unsound Concrete Removal And Patching Operations.
2. It Is The Responsibility Of The Contractor To Repair Any Reinforcement That Is Accidentally Cut By Saw Cutting Operations.
3. When Existing Transverse Reinforcement Is Exposed In The Deck Surface, Saw Cutting Shall Be Waived With The Approval Of The Engineer.
4. The Saw Cut Depth Shall Not Exceed 1 Inch Or The Concrete Cover Over The Top Steel Reinforcing Bars, Whichever Is Less.
5. Remove Unsound Portland Cement Concrete And Unsound Concrete Patches To Expose Sound, Hard Concrete Substrate. Replace Original Deck Surface With Rapid Setting Concrete Patch.

DESIGN OVERSIGHT

SIGN OFF DATE

	BY	CHECKED			
DESIGN	Z. Daniel	W. Chu	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
DETAILS	E. Gray	W. Chu	LAYOUT	Z. Daniel	W. Chu
QUANTITIES	Z. Daniel	J. Ramirez	SPECIFICATIONS	E. Johnson	PLANS AND SPECS COMPARED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55-0401
POST MILES 12.54

KATELLA AVENUE UC (WIDEN)
GENERAL PLAN NO. 2

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 2 OF 23

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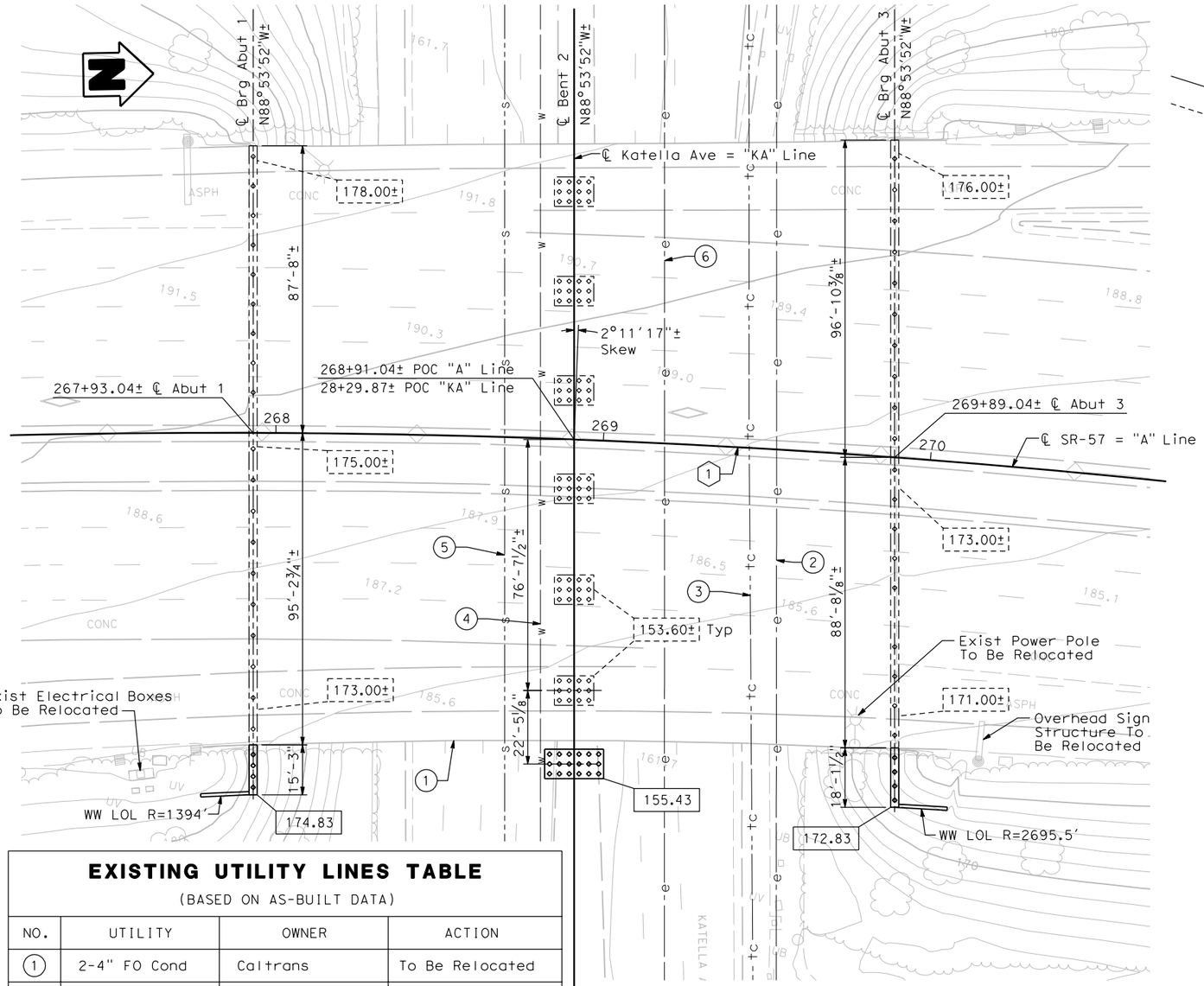

PLAN

SCALE 1"=20'

LEGEND

Indicates New Construction

Indicates Existing

XXX.XX Indicates Bottom Of Footing Elevation

XXX.XX± Indicates Bottom Of Exist Footing Elevation

NOTE:

1. Locations Of Utilities Are Approximate. See Utility Plans For Additional Information.

PILE DATA TABLE

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abut 1	12" Square PC/PS Conc Pile, Class 140 (Alt X)	230	-	102.0(a) 125.0(c) 154.0(d)	102.0	230
Bent 2	12" Square PC/PS Conc Pile, Class 140 (Alt X)	230	70	103.0(a) 128.0(b) 115.0(c) 135.0(d)	103.0	230
Abut 3	12" Square PC/PS Conc Pile, Class 140 (Alt X)	240	-	103.0(a) 125.0(c) 152.0(d)	103.0	240

Notes:
1. Design Tip Elevations For Abutments Are Controlled By:
   (a) Compression; (c) Settlement; (d) Lateral Load.
2. Design Tip Elevations For Bents Are Controlled By:
   (a) Compression; (b) Tension; (c) Settlement; (d) Lateral Load.
3. The Specified Tip Elevation Shall Not Be Raised Above The Design Tip Elevations For Tension, Lateral, And Tolerable Settlement.

EXISTING UTILITY LINES TABLE

(BASED ON AS-BUILT DATA)

NO.	UTILITY	OWNER	ACTION
1	2-4" FO Cond	Caltrans	To Be Relocated
2	12 KV UG	City Of Anaheim	Protect In Place
3	Conduit Bank	AT&T, SBC, Pac-Bell	Protect In Place
4	12" Water	City Of Anaheim	Protect In Place
5	30" VCP	Sewer OCSD	Protect In Place
6	Elect Conduit	SCE	Protect In Place

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

ABBREVIATIONS

HP = High Pressure

FO = Fiber Optic

KV = Kilovolts

UG = Underground

CURVE DATA

1 "A" Line

R = 2800'±

Δ = 44°09'31"±

T = 1135.78'±

L = 2158.00'±

BENCHMARKS AND DATUM

BASIS OF BEARINGS

The Bearings Shown Hereon Are Based Upon The Bearing Between OCS Horizontal Control Station GPS No. 0560 And Station 0111 Being North 4°59'28" East, Per Records On File In The Office Of The County Surveyor.

DATUM STATEMENT

Coordinates Shown Are Based On The California Coordinate System (CCS83), Zone VI, 1983 NAD, (1991.35 Epoch OCS GPS Adjustment). All Coordinates Shown Are Grid, Unless Otherwise Noted. The Average Combination Factor Of The Two Stations Listed Above Is 0.99999204.

BENCHMARK

Elevations Shown Hereon Are Based On OCS Vertical Control Data Sheet Designation 1K-29-80 As Elevation 202.237' NAVD 88 (OCS 2006 Adjustment), Per Records On File In The Office Of The County Surveyor.

Designation: 1B-99-99

Elevation: 158.271 (NAVD 88; Year Leveled-2006)

Description:
Described By OCS 2002 - Found 3 3/4" OCS Aluminum Benchmark Disk Stamped "1B-99-99", Set In The Southeast Corner Of A 4' By 22' Concrete Catch Basin. Monument Is Located In The Northwesterly Corner Of The Intersection Of Katella Avenue And Howell Street, 48' Northerly Of The Centerline Of Katella Avenue And 125' Westerly Of The Centerline Of Howell Street. Monument Is Set Level With The Sidewalk.

DESIGN OVERSIGHT

SIGN OFF DATE

SCALE: 1"=20' | VERT.DATUM 1991 | HORZ.DATUM 1991

PHOTOGRAMMETRY AS OF: | ALIGNMENT TIES

SURVEYED BY E. Martinez | DRAFTED BY

FIELD CHECKED BY D. Williams | CHECKED BY

	BY	CHECKED
DESIGN	Z. Daniel	W. Chu
DETAILS	E. Gray	W. Chu
QUANTITIES	Z. Daniel	J. Ramirez

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55-0401
POST MILE 12.54

KATELLA AVENUE UC (WIDEN)
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
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DISREGARD PRINTS BEARING EARLIER REVISION DATES

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SHEET 4 OF 23

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This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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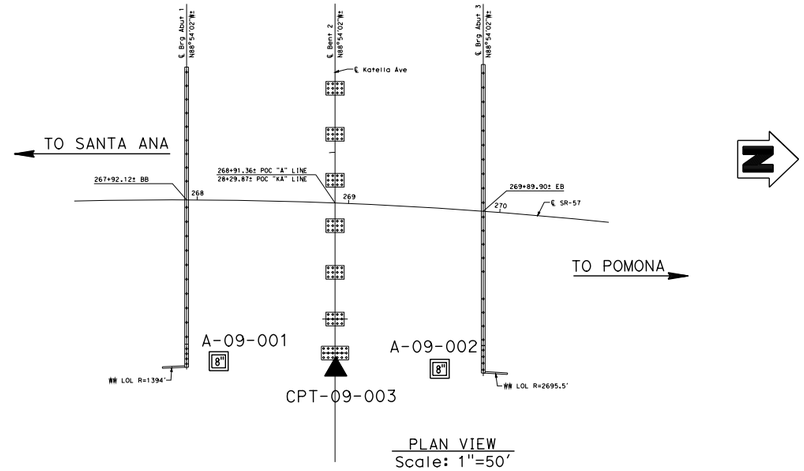
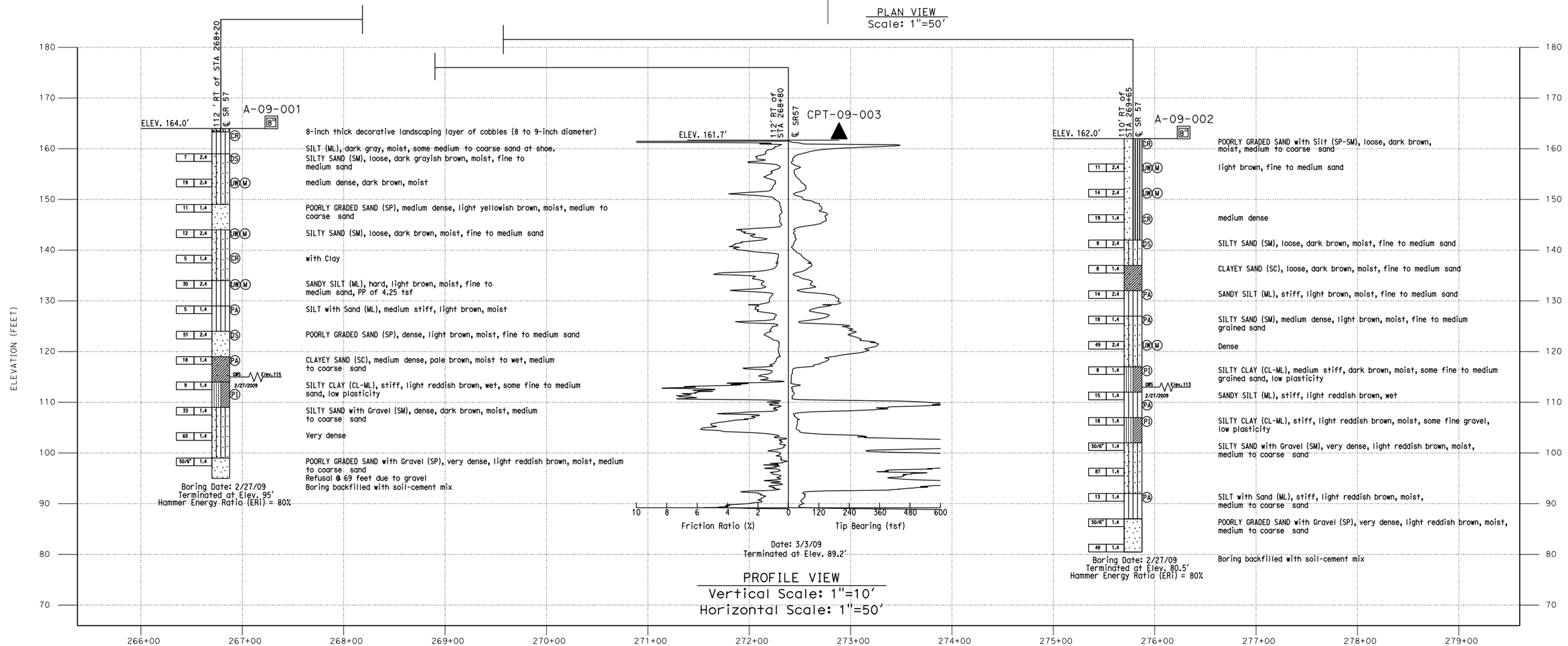
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614



PLAN VIEW
Scale: 1"=50'



PROFILE VIEW
Vertical Scale: 1"=10'
Horizontal Scale: 1"=50'

Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.

DESIGN OVERSIGHT	DRAWN BY: Buu Tran	Amit Bakane	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra	BRIDGE NO. 55-0401
SIGN OFF DATE	CHECKED BY: Taekuk Kim	FIELD INVESTIGATION BY: DATE: 2/27/09 AND 3/3/09		PROJECT ENGINEER	POST MILES 12.54

KATELLA AVENUE UC (WIDEN)
LOG OF TEST BORINGS 1 OF 4

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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SHEET 20 OF 23

FILE => 55-0401r-z-ltb01.DGN

USERNAME => btran DATE PLOTTED => 03-AUG-2010 TIME PLOTTED => 09:45

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

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LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

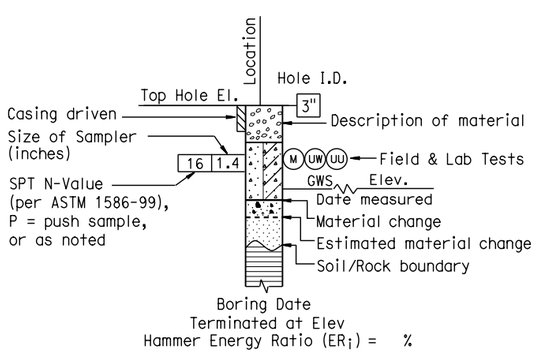
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
⬚	O	Other

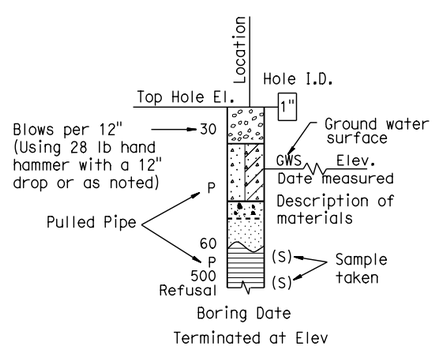
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

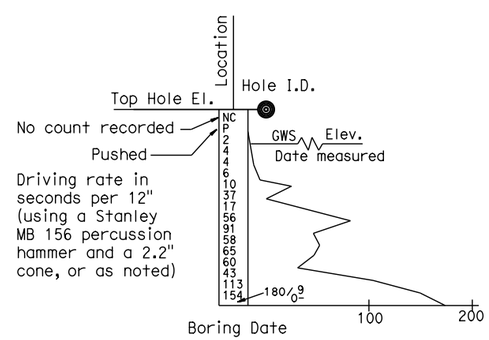
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



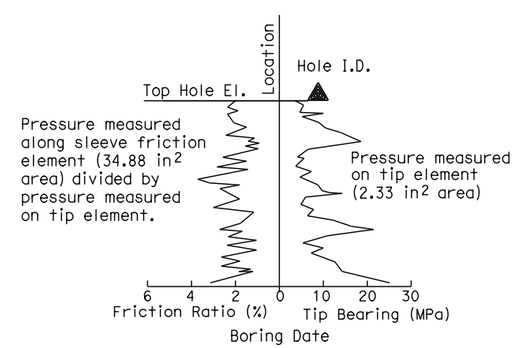
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT SIGN OFF DATE	DRAWN BY Buu Tran CHECKED BY Taekuk Kim	Amit Bakane FIELD INVESTIGATION BY: DATE: 2/27/09 AND 3/3/09	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55-0401 POST MILES 12.54

KATELLA AVENUE UC (WIDEN)
LOG OF TEST BORINGS 2 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10 6/10

REVISION DATES

SHEET 21 OF 23

FILE => 55-0401r-z-1tb02.DGN

USERNAME => btran DATE PLOTTED => 03-AUG-2010 TIME PLOTTED => 10:00

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY Buu Tran

CHECKED BY Taekuk Kim

Amit Bakane
FIELD INVESTIGATION BY:
DATE: 2/27/09 AND 3/3/09

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Djan Chandra
PROJECT ENGINEER

BRIDGE NO. 55-0401
POST MILES 12.54

KATELLA AVENUE UC (WIDEN)
LOG OF TEST BORINGS 3 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES: 10/09 2/10 5/10 6/10

SHEET 22 OF 23

FILE => 55-0401r-z-1tb03.DGN

USERNAME => btran DATE PLOTTED => 03-AUG-2010 TIME PLOTTED => 10:05

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	ORA	57,91	12.5/15.6, 5.9/7.0	285	443

A. E. Bacher
DIVISION OF STRUCTURES DESIGN ENGINEER — ASSISTANT CHIEF ENGINEER AND DESIGN
DATE APPROVED December 18, 1972

BENCH MARK

B.M. #15-ORA-61 — Elev. 150.75
Standard Orange County survey monument at station 24+16 E.C. ℄ Katella Ave.

To convert to current datum NAVD88, approximately 1.84 feet should be added to the as-built elevations.

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED ENGINEER-GEOTECHNICAL

KATELLA AVENUE UC (WIDEN)

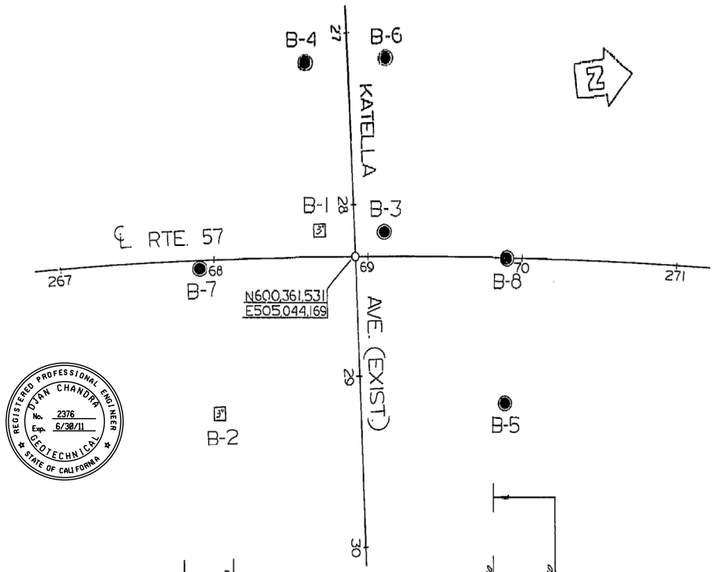
LOG OF TEST BORINGS 4 OF 4

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA — CU: 12231 EA: 0F0401 — BRIDGE NO. 55-0401 — 23 | 23

REGISTERED PROFESSIONAL ENGINEER — ARAN CHANDRA — No. 2376 — Exp. 6/30/11 — GEOTECHNICAL — STATE OF CALIFORNIA

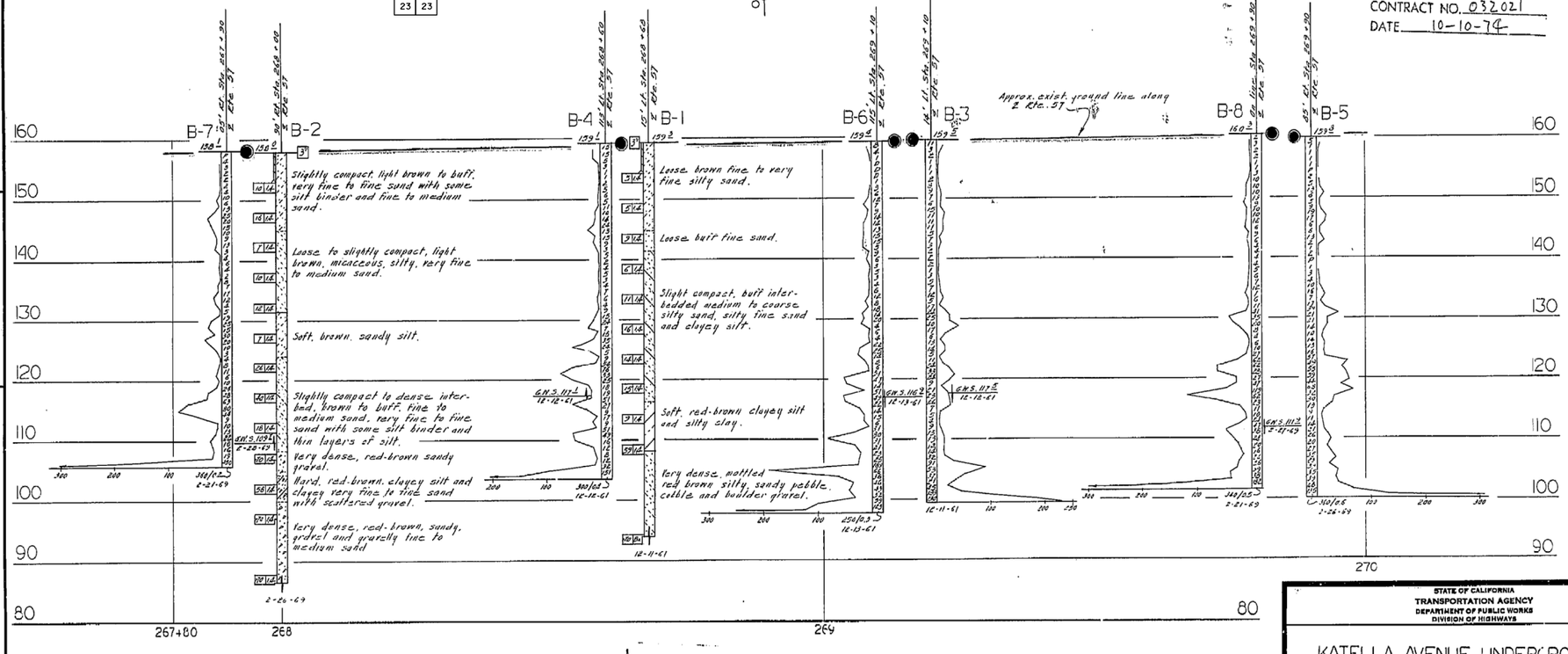
PLAN

Scale: 1" = 40'



PROFILE

Scale: Vert. 1" = 10'
Horiz. 1" = 10'



NO AS BUILT changes
CORRECTIONS BY R. Strungs
CONTRACT NO. 032021
DATE 10-10-74

LEGEND OF BORING OPERATIONS

PENETROMETER — 2¾" CONE PENETROMETER — SAMPLER BORING (DRY) — ROTARY BORING (WET) — AUGER BORING (DRY) — JET BORING — CORE BORING — TEST PIT

1" SOIL TUBE — ROTARY BORING — PENETRATION BORING

LEGEND OF EARTH MATERIALS

GRAVEL — SAND — SILT — CLAY — SANDY CLAY OR CLAYEY SAND — SANDY SILT OR SILTY SAND — SILTY CLAY OR CLAYEY SILT — PEAT AND/OR ORGANIC MATTER — FILL MATERIAL — IGNEOUS ROCK — SEDIMENTARY ROCK — METAMORPHIC ROCK

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

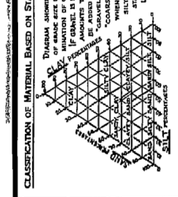


DIAGRAM SHOWING THE BASIS FOR ESTIMATED OF GRADE SIZE DISTRIBUTION WITH AN ESTIMATED SILT CONTENT IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE SOIL NAME. FOR EXAMPLE "GRAVELLY SANDY CLAY" THE TERMS "COARSE", "MEDIUM" AND "FINE" ARE ADDED TO SAND AND GRAVEL. REFER TO STANDARD GRADE SIZE LIMITS.

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

FIELD STUDY By H.C. Lin 2-27-69
DRAWN By J. Lee 3-13-69
CHECKED By H.C. Lin 5-14-69
Approved Recommended: Foundation Engineer

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000 6373

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

KATELLA AVENUE UNDERCROSSING

LOG OF TEST BORINGS

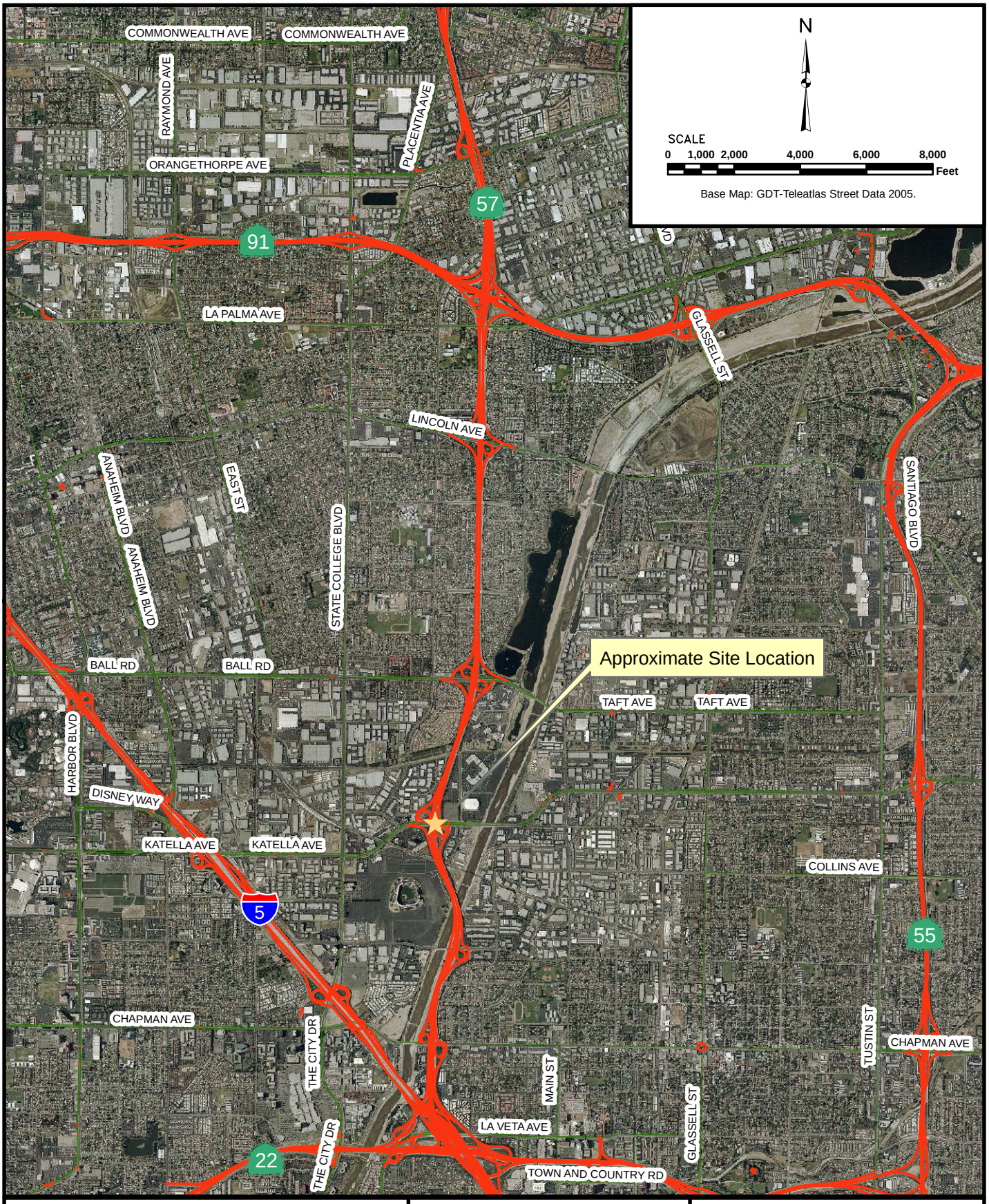
BRIDGE NO.	POST MILE	DRAWING NO.	SHEET	OF
55-501	12.5		17	17

WO 032021
CU 07206

Disregard prints bearing earlier revision dates → REVISION DATES (PRELIMINARY STAGE ONLY) 10/1/74

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 1/20/06 — SIGNATURE — TITLE



Katella Avenue Undercrossing Widening
Northbound SR-57 Widening
Orange County, California

SITE LOCATION MAP

Project No.

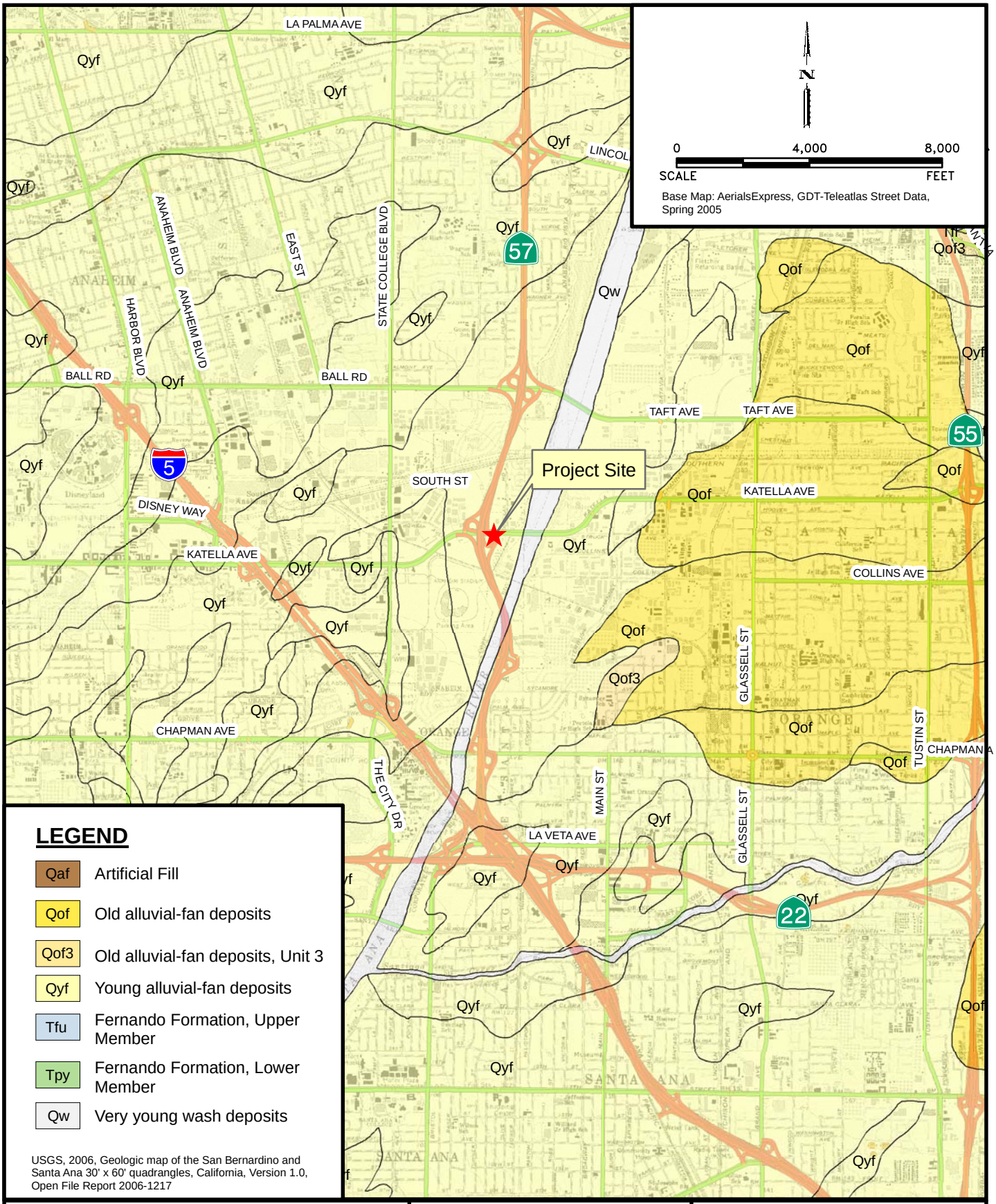
602231-002

Date

May 2009

Figure 1

P:\Drafting\602231\002\GIS\602231002_SiteLocationMap_New.mxd



Katella Avenue Undercrossing Widening
Northbound SR-57 Widening
Orange County, California

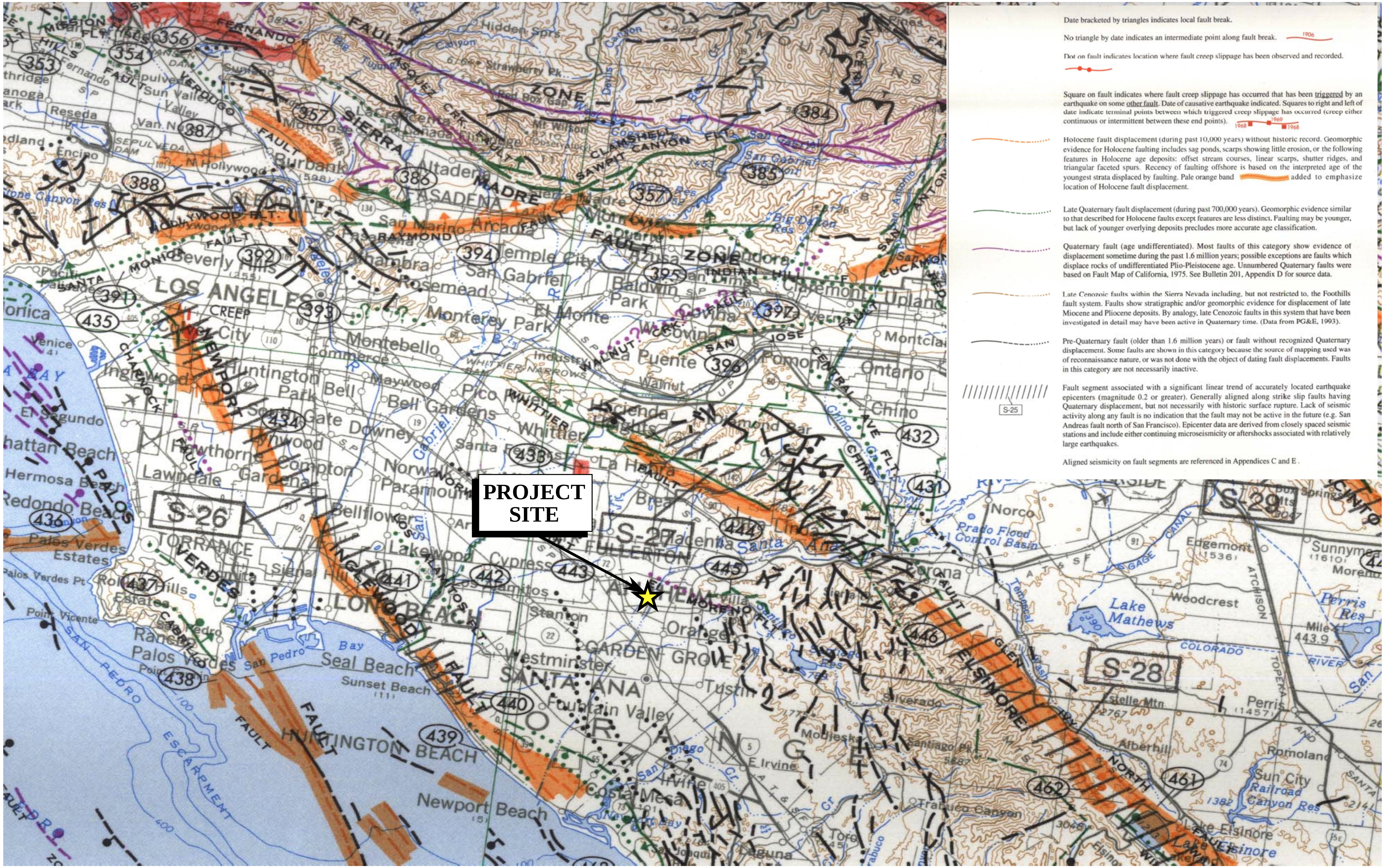
REGIONAL GEOLOGIC MAP

Project No.
602231-002

Date
June 2009

Figure 2

\\GIS\Drafting\602231\002\GIS\Figure3-GeologyMap-KatellaAve.mxd



Base Map: Fault Activity Map of California and Adjacent Areas with Location and Ages of Recent Volcanic Eruptions; CDMG 1994

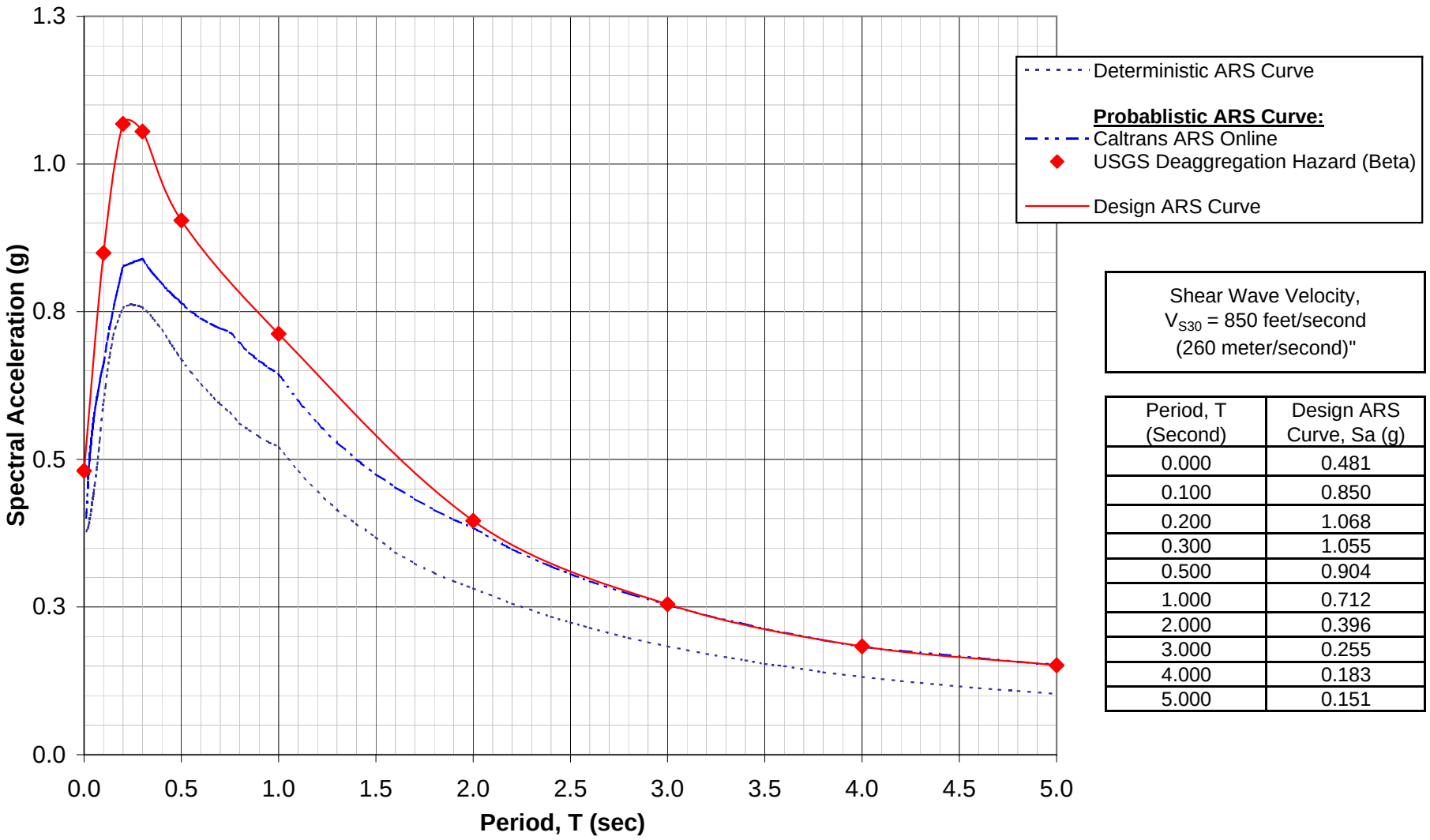
FAULT ACTIVITY MAP

Katella Avenue Undercrossing
Northbound SR 57 Widening
Anaheim, California

Project No.	602231-002
Scale (Approx)	1:750,000
Engr./Geol.	DJC / ELB
Drafted By	BQT
Date	6/09

Leighton

Figure 3



Shear Wave Velocity,
V_{S30} = 850 feet/second
(260 meter/second)"

Period, T (Second)	Design ARS Curve, Sa (g)
0.000	0.481
0.100	0.850
0.200	1.068
0.300	1.055
0.500	0.904
1.000	0.712
2.000	0.396
3.000	0.255
4.000	0.183
5.000	0.151

CALTRANS ARS CURVES
KATELLA AVENUE UNDERCROSSING
SR-57 NORTHBOUND WIDENING
ORANGE COUNTY, CALIFORNIA

Project Name:	SR-57 WIDENING
Project No.:	602231-002
Designed/Checked by:	TK/DJC
Date:	2/1/2010

Figure 4

APPENDIX A

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

				Gradation				Atterberg Limits		Maximum Density		Shear Strength Peak		Shear Strength Ultimate		Chemical Analyses					
Boring No.	Sample Type	Top of Sample (ft)	Bottom of Sample (ft)	Gravel (%)	Sand (%)	Silt (%)	Clay <5μm (%)	LL:PL:PI	Sand Equivalent	Max Dry Density (pcf)	Optimum Moisture Content (%)	ϕ' (deg)	C' (psf)	ϕ' (deg)	C' (psf)	pH	Sulfate (ppm)	Chloride (ppm)	Resistivity (Ω-cm)	Expansion Index of Soil	R-Value
A-09-001	BULK	1.0	5.0													7.76	113	85	2285		
	RING	5.0	6.5									29	105	29	40						
	SPT	25.0	26.5													7.1	62	60			
	RING	30.0	31.5			31	69														
	SPT	35.0	36.5	0	23	46	31														
	RING	40.0	41.5									44	170	33	0						
	SPT	45.0	46.5			31	69														
	SPT	50.0	51.5					22:14:08													
A-09-002	BULK	1.0	5.0													7.5	80	57	4300		
	SPT	15.0	16.5													7.6	16	70			
	RING	20.0	21.5									36	225	31	100						
	RING	30.0	31.5			28	72														
	SPT	35.0				88	12														
	SPT	45.0	46.5					35:20:15													
	SPT	50.0	51.5	4	32	40	24														
	SPT	55.0	56.5					34:17:17													
	SPT	70.0	71.5	5	28	34	33														

NOTE: The laboratory tests were performed in general accordance with the following standards:
Sieve Analysis - ASTM D422
Atterberg Limits - ASTM D 4318
Direct Shear Test - ASTM D3080
Corrosivity Tests - DOT CA 532/643 - pH, DOT CA 417 - soluble sulfates, DOT CA 422 - chlorides, DOT CA 643 - minimum resistivity

Leighton Consulting, Inc.

SR-57 Widening
Project No: 602231-002
Sheet 1 of 1

Boring No.	A-09-001	A-09-001	A-09-001	A-09-002	A-09-002	A-09-002		
Sample No.	R-2	R-3	R-4	R-1	R-2	R-5		
Depth (ft.)	10.0	20.0	30.0	5.0	10.0	40.0		
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive		
Soil Identification	Dark brown silty sand (SM)	Dark brown silty sand (SM)	Light brown sandy silt (ML)	Light brown poorly-graded sand (SP)	Light brown poorly-graded sand with silt (SP-SM)	Light brown silty sand (SM)		
Pocket Penetrometer (tons/ft^2)			4.25					
Weight Soil + Rings / Tube (g)	1206.91	1003.64	1158.20	1020.97	1135.64	1171.75		
Weight of Rings / Tube (g)	266.40	222.00	266.40	266.40	266.40	266.40		
Average Length (in.)	6.00	5.00	6.00	6.00	6.00	6.00		
Average Diameter (in.)	2.416	2.416	2.416	2.416	2.416	2.416		
Wet. Wt. of Soil + Cont. (g)	206.82	203.60	600.95	190.26	186.98	200.56		
Dry Wt. of Soil + Cont. (g)	184.15	187.18	529.24	175.58	169.84	179.18		
Weight of Container (g)	39.17	39.31	137.10	39.17	38.34	38.33		
Container No.								
Wet Density	130.3	129.9	123.5	104.5	120.4	125.4		
Moisture Content (%)	**16**	**11**	**18**	**11**	**13**	**15**		
Dry Density (pcf)	**113**	**117**	**104**	**94**	**107**	**109**		
Degree of Saturation (%)	85.0	67.9	80.4	36.9	60.4	74.7		

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/04/09

Boring No.	A-09-001	A-09-001	A-09-002	A-09-002				
Sample No.	R-4	S-4	R-4	S-3				
Depth (ft.)	30	45	30	35				
Sample Type	Drive	SPT	Drive	SPT				
Soil Identification	Light brown sandy silt (ML)	Pale brown clayey sand (SC)	Light brown sandy silt (ML)	Light brown silty sand (SM)				
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00				
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00				
Weight of Container (g)	1.00	1.00	1.00	1.00				
Moisture Content (%)	0.00	0.00	0.00	0.00				
Sample Dry Weight Determination								
Weight of Sample + Container (g)	529.24	639.61	473.79	501.67				
Weight of Container (g)	137.10	135.76	126.68	137.83				
Weight of Dry Sample (g)	392.14	503.85	347.11	363.84				
Container No.:								
After Wash								
Method (A or B)	B	B	B	B				
Dry Weight of Sample + Cont. (g)	257.60	484.26	225.38	458.33				
Weight of Container (g)	137.10	135.76	126.68	137.83				
Dry Weight of Sample (g)	120.50	348.50	98.70	320.50				
% Passing No. 200 Sieve	**69.3**	**30.8**	**71.6**	**11.9**				
% Retained No. 200 Sieve	30.7	69.2	28.4	88.1				

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/04/09

Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	03/13/09
Project No. :	602231-002	Input By:	J. Ward	Date:	03/18/09
Boring No.:	A-09-001	Checked By:	J. Ward		
Sample No.:	S-5	Depth (ft.)	50.0		
Soil Identification:	Light reddish brown silty clay (CL-ML)				

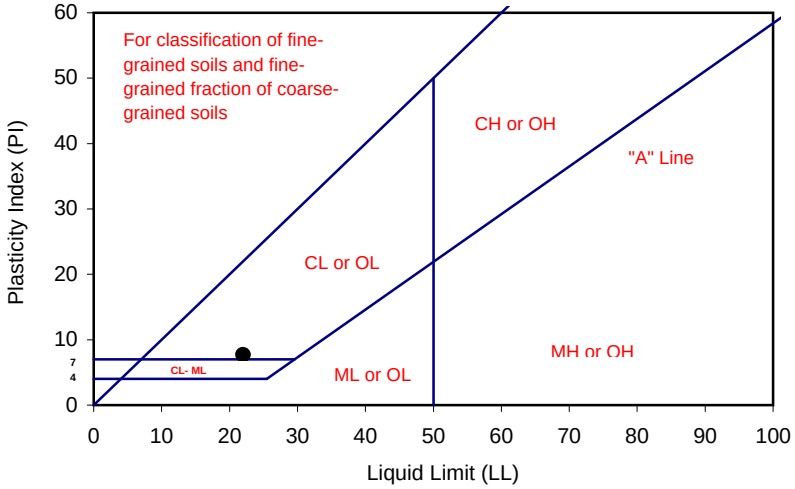
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	24	16	
Wet Wt. of Soil + Cont. (g)	10.74	9.48	22.64	21.29	22.99	
Dry Wt. of Soil + Cont. (g)	9.53	8.43	18.82	17.65	18.97	
Wt. of Container (g)	1.08	1.07	1.09	1.05	1.08	
Moisture Content (%) [Wn]	14.32	14.27	21.55	21.93	22.47	

Liquid Limit	**22**
Plastic Limit	**14**
Plasticity Index	**8**
Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) 1.46

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



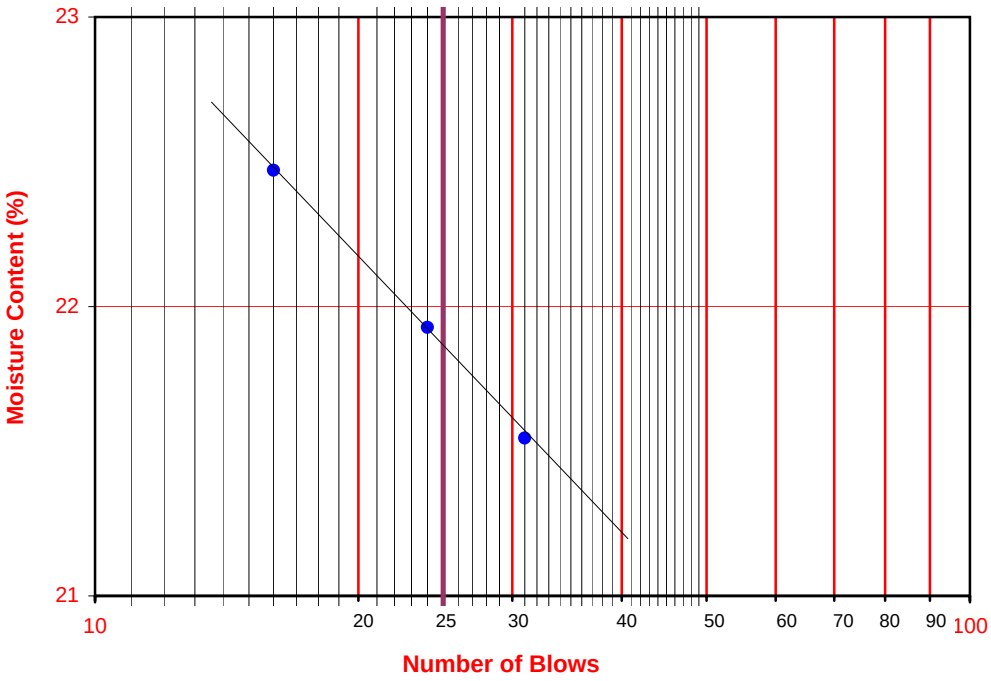
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	03/13/09
Project No. :	602231-002	Input By:	J. Ward	Date:	03/18/09
Boring No.:	A-09-002	Checked By:	J. Ward		
Sample No.:	S-4	Depth (ft.)	45.0		
Soil Identification:	Dark brown silty clay (CL-ML)				

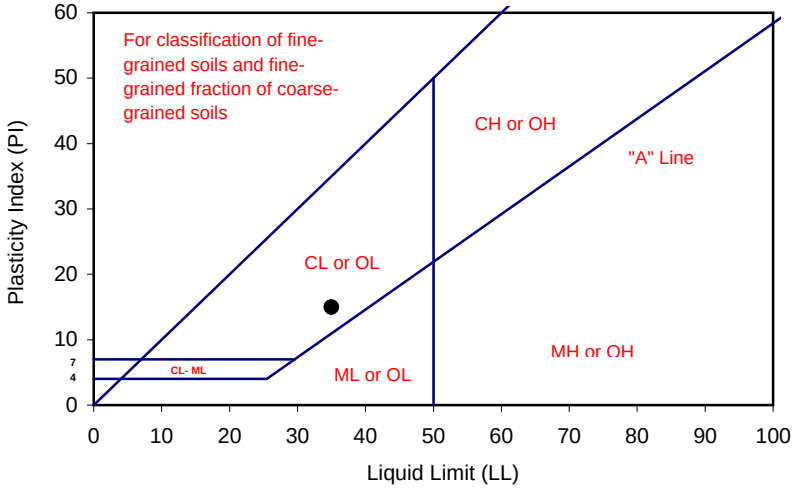
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	24	15	
Wet Wt. of Soil + Cont. (g)	9.49	10.48	21.45	20.59	23.38	
Dry Wt. of Soil + Cont. (g)	8.08	8.91	16.33	15.54	17.34	
Wt. of Container (g)	1.06	1.03	1.01	1.05	1.03	
Moisture Content (%) [Wn]	20.09	19.92	33.42	34.85	37.03	

Liquid Limit	**35**
Plastic Limit	**20**
Plasticity Index	**15**
Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) 10.95

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



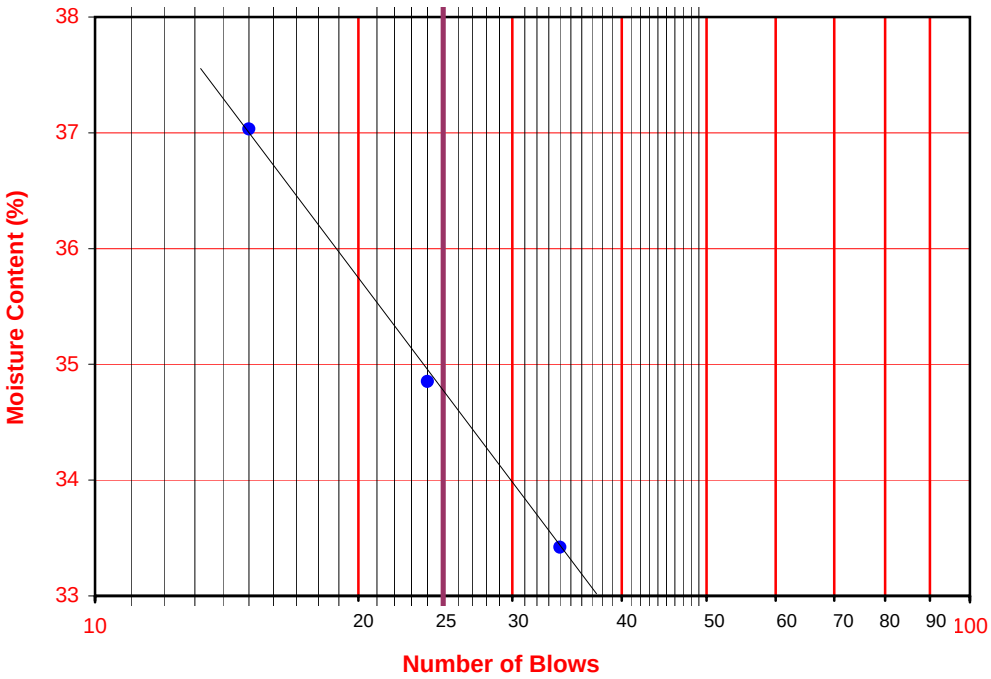
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	03/17/09
Project No. :	602231-002	Input By:	J. Ward	Date:	03/18/09
Boring No.:	A-09-002	Checked By:	J. Ward		
Sample No.:	S-6	Depth (ft.)	55.0		
Soil Identification:	Light reddish brown silty clay (CL-ML)				

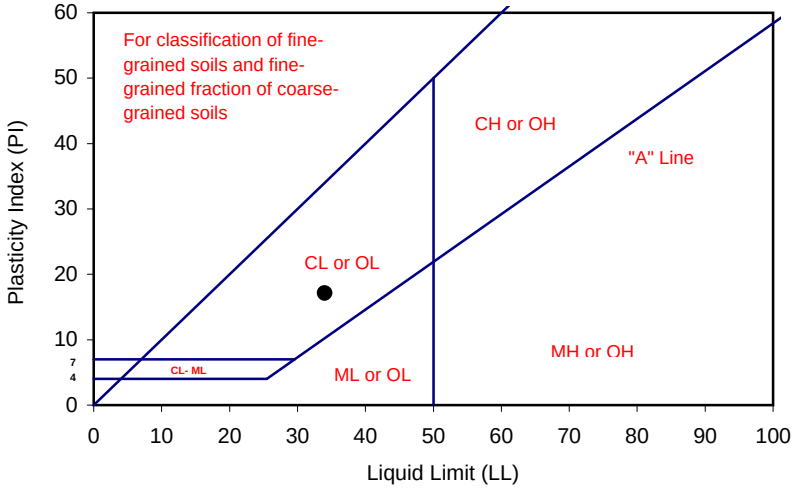
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			29	23	17	
Wet Wt. of Soil + Cont. (g)	10.39	9.96	20.30	20.87	21.57	
Dry Wt. of Soil + Cont. (g)	9.05	8.67	15.48	15.74	16.15	
Wt. of Container (g)	1.09	1.04	1.06	1.02	1.06	
Moisture Content (%) [Wn]	16.83	16.91	33.43	34.85	35.92	

Liquid Limit	**34**
Plastic Limit	**17**
Plasticity Index	**17**
Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) 10.22

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



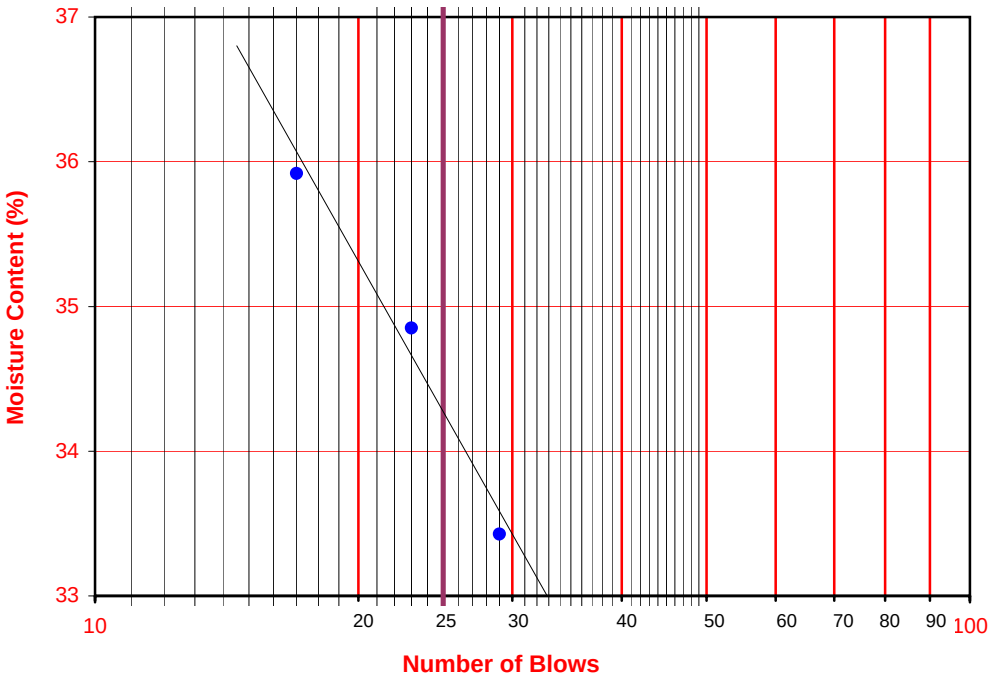
PROCEDURES USED

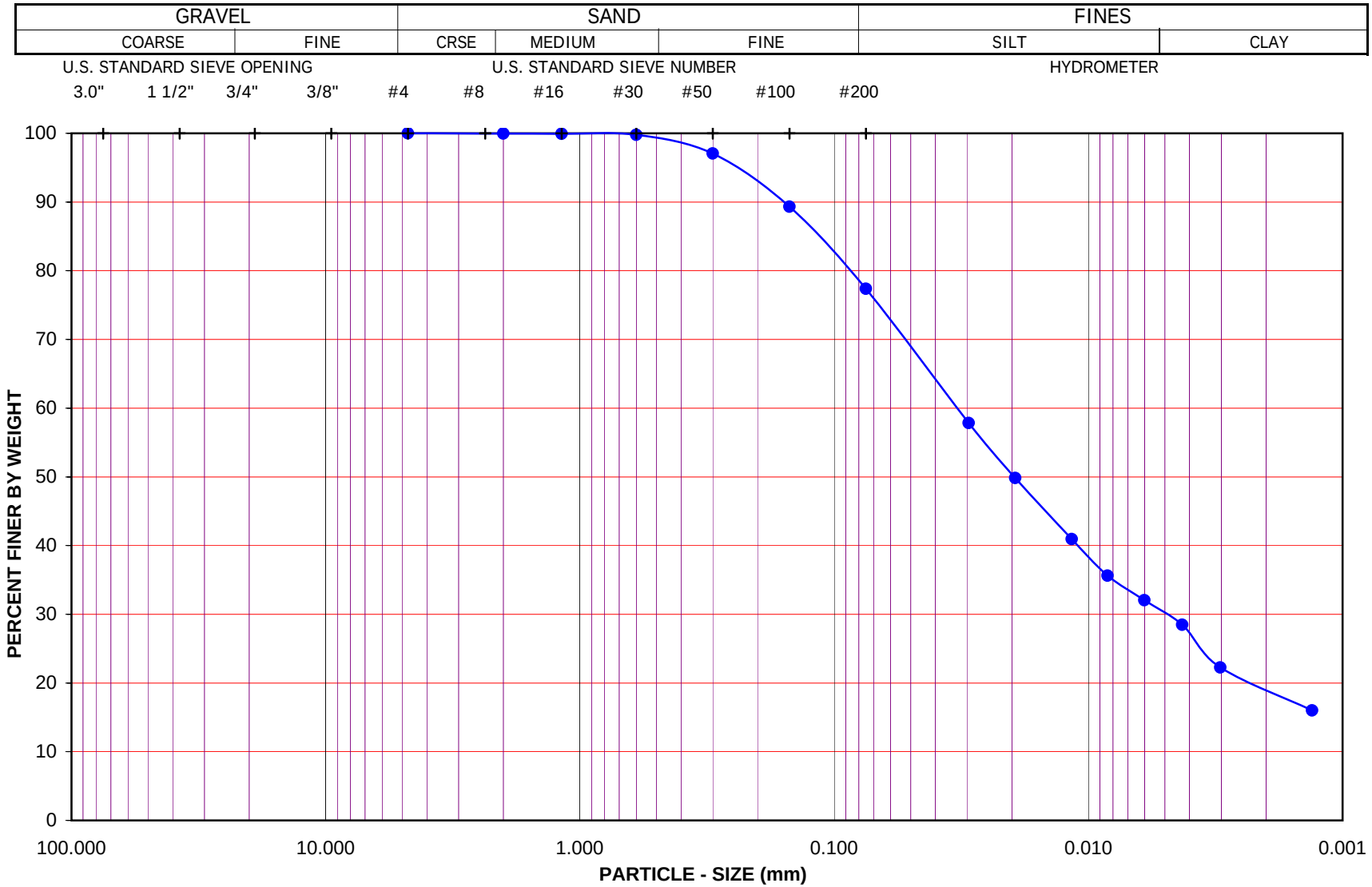
[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test





Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-001 Sample No.: S-3

Depth (feet) : 35.0 Soil Type : (ML)

Soil Identification: Light brown silt with sand (ML)

GR:SA:FI : (%) 0 : 23 : 77

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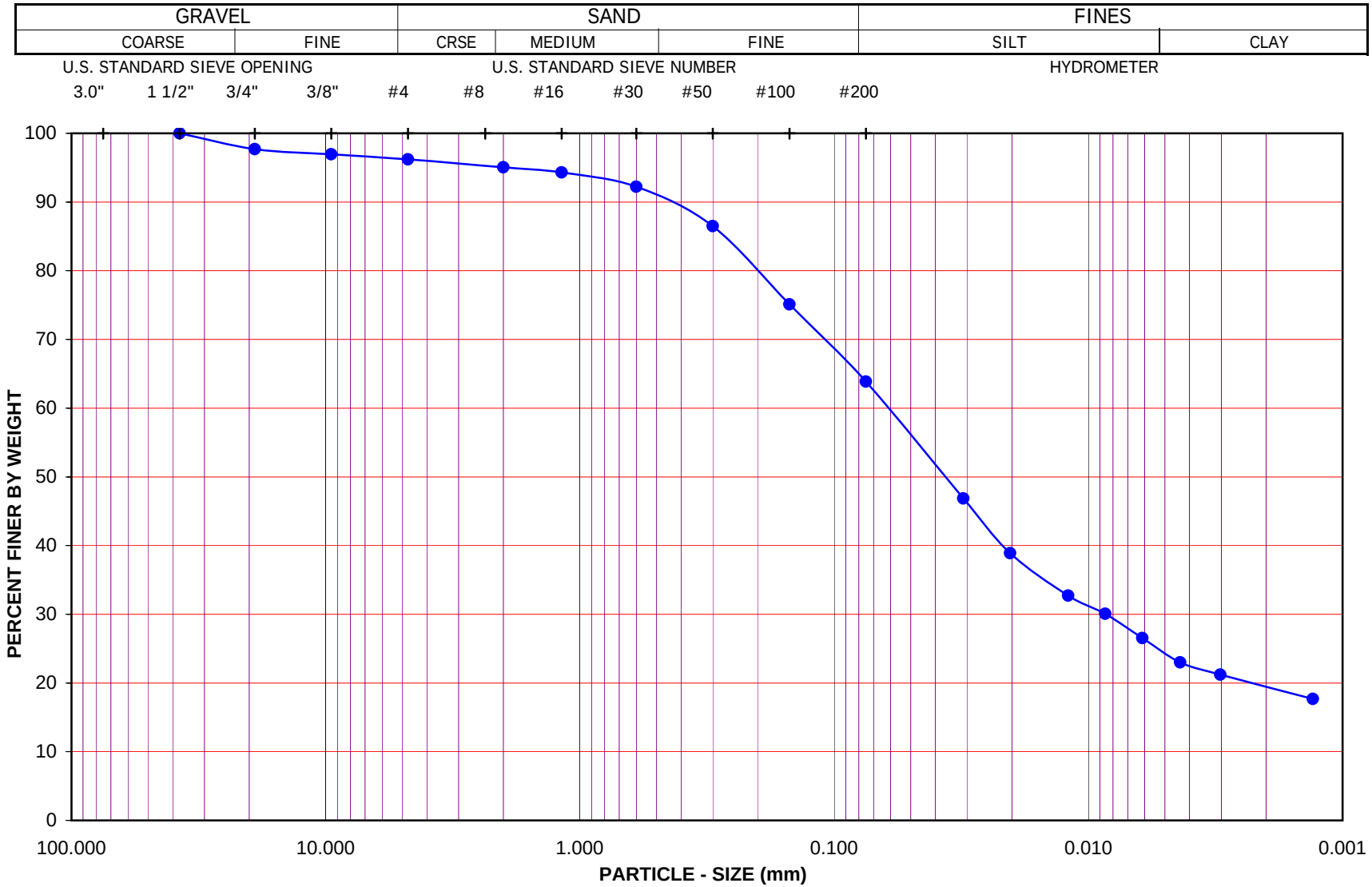
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-002 Sample No.: S-5

Depth (feet) : 50.0 Soil Type : (ML)

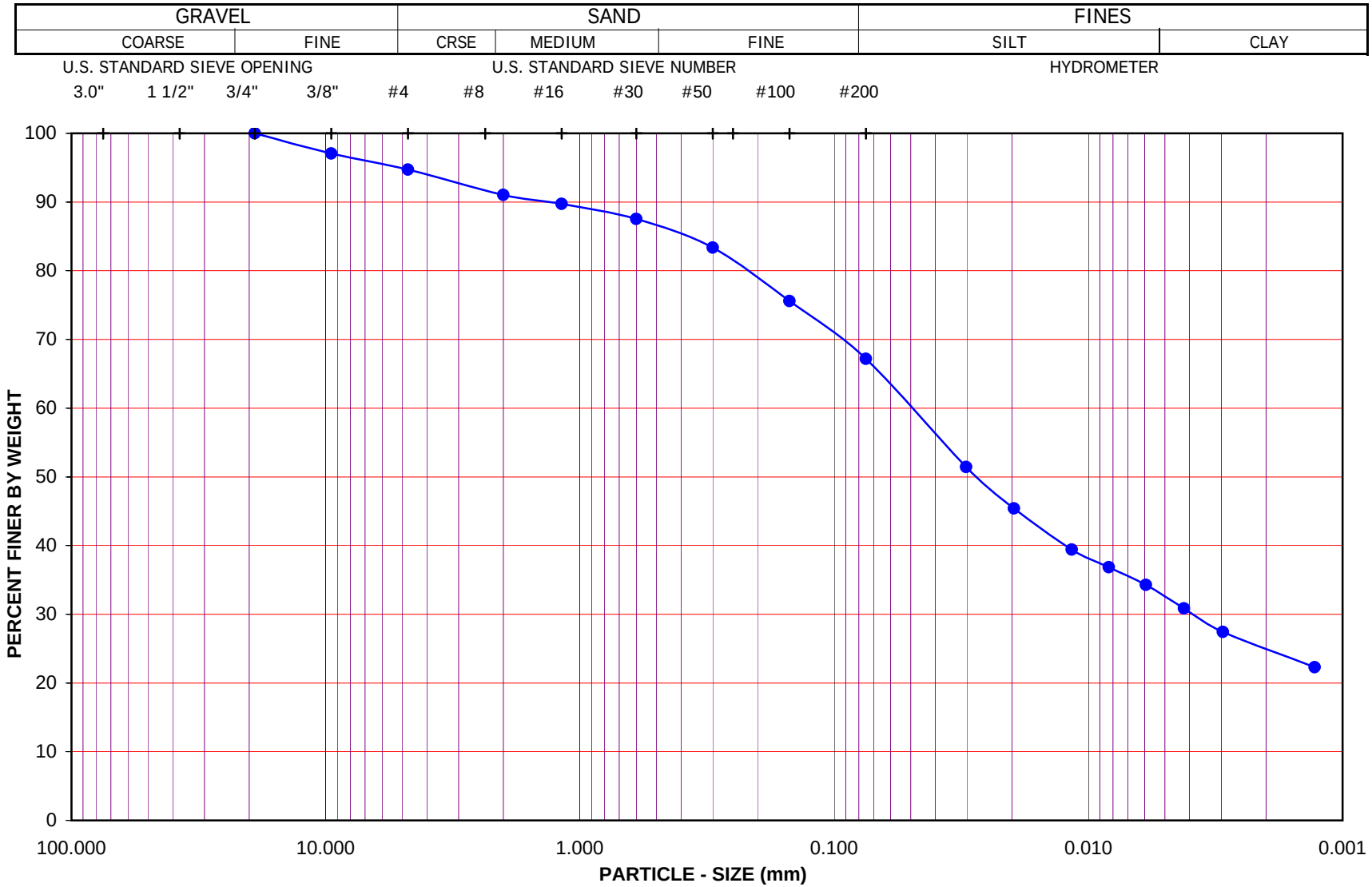
Soil Identification: Light reddish brown sandy silt (ML)

GR:SA:FI : (%) 4 : 32 : 64

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-002 Sample No.: S-9

Depth (feet) : 70.0 Soil Type : (ML)

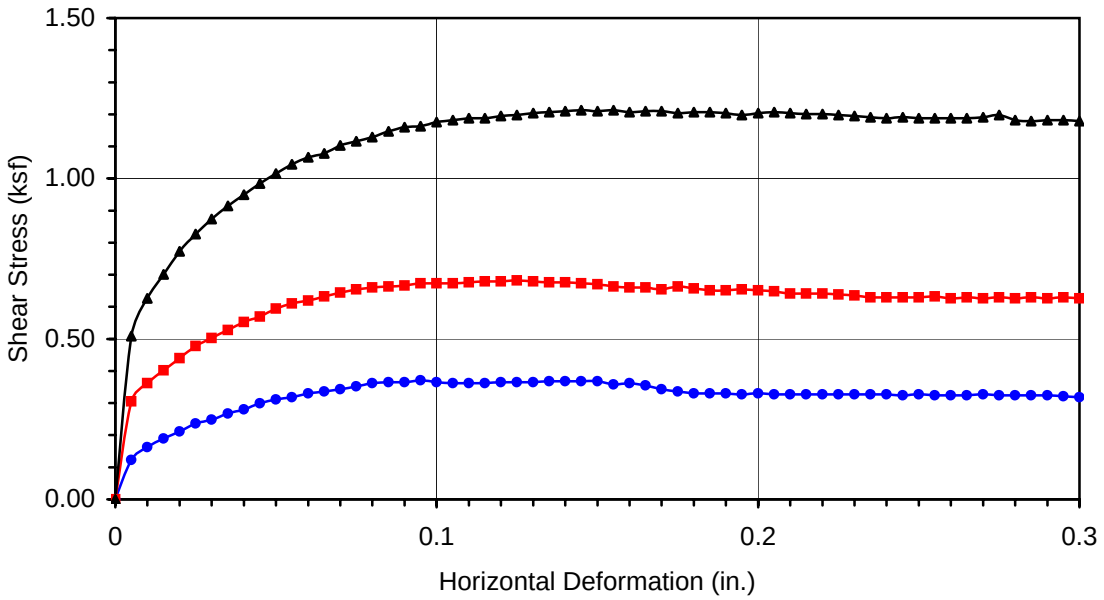
Soil Identification: Light reddish brown silt with sand (ML)

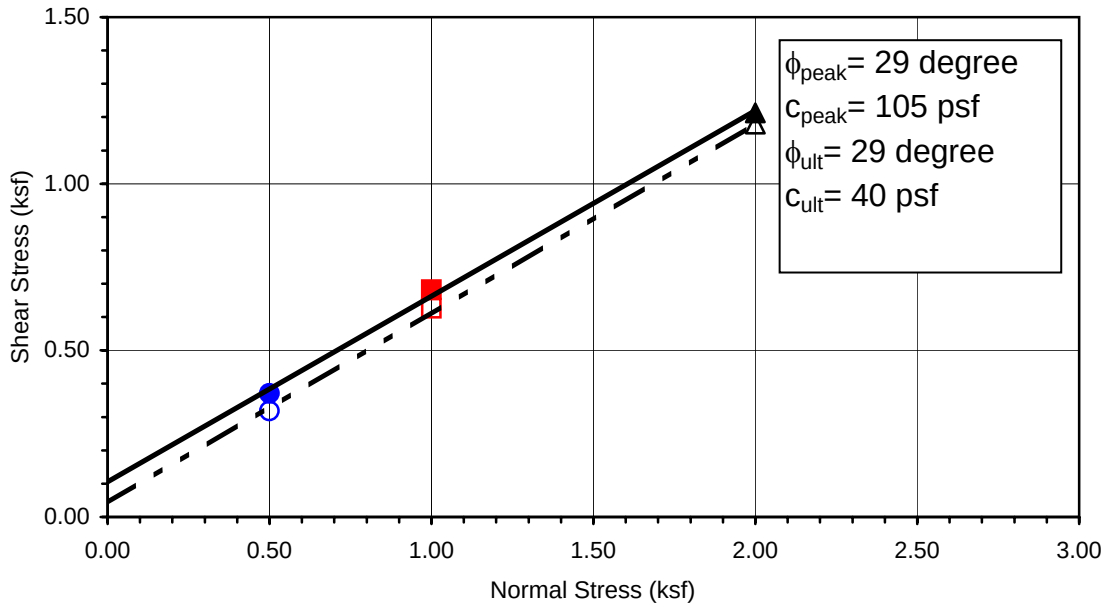
GR:SA:FI : (%) 5 : 28 : 67

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10





Boring No.	**A-09-001**
Sample No.	**R-1**
Depth (ft)	**5**
Sample Type: Drive	
Soil Identification: Dark grayish brown silty sand (SM)	

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.371	■ 0.682	▲ 1.213
Shear Stress @ End of Test (ksf)	○ 0.318	□ 0.626	△ 1.179
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	26.29	26.29	26.29
Dry Density (pcf)	89.0	90.7	92.6
Saturation (%)	79.4	82.6	86.5
Soil Height Before Shearing (in.)	0.9928	0.9644	0.9462
Final Moisture Content (%)	35.5	35.6	32.1

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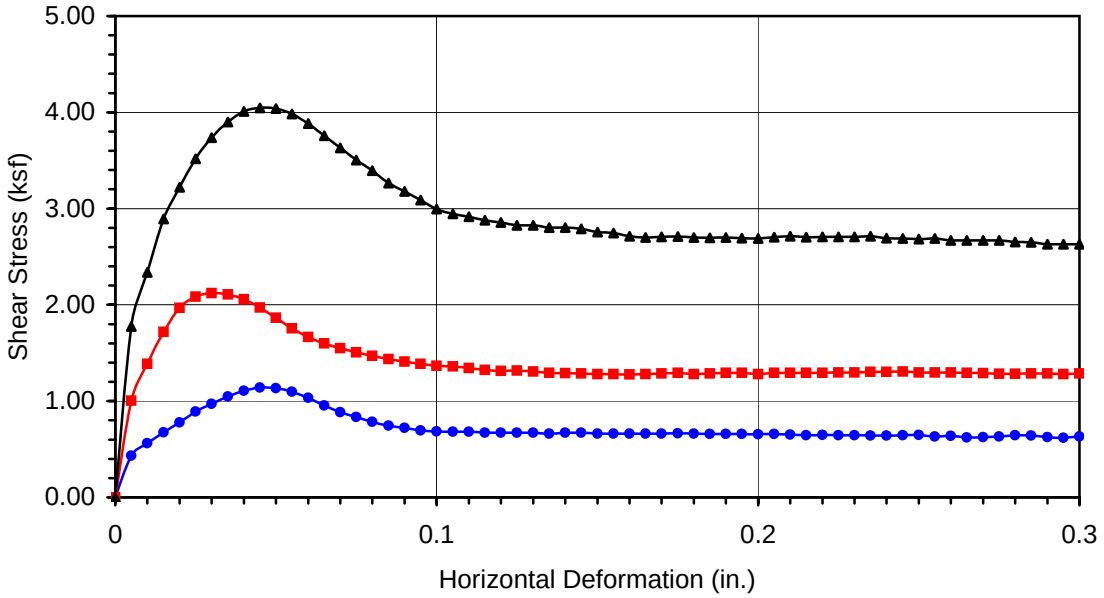
DIRECT SHEAR TEST RESULTS

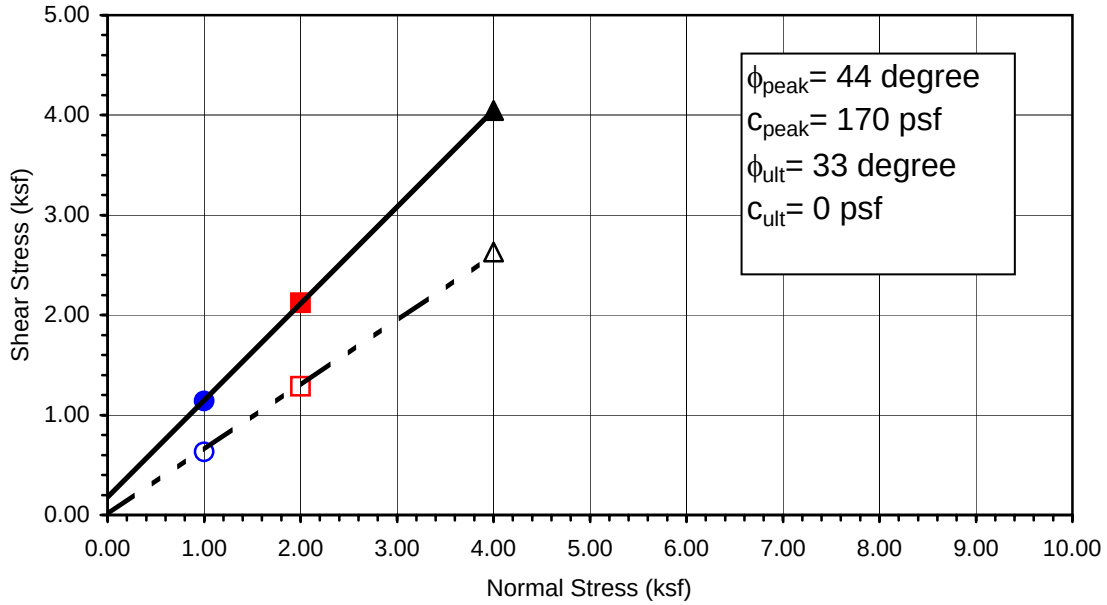
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09





Boring No.	**A-09-001**
Sample No.	**R-5**
Depth (ft)	**40**

Sample Type:

Drive

Soil Identification:
Light brown poorly graded sand (SP)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.141	■ 2.122	▲ 4.046
Shear Stress @ End of Test (ksf)	○ 0.632	□ 1.286	△ 2.631
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	5.36	5.36	5.36
Dry Density (pcf)	109.8	112.3	112.7
Saturation (%)	27.1	28.9	29.2
Soil Height Before Shearing (in.)	0.9956	0.9916	0.9865
Final Moisture Content (%)	19.3	18.0	18.1

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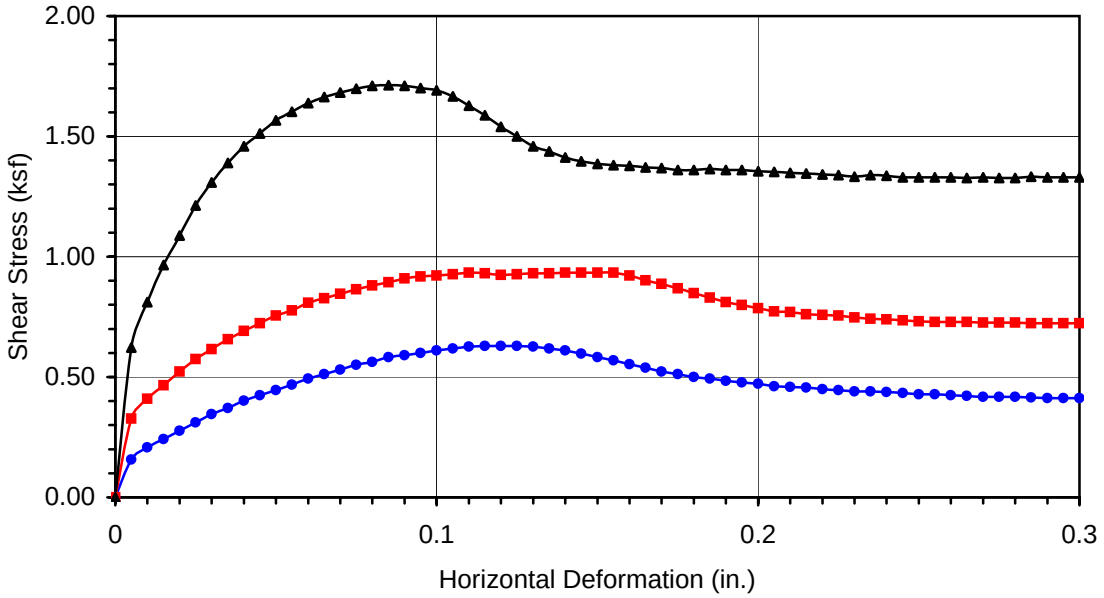
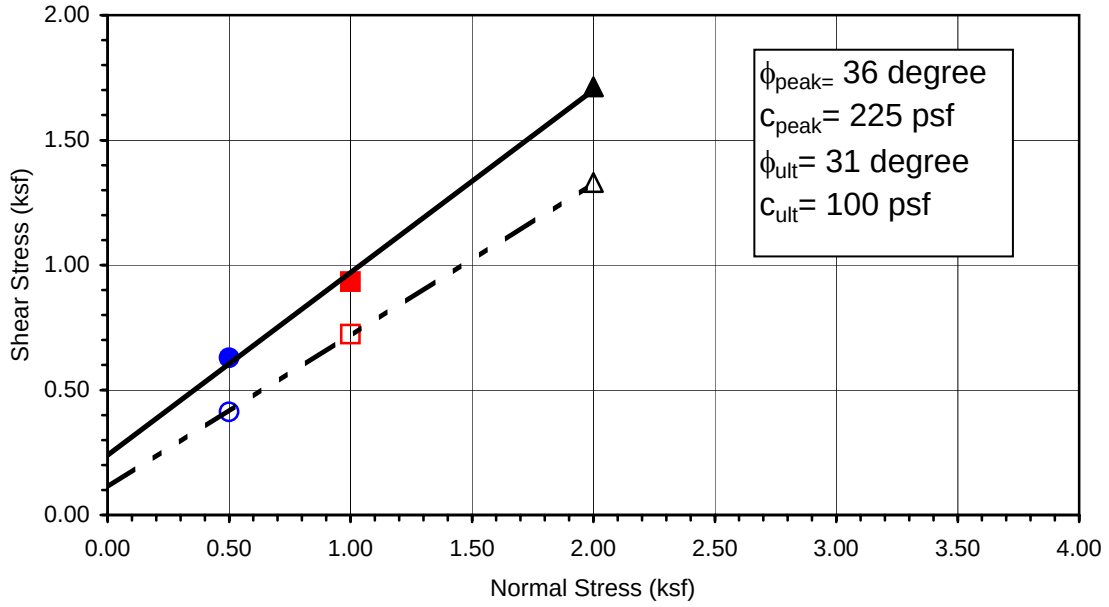
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09





Boring No.	**A-09-002**
Sample No.	**R-3**
Depth (ft)	**20**

Sample Type:

Drive

Soil Identification:
Dark brown silty sand (SM)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.629	■ 0.934	▲ 1.713
Shear Stress @ End of Test (ksf)	○ 0.412	□ 0.723	△ 1.330
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	17.82	17.82	17.82
Dry Density (pcf)	109.9	109.2	110.7
Saturation (%)	90.2	88.6	92.0
Soil Height Before Shearing (in.)	0.9704	0.9556	0.9746
Final Moisture Content (%)	20.4	20.7	16.4

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DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09

Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 03/05/09

Project No. : 602231-002 | Data Input By: J. Ward | Date: 03/19/09

Boring No.	A-09-001	A-09-002		
Sample No.	Bag-1	Bag-1		
Sample Depth (ft)	1-5	1-5		
Soil Identification:	Dark gray (ML)	Dark brown (SP-SM)		
Wet Weight of Soil + Container (g)	184.90	153.20		
Dry Weight of Soil + Container (g)	179.00	140.10		
Weight of Container (g)	69.10	35.60		
Moisture Content (%)	5.37	12.54		
Weight of Soaked Soil (g)	100.10	100.50		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	6	8		
Crucible No.	21	23		
Furnace Temperature (°C)	830	830		
Time In / Time Out	7:20 / 8:05	7:20 / 8:05		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	18.8027	18.4150		
Wt. of Crucible (g)	18.8001	18.4133		
Wt. of Residue (g) (A)	0.0026	0.0017		
PPM of Sulfate (A) x 41150	106.99	69.95		
PPM of Sulfate, Dry Weight Basis	**113**	**80**		

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30		
ml of AgNO3 Soln. Used in Titration (C)	1.0	0.7		
PPM of Chloride (C -0.2) * 100 * 30 / B	80	50		
PPM of Chloride, Dry Wt. Basis	**85**	**57**		

pH TEST, DOT California Test 532/643

pH Value	**7.76**	**7.54**		
Temperature °C	19.9	19.9		

Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 N Widening | Tested By : V. Juliano | Date: 01/18/10

Project No. : 602231-002 | Data Input By: J. Ward | Date: 01/20/10

Boring No.	A-09-001	A-09-002		
Sample No.	S-2	S-1		
Sample Depth (ft)	25.0	15.0		
Soil Identification:	Dark brown (SM)	Light brown (SP-SM)		
Wet Weight of Soil + Container (g)	153.40	201.10		
Dry Weight of Soil + Container (g)	152.80	200.80		
Weight of Container (g)	65.20	60.70		
Moisture Content (%)	0.68	0.21		
Weight of Soaked Soil (g)	100.20	100.50		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	6	8		
Crucible No.	20	21		
Furnace Temperature (°C)	830	830		
Time In / Time Out	7:30 / 8:15	7:30 / 8:15		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	21.2290	18.8035		
Wt. of Crucible (g)	21.2275	18.8031		
Wt. of Residue (g) (A)	0.0015	0.0004		
PPM of Sulfate (A) x 41150	61.73	16.46		
PPM of Sulfate, Dry Weight Basis	**62**	**16**		

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30		
ml of AgNO3 Soln. Used in Titration (C)	0.8	0.9		
PPM of Chloride (C -0.2) * 100 * 30 / B	60	70		
PPM of Chloride, Dry Wt. Basis	**60**	**70**		

pH TEST, DOT California Test 532/643

pH Value	**7.12**	**7.57**		
Temperature °C	20.7	20.6		

Leighton

SOIL RESISTIVITY TEST

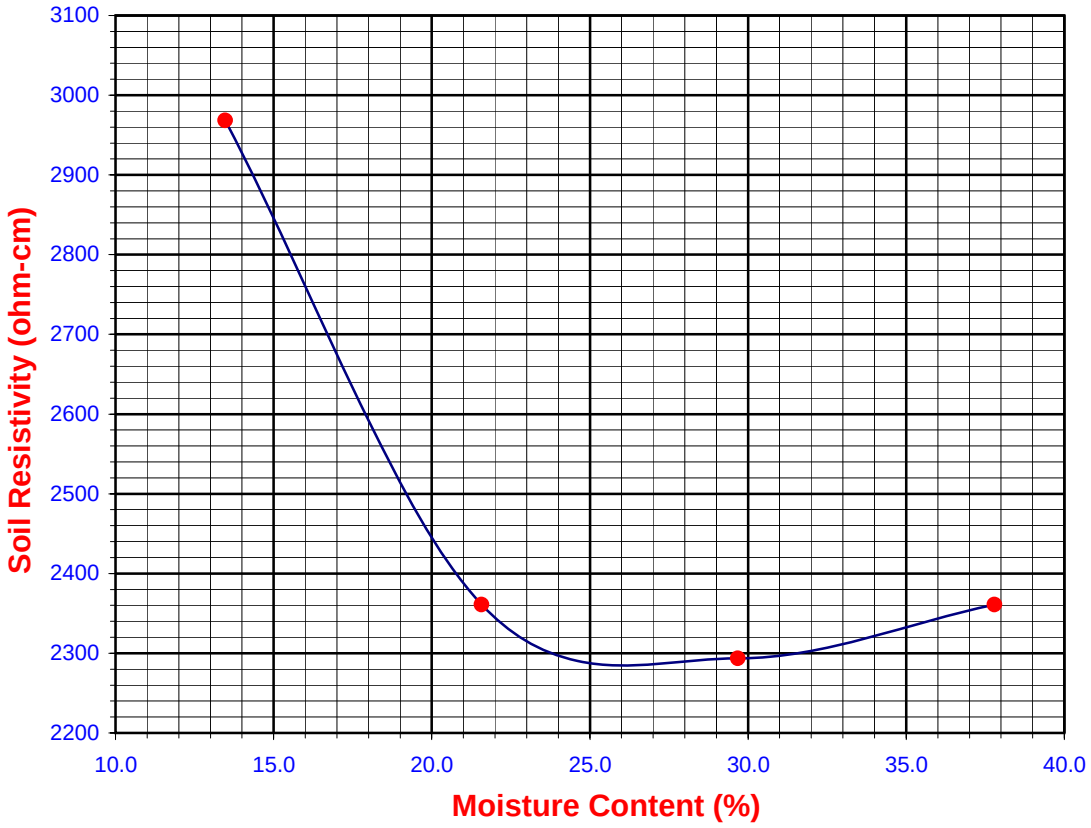
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/06/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/19/09
Boring No.:	A-09-001	Depth (ft.) :	1-5		
Sample No. :	Bag-1				
Soil Identification:	Dark gray (ML)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	13.47	440	2968
2	200	21.58	350	2361
3	300	29.68	340	2294
4	400	37.79	350	2361
5				

Moisture Content (%) (MCi)	5.37
Wet Wt. of Soil + Cont. (g)	184.90
Dry Wt. of Soil + Cont. (g)	179.00
Wt. of Container (g)	69.10
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
2285	**26.2**	**113**	**85**	**7.76**	**19.9**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: SR-57 Widening

Project No. : 602231-002

Boring No.: A-09-002

Sample No. : Bag-1

Soil Identification: Dark brown (SP-SM)

Tested By : V. Juliano Date: 03/10/09

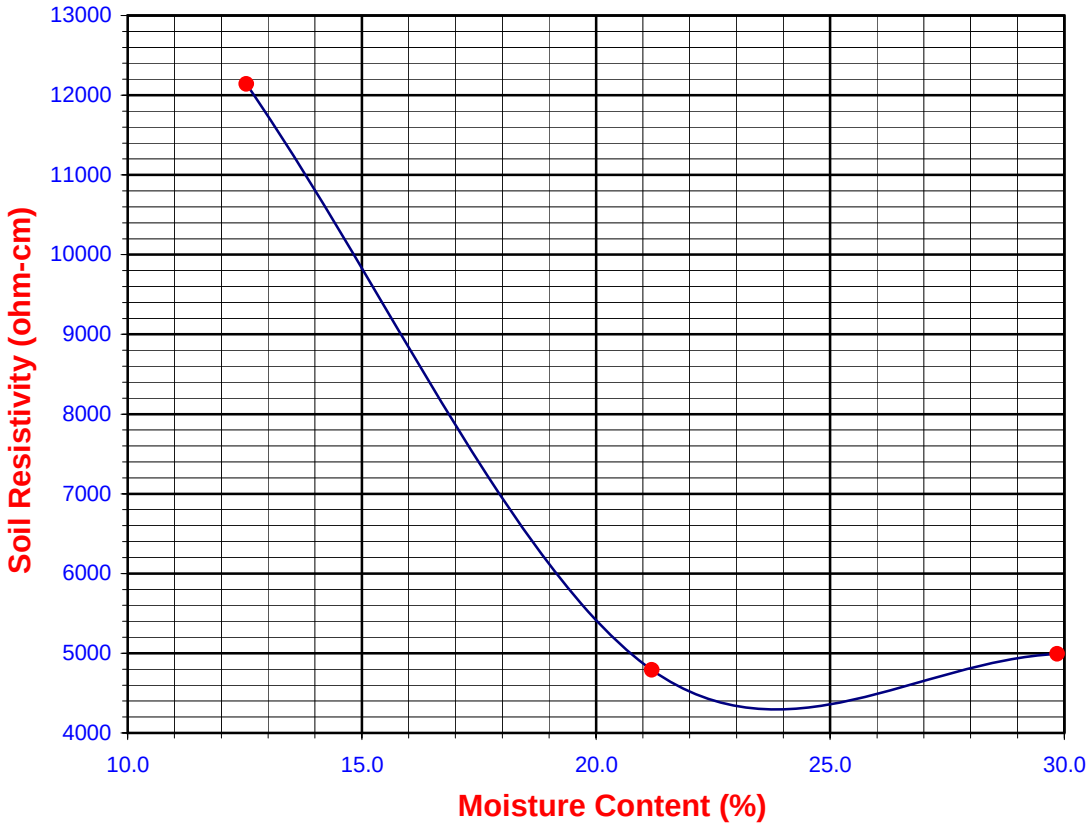
Data Input By: J. Ward Date: 03/19/09

Depth (ft.) : 1-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	0	12.54	1800	12143
2	100	21.19	710	4790
3	200	29.85	740	4992
4				
5				

Moisture Content (%) (MCi)	12.54
Wet Wt. of Soil + Cont. (g)	153.20
Dry Wt. of Soil + Cont. (g)	140.10
Wt. of Container (g)	35.60
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
4300	**23.8**	**80**	**57**	**7.54**	**19.9**



APPENDIX B

Lateral Earth Pressure Calculation

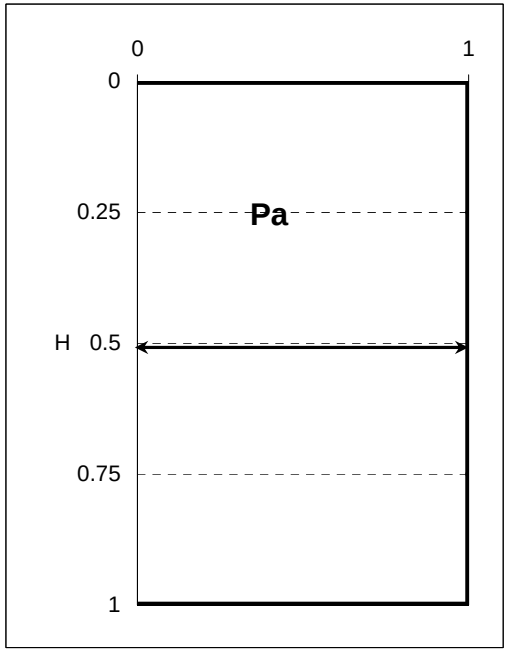
ϕ (degree)	32		
γ (pcf)	125.0		
Individual Pile	No		
Factor of Safety	1.0		
	Level Backfill	Both Back and Front slope	
H, Horizontal		2	
V, Vertical		1	
Friction resistance	0.42		
K_p	3.25	1.23	
K_0	0.47	0.72	
K_a	0.31	0.47	
P_p (pcf)	**406.8**	**154.4**	
P_0 (pcf)	**58.8**	**89.9**	
P_a (pcf)	**38.4**	**58.8**	

Temporary Excavation - Braced Cut

	1	2	3	
	Sand	Soft & Medium Clay	Stiff Clay	

Soil Type: 1

Soil Pressure (psf): **25.0**



Assumption: Wall friction (δ) assumed to be 0.
Passive Pressure: Rankine Theory
Active Pressure: Rankine Theory for Level Backfill and NAVFAC DM 7.02 Ch3 for Sloping Backfill.
At rest condition: empirical relationship by Jaky 1944

Jaky, J., 1944, The Coefficient of Earth Pressure at Rest," Journal of the Society of Hungarian Architects and Engineers, Vol 7, 355-358

NAVFAC Figure 33, Passive pressure distribution for solider piles, p7.2-112

LATERAL EARTH PRESSURES-STATIC CONDITION
KATELLA AVENUE UNDERCROSSING
ANAHEIM, CALIFORNIA

PROJECT NAME : SR-57/Katella Ave Widen
PROJECT NO: 602231-001
DESIGNED BY: TK
CHECKED BY: DJC
DATE: 2/1/2010

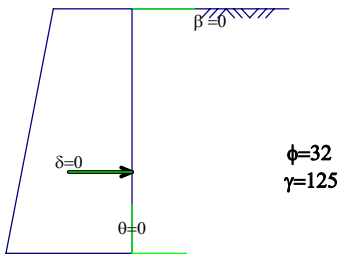
Figure B1

INPUT DATA

Condition:…… Horizontal Soil Layer (MCE)

ϕ, Soil friction (deg)	32.0
δ, Friction angle between soil and concrete wall (deg)	0.0
β, Backfill slope angle (deg)	0.0
θ, Angle of wall slope with vertical wall	0.0
γ, Wet unit weight of the soil (pcf)	125
PeakHorizontal Acceleration	0.42
k_h, Horizontal acceleration coefficient	0.21
k_v, Vertical acceleration coefficient	0.00
$\psi = \tan^{-1}(k_h/(1-k_v))$	11.9 deg

CONFIGURATION



OUTPUT

a) At Rest condition

1. Coeff of **Earth Pressure at Rest, Ko** :…….…… **0.47**
   Equivalent Fluid Pressure…… 58.8 psf/ft

USE 59 psf/ft

Rankine Solution (For vertical wall only, θ = 0, assuming no wall friction, δ = 0, and upward backfill only, β>0)

1. Coeff of **Active Earth Pressure, K_A** :…….. **0.31**
   Equivalent Fluid Pressure…… 38.4 psf/ft

USE 39 psf/ft

$$K_A^{RANKINE} = \frac{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}$$

2. Coeff of **Passive Earth Pressure, K_P**:……..**3.25**
   Equivalent Fluid Pressure…… 406.8 psf/ft

USE 400 psf/ft

$$K_P^{RANKINE} = \frac{\cos\beta + \sqrt{\cos^2\beta - \cos^2\phi}}{\cos\beta - \sqrt{\cos^2\beta - \cos^2\phi}}$$

3. Coeff of **Seismic & Static Active Earth Pressure, K_{AE}** :…… **0.45**
   Equivalent Fluid Pressure…….. 56 psf/ft

$$K_{AE} = \frac{\cos^2(\phi-\theta-\psi)}{\cos\psi\cos^2\theta\cos(\delta+\theta+\psi)\left[1+\sqrt{\frac{\sin(\delta+\phi)\sin(\phi-\beta-\psi)}{\cos(\delta+\theta+\psi)\cos(\beta-\theta)}}\right]^2}$$

4. **Seismic Active Earth Pressure**
   Equivalent Fluid Pressure: 56 psf/ft- 39 psf/ft= 17.1 psf/ft

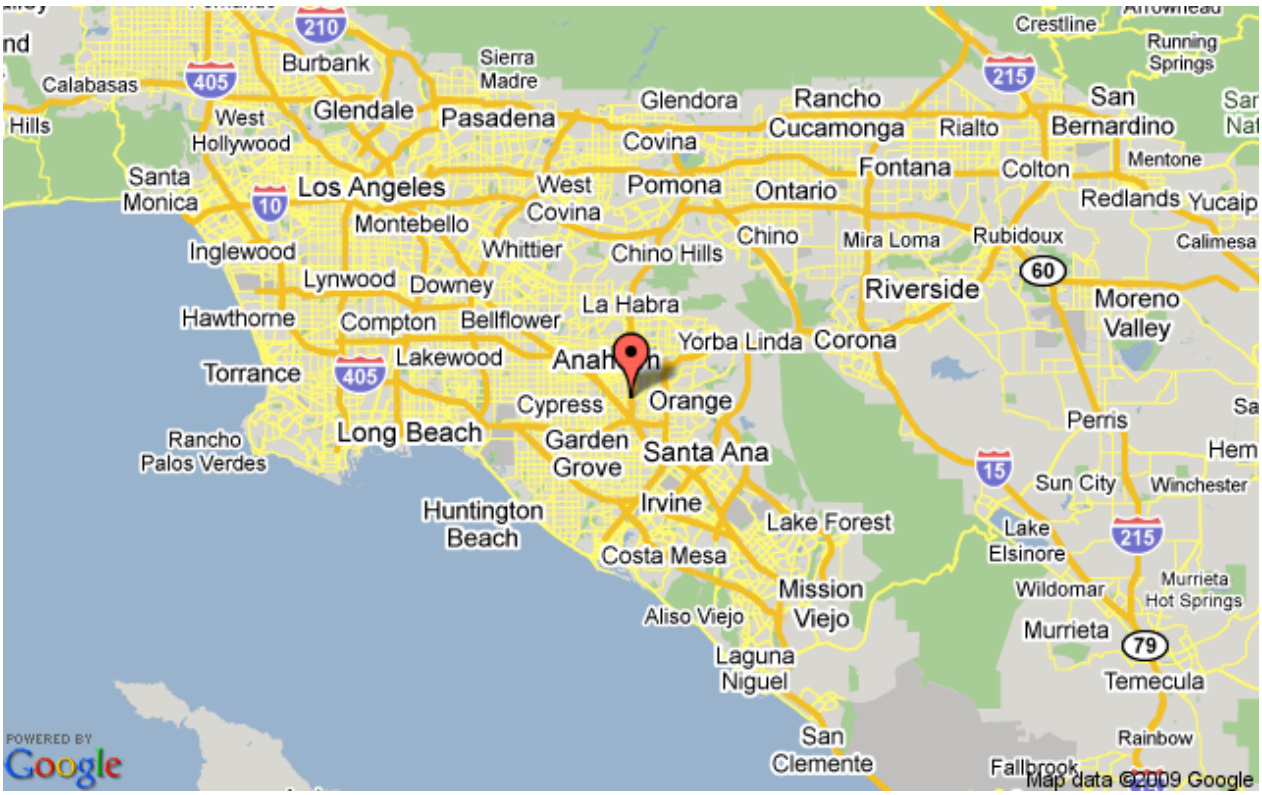
USE 18 psf/ft

Ref:
1. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prince Hall, 1996.
2. Donald P. Couto, "Foundation Design, Principles and Design", Prince Hall, 1994.

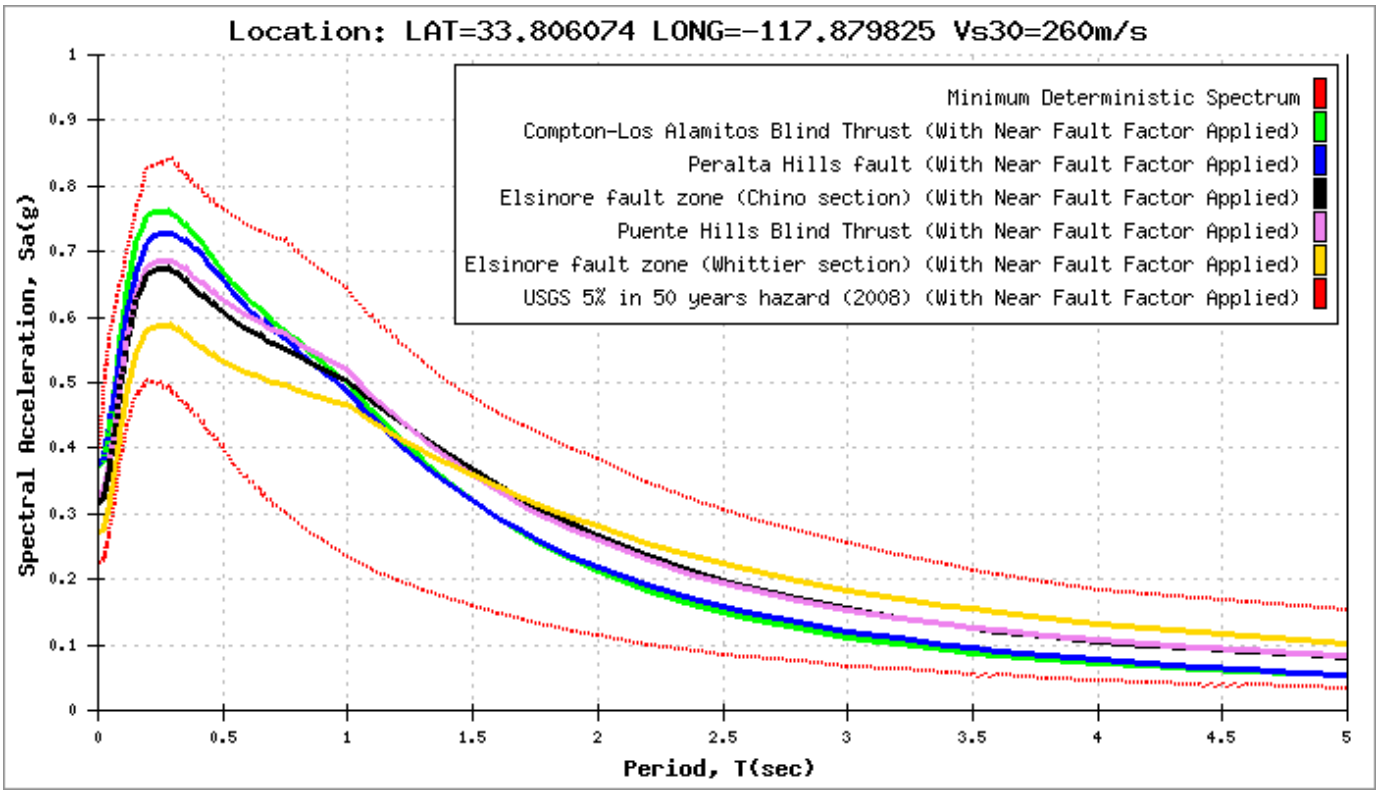
P:\Legacy\Consulting\602000\602231-002 SB 57 Phase 2\SIG\Lateral Loads\Lateral Active and Passive Pressures Seismic_Katella.xls\Output

PASSIVE AND ACTIVE PRESSURES **KATELLA AVENUE UNDERCROSSING** **ANAHEIM, CALIFORNIA**	PROJECT NAME : KATELLA AVE UC PROJECT NUMBER : 602231-002 DESIGNED/CHECKED BY: TK/DJC	**Figure B2**

SELECT SITE LOCATION



CALCULATED SPECTRA



SITE DATA

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	6.2	(5 to 8.5)
F_{RV}	1	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	50	(0 to 90)
Z_{TOR} *(km)*	0	

Distance

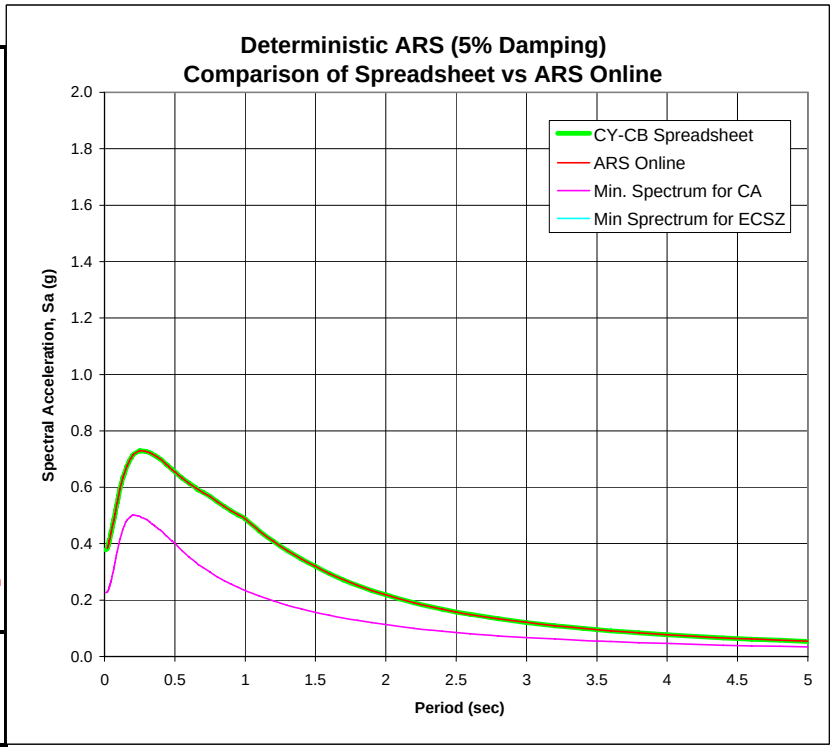
R_{RUP} *(km)*	3.8	
R_{JB} *(km)*	3.8	
R_X *(km)*	3.1	
Hanging Wall?	☐ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	260	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	405	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 1%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.37817
0.020	0.38354
0.022	0.38736
0.025	0.39243
0.029	0.39845
0.030	0.40025
0.032	0.40504
0.035	0.41187
0.036	0.41410
0.040	0.42259
0.042	0.42721
0.044	0.43186
0.045	0.43430
0.046	0.43675
0.048	0.44136
0.050	0.44596
0.055	0.45770
0.060	0.46961
0.065	0.48159
0.067	0.48654
0.070	0.49387
0.075	0.50608
0.080	0.51931
0.085	0.53238
0.090	0.54532
0.095	0.55807
0.100	0.57043
0.110	0.59297
0.120	0.61358
0.130	0.63204
0.133	0.63694
0.140	0.64772
0.150	0.66179
0.160	0.67475
0.170	0.68606
0.180	0.69638

Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.378	1	1	0.378	0%
0.02	0.383	1	1	0.383	0%
0.022	0.387	1	1	0.387	0%
0.025	0.392	1	1	0.392	0%
0.029	0.398	1	1	0.398	0%
0.03	0.4	1	1	0.4	0%
0.032	0.405	1	1	0.405	0%
0.035	0.412	1	1	0.412	0%
0.036	0.414	1	1	0.414	0%
0.04	0.423	1	1	0.423	0%
0.042	0.427	1	1	0.427	0%
0.044	0.432	1	1	0.432	0%
0.045	0.434	1	1	0.434	0%
0.046	0.437	1	1	0.437	0%
0.048	0.441	1	1	0.441	0%
0.05	0.446	1	1	0.446	0%
0.055	0.458	1	1	0.458	0%
0.06	0.47	1	1	0.47	0%
0.065	0.482	1	1	0.482	0%
0.067	0.486	1	1	0.486	0%
0.07	0.494	1	1	0.494	0%
0.075	0.506	1	1	0.506	0%
0.08	0.519	1	1	0.519	0%
0.085	0.532	1	1	0.532	0%
0.09	0.545	1	1	0.545	0%
0.095	0.558	1	1	0.558	0%
0.1	0.57	1	1	0.57	0%
0.11	0.593	1	1	0.593	0%
0.12	0.614	1	1	0.614	0%
0.13	0.632	1	1	0.632	0%
0.133	0.637	1	1	0.637	0%
0.14	0.648	1	1	0.648	0%
0.15	0.662	1	1	0.662	0%
0.16	0.675	1	1	0.675	0%
0.17	0.686	1	1	0.686	0%
0.18	0.696	1	1	0.696	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.234		
0.029	0.238		
0.03	0.239		
0.032	0.242		
0.035	0.247		
0.036	0.249		
0.04	0.255		
0.042	0.259		
0.044	0.262		
0.045	0.264		
0.046	0.266		
0.048	0.269		
0.05	0.273		
0.055	0.285		
0.06	0.297		
0.065	0.31		
0.067	0.315		
0.07	0.322		
0.075	0.334		
0.08	0.347		
0.085	0.359		
0.09	0.372		
0.095	0.384		
0.1	0.396		
0.11	0.415		
0.12	0.433		
0.13	0.449		
0.133	0.454		
0.14	0.463		
0.15	0.476		
0.16	0.483		
0.17	0.489		
0.18	0.494		

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	6.8	(5 to 8.5)
F_{RV}	1	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	20	(0 to 90)
Z_{TOR} *(km)*	5	

Distance

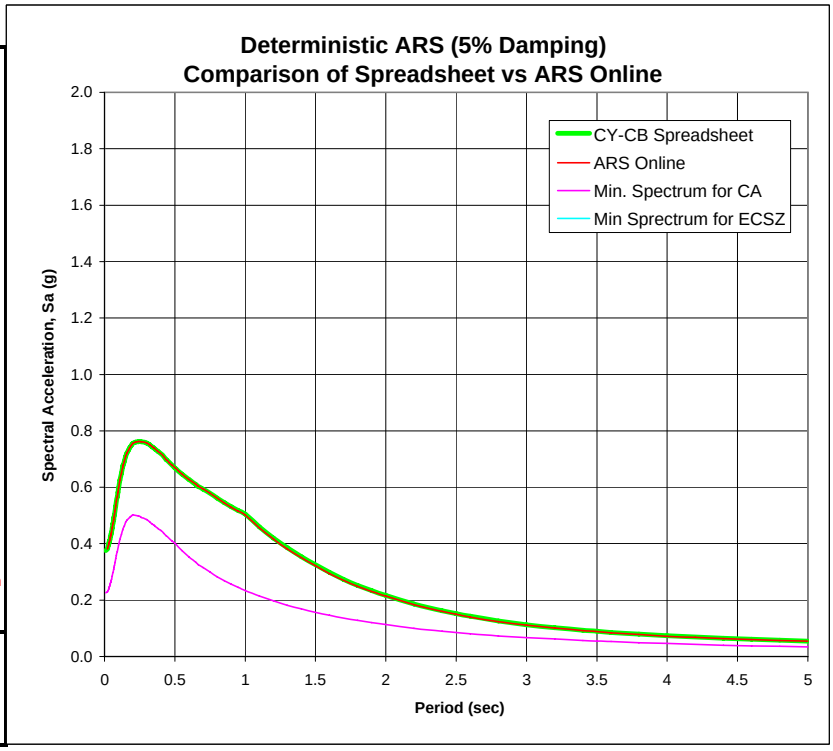
R_{RUP} *(km)*	11.7	
R_{JB} *(km)*	6.1	
R_X *(km)*	19.9	
Hanging Wall?	☑ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	260	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	435	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 2%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.37529
0.020	0.38138
0.022	0.38499
0.025	0.38978
0.029	0.39543
0.030	0.39718
0.032	0.40177
0.035	0.40818
0.036	0.41022
0.040	0.41818
0.042	0.42251
0.044	0.42688
0.045	0.42923
0.046	0.43149
0.048	0.43593
0.050	0.44024
0.055	0.45545
0.060	0.47073
0.065	0.48609
0.067	0.49233
0.070	0.50163
0.075	0.51704
0.080	0.53358
0.085	0.54982
0.090	0.56605
0.095	0.58205
0.100	0.59762
0.110	0.62465
0.120	0.64960
0.130	0.67216
0.133	0.67831
0.140	0.69179
0.150	0.70950
0.160	0.72143
0.170	0.73171
0.180	0.74081

Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.375	1	1	0.375	0%
0.02	0.381	1	1	0.381	0%
0.022	0.385	1	1	0.385	0%
0.025	0.39	1	1	0.39	0%
0.029	0.396	1	1	0.396	0%
0.03	0.397	1	1	0.397	0%
0.032	0.402	1	1	0.402	0%
0.035	0.408	1	1	0.408	0%
0.036	0.41	1	1	0.41	0%
0.04	0.418	1	1	0.418	0%
0.042	0.423	1	1	0.423	0%
0.044	0.427	1	1	0.427	0%
0.045	0.429	1	1	0.429	0%
0.046	0.432	1	1	0.432	0%
0.048	0.436	1	1	0.436	0%
0.05	0.44	1	1	0.44	0%
0.055	0.456	1	1	0.456	0%
0.06	0.471	1	1	0.471	0%
0.065	0.486	1	1	0.486	0%
0.067	0.492	1	1	0.492	0%
0.07	0.502	1	1	0.502	0%
0.075	0.517	1	1	0.517	0%
0.08	0.534	1	1	0.534	0%
0.085	0.55	1	1	0.55	0%
0.09	0.566	1	1	0.566	0%
0.095	0.582	1	1	0.582	0%
0.1	0.598	1	1	0.598	0%
0.11	0.625	1	1	0.625	0%
0.12	0.65	1	1	0.65	0%
0.13	0.672	1	1	0.672	0%
0.133	0.678	1	1	0.678	0%
0.14	0.692	1	1	0.692	0%
0.15	0.71	1	1	0.71	0%
0.16	0.722	1	1	0.722	0%
0.17	0.732	1	1	0.732	0%
0.18	0.741	1	1	0.741	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.234		
0.029	0.238		
0.03	0.239		
0.032	0.242		
0.035	0.247		
0.036	0.249		
0.04	0.255		
0.042	0.259		
0.044	0.262		
0.045	0.264		
0.046	0.266		
0.048	0.269		
0.05	0.273		
0.055	0.285		
0.06	0.297		
0.065	0.31		
0.067	0.315		
0.07	0.322		
0.075	0.334		
0.08	0.347		
0.085	0.359		
0.09	0.372		
0.095	0.384		
0.1	0.396		
0.11	0.415		
0.12	0.433		
0.13	0.449		
0.133	0.454		
0.14	0.463		
0.15	0.476		
0.16	0.483		
0.17	0.489		
0.18	0.494		

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	7.6	(5 to 8.5)
F_{RV}	1	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	50	(0 to 90)
Z_{TOR} *(km)*	0	

Distance

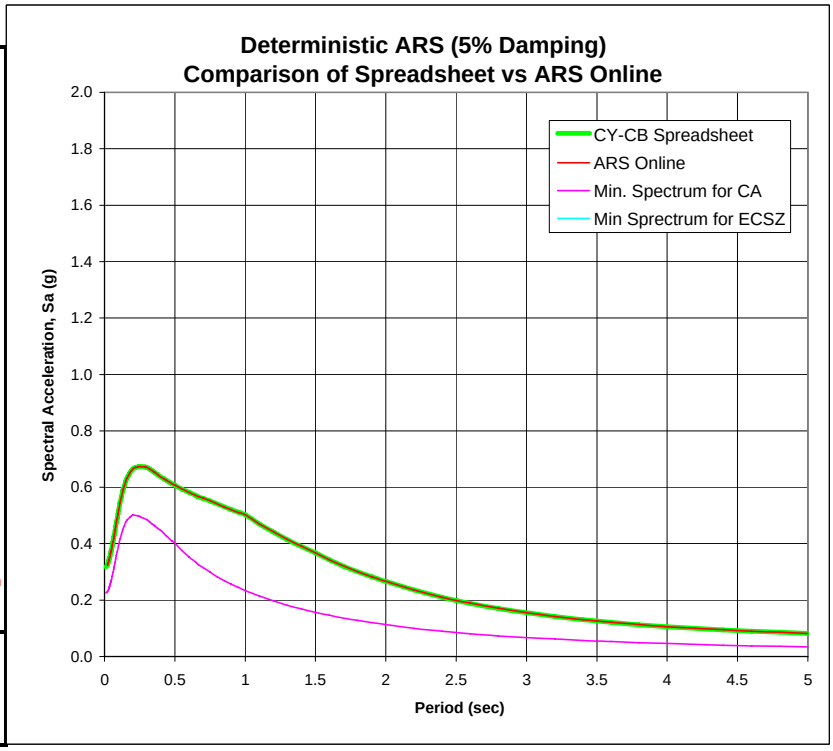
R_{RUP} *(km)*	17.1	
R_{JB} *(km)*	9.7	
R_X *(km)*	22.3	
Hanging Wall?	☑ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	260	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	405	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 0%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.31757
0.020	0.32346
0.022	0.32680
0.025	0.33129
0.029	0.33673
0.030	0.33839
0.032	0.34257
0.035	0.34854
0.036	0.35051
0.040	0.35799
0.042	0.36213
0.044	0.36629
0.045	0.36850
0.046	0.37070
0.048	0.37490
0.050	0.37906
0.055	0.39229
0.060	0.40572
0.065	0.41917
0.067	0.42473
0.070	0.43295
0.075	0.44665
0.080	0.46131
0.085	0.47583
0.090	0.49026
0.095	0.50453
0.100	0.51841
0.110	0.54335
0.120	0.56629
0.130	0.58698
0.133	0.59255
0.140	0.60483
0.150	0.62097
0.160	0.63241
0.170	0.64210
0.180	0.65080

Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.318	1	1	0.318	0%
0.02	0.323	1	1	0.323	0%
0.022	0.327	1	1	0.327	0%
0.025	0.331	1	1	0.331	0%
0.029	0.337	1	1	0.337	0%
0.03	0.338	1	1	0.338	0%
0.032	0.343	1	1	0.343	0%
0.035	0.349	1	1	0.349	0%
0.036	0.351	1	1	0.351	0%
0.04	0.358	1	1	0.358	0%
0.042	0.362	1	1	0.362	0%
0.044	0.366	1	1	0.366	0%
0.045	0.369	1	1	0.369	0%
0.046	0.371	1	1	0.371	0%
0.048	0.375	1	1	0.375	0%
0.05	0.379	1	1	0.379	0%
0.055	0.392	1	1	0.392	0%
0.06	0.406	1	1	0.406	0%
0.065	0.419	1	1	0.419	0%
0.067	0.425	1	1	0.425	0%
0.07	0.433	1	1	0.433	0%
0.075	0.447	1	1	0.447	0%
0.08	0.461	1	1	0.461	0%
0.085	0.476	1	1	0.476	0%
0.09	0.49	1	1	0.49	0%
0.095	0.505	1	1	0.505	0%
0.1	0.518	1	1	0.518	0%
0.11	0.543	1	1	0.543	0%
0.12	0.566	1	1	0.566	0%
0.13	0.587	1	1	0.587	0%
0.133	0.593	1	1	0.593	0%
0.14	0.605	1	1	0.605	0%
0.15	0.621	1	1	0.621	0%
0.16	0.632	1	1	0.632	0%
0.17	0.642	1	1	0.642	0%
0.18	0.651	1	1	0.651	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.234		
0.029	0.238		
0.03	0.239		
0.032	0.242		
0.035	0.247		
0.036	0.249		
0.04	0.255		
0.042	0.259		
0.044	0.262		
0.045	0.264		
0.046	0.266		
0.048	0.269		
0.05	0.273		
0.055	0.285		
0.06	0.297		
0.065	0.31		
0.067	0.315		
0.07	0.322		
0.075	0.334		
0.08	0.347		
0.085	0.359		
0.09	0.372		
0.095	0.384		
0.1	0.396		
0.11	0.415		
0.12	0.433		
0.13	0.449		
0.133	0.454		
0.14	0.463		
0.15	0.476		
0.16	0.483		
0.17	0.489		
0.18	0.494		

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	7.6	(5 to 8.5)
F_{RV}	0	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	75	(0 to 90)
Z_{TOR} *(km)*	0	

Distance

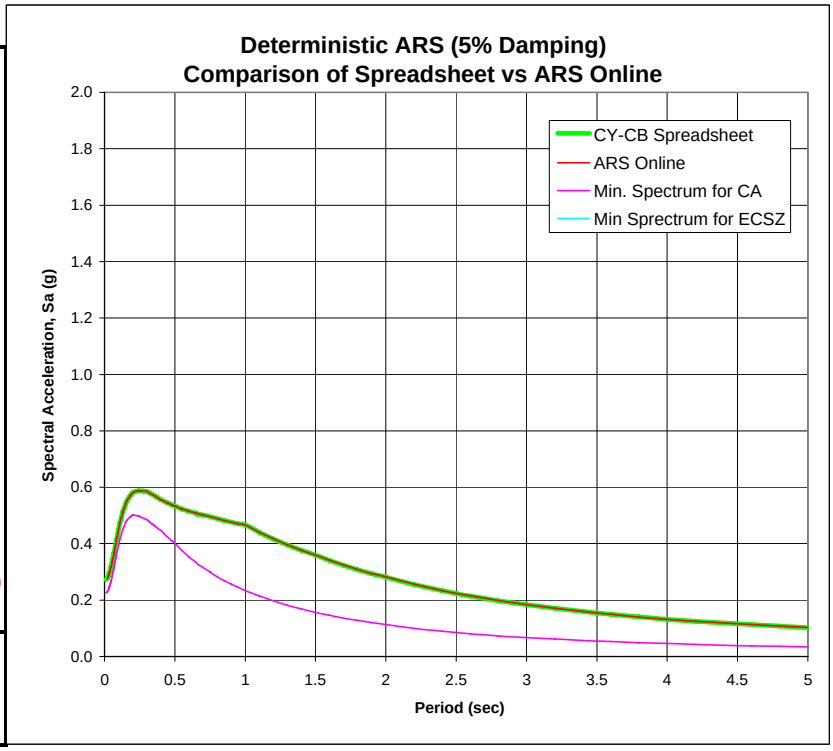
R_{RUP} *(km)*	13.8	
R_{JB} *(km)*	13.8	
R_X *(km)*	13.8	
Hanging Wall?	☐ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	260	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	405	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 0%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.27287
0.020	0.27642
0.022	0.27905
0.025	0.28264
0.029	0.28696
0.030	0.28828
0.032	0.29187
0.035	0.29710
0.036	0.29884
0.040	0.30554
0.042	0.30921
0.044	0.31289
0.045	0.31485
0.046	0.31678
0.048	0.32052
0.050	0.32428
0.055	0.33643
0.060	0.34879
0.065	0.36112
0.067	0.36619
0.070	0.37366
0.075	0.38612
0.080	0.39939
0.085	0.41257
0.090	0.42556
0.095	0.43839
0.100	0.45088
0.110	0.47278
0.120	0.49298
0.130	0.51125
0.133	0.51619
0.140	0.52716
0.150	0.54161
0.160	0.55169
0.170	0.56029
0.180	0.56805

Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.273	1	1	0.273	0%
0.02	0.276	1	1	0.276	0%
0.022	0.279	1	1	0.279	0%
0.025	0.283	1	1	0.283	0%
0.029	0.287	1	1	0.287	0%
0.03	0.288	1	1	0.288	0%
0.032	0.292	1	1	0.292	0%
0.035	0.297	1	1	0.297	0%
0.036	0.299	1	1	0.299	0%
0.04	0.305	1	1	0.305	0%
0.042	0.309	1	1	0.309	0%
0.044	0.313	1	1	0.313	0%
0.045	0.315	1	1	0.315	0%
0.046	0.317	1	1	0.317	0%
0.048	0.32	1	1	0.32	0%
0.05	0.324	1	1	0.324	0%
0.055	0.336	1	1	0.336	0%
0.06	0.349	1	1	0.349	0%
0.065	0.361	1	1	0.361	0%
0.067	0.366	1	1	0.366	0%
0.07	0.374	1	1	0.374	0%
0.075	0.386	1	1	0.386	0%
0.08	0.399	1	1	0.399	0%
0.085	0.412	1	1	0.412	0%
0.09	0.425	1	1	0.425	0%
0.095	0.438	1	1	0.438	0%
0.1	0.451	1	1	0.451	0%
0.11	0.473	1	1	0.473	0%
0.12	0.493	1	1	0.493	0%
0.13	0.511	1	1	0.511	0%
0.133	0.516	1	1	0.516	0%
0.14	0.527	1	1	0.527	0%
0.15	0.541	1	1	0.541	0%
0.16	0.552	1	1	0.552	0%
0.17	0.56	1	1	0.56	0%
0.18	0.568	1	1	0.568	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.234		
0.029	0.238		
0.03	0.239		
0.032	0.242		
0.035	0.247		
0.036	0.249		
0.04	0.255		
0.042	0.259		
0.044	0.262		
0.045	0.264		
0.046	0.266		
0.048	0.269		
0.05	0.273		
0.055	0.285		
0.06	0.297		
0.065	0.31		
0.067	0.315		
0.07	0.322		
0.075	0.334		
0.08	0.347		
0.085	0.359		
0.09	0.372		
0.095	0.384		
0.1	0.396		
0.11	0.415		
0.12	0.433		
0.13	0.449		
0.133	0.454		
0.14	0.463		
0.15	0.476		
0.16	0.483		
0.17	0.489		
0.18	0.494		

Comparison of ARS Curves
(unlock sheet with "shmi")

Model Inputs

Fault

Magnitude	7.3	(5 to 8.5)
F_{RV}	1	(input 1 = Rev)
F_{NM}	0	(input 1 = Normal)
Dip (degree)	25	(0 to 90)
Z_{TOR} *(km)*	2.6	

Distance

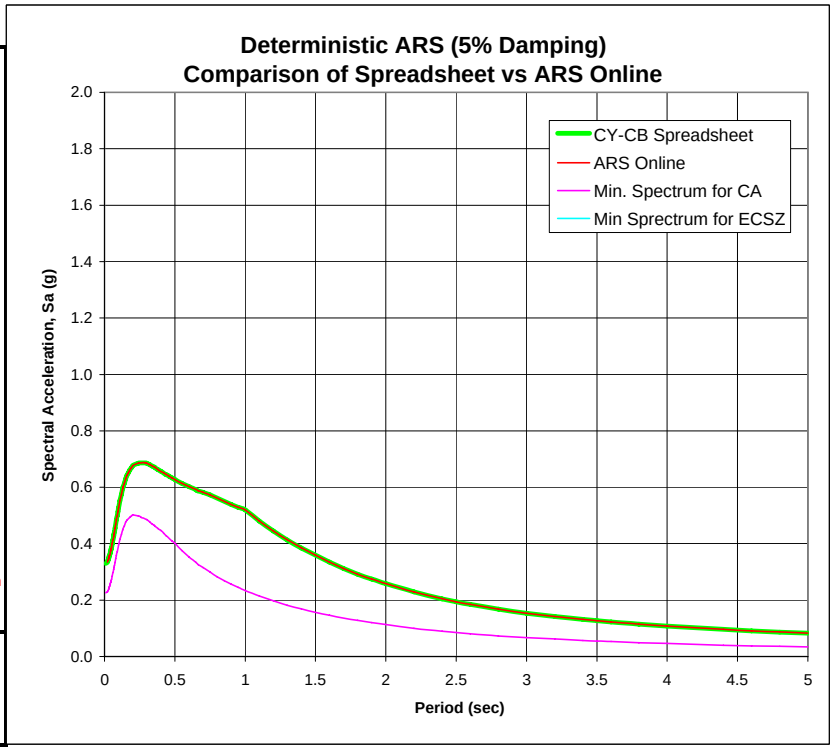
R_{RUP} *(km)*	12.3	
R_{JB} *(km)*	12.0	
R_X *(km)*	12.0	
Hanging Wall?	☐ Yes?	
Near-Field Factor?	☑ Yes?	

Site

V_{S30} *(m/sec)*	260	(270 to 1500 m/s)
$Z_{1.0}$ *(m)*	405	(0 - No Basin)
$Z_{2.5}$ *(km)*	2	(0 - No Basin)
No. Cal. Basin?	☐ Yes ?	(Check only for sites located within a Basin)
So. Cal. Basin?	☐ Yes ?	

Analysis

ARS Online vs CY-CB Spreadsheet Results
MAX. % Diff. = 1%



CY-CB Spreadsheet Results	
T (sec)	CB-CY S(a)
0.010	0.33064
0.020	0.33475
0.022	0.33770
0.025	0.34164
0.029	0.34630
0.030	0.34775
0.032	0.35169
0.035	0.35731
0.036	0.35914
0.040	0.36624
0.042	0.37013
0.044	0.37405
0.045	0.37614
0.046	0.37819
0.048	0.38217
0.050	0.38612
0.055	0.39968
0.060	0.41341
0.065	0.42714
0.067	0.43276
0.070	0.44107
0.075	0.45489
0.080	0.46980
0.085	0.48453
0.090	0.49914
0.095	0.51357
0.100	0.52762
0.110	0.55221
0.120	0.57497
0.130	0.59562
0.133	0.60125
0.140	0.61371
0.150	0.63014
0.160	0.64179
0.170	0.65189
0.180	0.66102

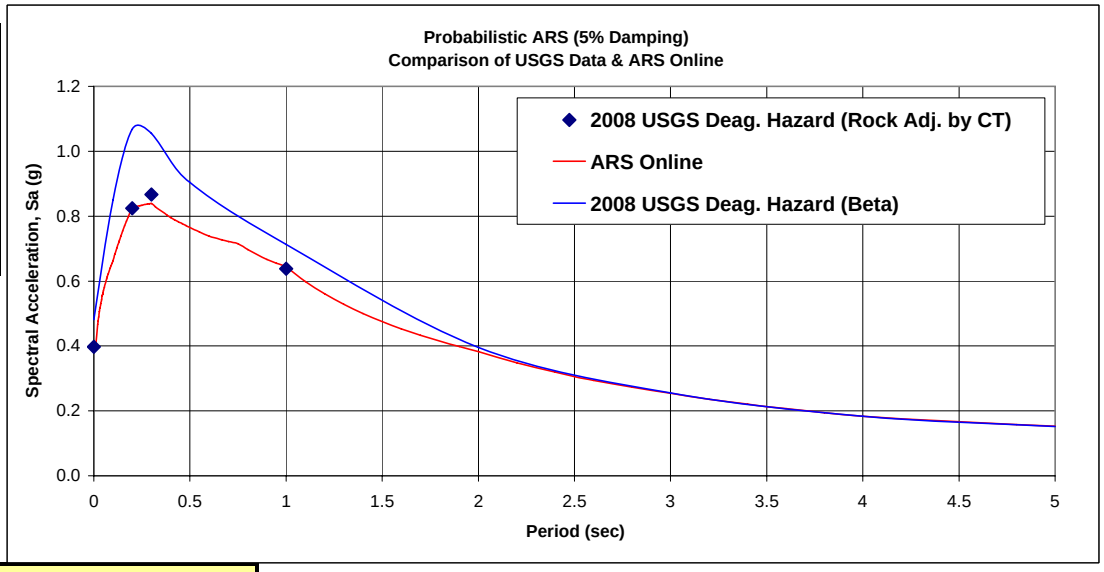
Place ARS Online Deterministic Data Here "Paste"					
T (sec)	Base S(a)	Basin Factor	Near Fault Factor	Final Adj. S(a)	Diff. (%)
0.01	0.331	1	1	0.331	0%
0.02	0.335	1	1	0.335	0%
0.022	0.338	1	1	0.338	0%
0.025	0.342	1	1	0.342	0%
0.029	0.346	1	1	0.346	0%
0.03	0.348	1	1	0.348	0%
0.032	0.352	1	1	0.352	0%
0.035	0.357	1	1	0.357	0%
0.036	0.359	1	1	0.359	0%
0.04	0.366	1	1	0.366	0%
0.042	0.37	1	1	0.37	0%
0.044	0.374	1	1	0.374	0%
0.045	0.376	1	1	0.376	0%
0.046	0.378	1	1	0.378	0%
0.048	0.382	1	1	0.382	0%
0.05	0.386	1	1	0.386	0%
0.055	0.4	1	1	0.4	0%
0.06	0.413	1	1	0.413	0%
0.065	0.427	1	1	0.427	0%
0.067	0.433	1	1	0.433	0%
0.07	0.441	1	1	0.441	0%
0.075	0.455	1	1	0.455	0%
0.08	0.47	1	1	0.47	0%
0.085	0.485	1	1	0.485	0%
0.09	0.499	1	1	0.499	0%
0.095	0.514	1	1	0.514	0%
0.1	0.528	1	1	0.528	0%
0.11	0.552	1	1	0.552	0%
0.12	0.575	1	1	0.575	0%
0.13	0.596	1	1	0.596	0%
0.133	0.601	1	1	0.601	0%
0.14	0.614	1	1	0.614	0%
0.15	0.63	1	1	0.63	0%
0.16	0.642	1	1	0.642	0%
0.17	0.652	1	1	0.652	0%
0.18	0.661	1	1	0.661	0%

For Comparsion Plots of Min. Sprectra, Paste Special into Cells			
Min. Spectrum for CA		Min Sprectrum for ECSZ	
T (sec)	S (a)	T (sec)	S (a)
0.01	0.226		
0.02	0.229		
0.022	0.231		
0.025	0.234		
0.029	0.238		
0.03	0.239		
0.032	0.242		
0.035	0.247		
0.036	0.249		
0.04	0.255		
0.042	0.259		
0.044	0.262		
0.045	0.264		
0.046	0.266		
0.048	0.269		
0.05	0.273		
0.055	0.285		
0.06	0.297		
0.065	0.31		
0.067	0.315		
0.07	0.322		
0.075	0.334		
0.08	0.347		
0.085	0.359		
0.09	0.372		
0.095	0.384		
0.1	0.396		
0.11	0.415		
0.12	0.433		
0.13	0.449		
0.133	0.454		
0.14	0.463		
0.15	0.476		
0.16	0.483		
0.17	0.489		
0.18	0.494		

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock spreadsheet "shmi")
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% in 50 yrs (or 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolation is used to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in the "calculation" tab.**

Input Site Information	
Latitude	Longitude
33.8001	-117.8800
V_{S30} (m/s) =	260
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	14.4
$Z_{1.0}$ (m) =	405
$Z_{2.5}$ (km) =	2



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.401	1	1	0.401
0.02	0.466	1	1	0.466
0.022	0.476	1	1	0.476
0.025	0.489	1	1	0.489
0.029	0.506	1	1	0.506
0.03	0.509	1	1	0.509
0.032	0.517	1	1	0.517
0.035	0.527	1	1	0.527
0.036	0.53	1	1	0.53
0.04	0.542	1	1	0.542
0.042	0.548	1	1	0.548
0.044	0.554	1	1	0.554
0.045	0.557	1	1	0.557
0.046	0.559	1	1	0.559
0.048	0.564	1	1	0.564
0.05	0.57	1	1	0.57
0.055	0.581	1	1	0.581
0.06	0.593	1	1	0.593
0.065	0.603	1	1	0.603
0.067	0.607	1	1	0.607
0.07	0.613	1	1	0.613
0.075	0.622	1	1	0.622
0.08	0.631	1	1	0.631
0.085	0.64	1	1	0.64
0.09	0.648	1	1	0.648
0.095	0.655	1	1	0.655
0.1	0.663	1	1	0.663
0.11	0.683	1	1	0.683
0.12	0.702	1	1	0.702
0.13	0.72	1	1	0.72
0.133	0.726	1	1	0.726
0.14	0.738	1	1	0.738
0.15	0.754	1	1	0.754
0.16	0.77	1	1	0.77
0.17	0.785	1	1	0.785
0.18	0.799	1	1	0.799
0.19	0.813	1	1	0.813
0.2	0.826	1	1	0.826
0.22	0.829	1	1	0.829
0.24	0.832	1	1	0.832
0.25	0.833	1	1	0.833

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. By CT)

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.396	1.000	1.004	1.000	0.397	0.401	-0.9%
0.2	0.963	1.000	0.856	1.000	0.824	0.826	-0.2%
0.3	0.787	1.000	1.102	1.000	0.867	0.839	3.2%
1	0.293	1.200	1.812	1.001	0.638	0.643	-0.9%

Max % Difference = 3.2%

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.4808	1.000	1.000	0.481	0.401	16.6%
0.1	0.8495	1.000	1.000	0.850	0.663	22.0%
0.2	1.0678	1.000	1.000	1.068	0.826	22.6%
0.3	1.0551	1.000	1.000	1.055	0.839	20.5%
0.5	0.9043	1.000	1.000	0.904	0.765	15.4%
1	0.5933	1.200	1.001	0.712	0.643	9.7%
2	0.3239	1.200	1.018	0.396	0.383	3.2%
3	0.2078	1.200	1.023	0.255	0.254	0.4%
4	0.14927	1.200	1.024	0.183	0.183	0.2%
5	0.12316	1.200	1.024	0.151	0.153	1.1%

Max % Difference = 15.4%

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

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Project Information

Dist – EA: 12-0F0401 County: ORA Route: 57 PM: 12.54

Bridge/Facility Name: Katella Ave. UC Widening Bridge/Facility No.: 55-0401

Latitude: 33.806074 Longitude: -117.879825

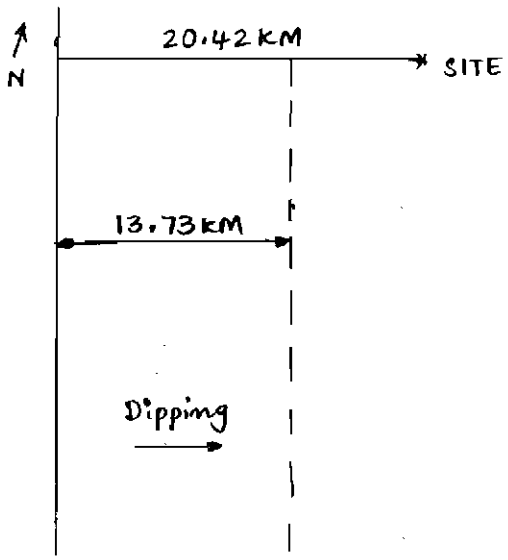
Deterministic Fault Information

Fault Name: Compton-Los Alamitos Fault ID#: 291 M_{MAX}: 6.8 Fault Type: R

Fault Dip: 20° Dip Direction: NE Top of Rupture: 5 km Bottom of Rupture: 10 km

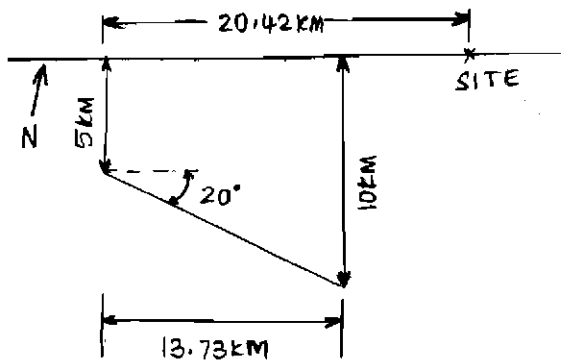
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	12.03 km	☒	Calculated / graphically	☐	Same as Rx (by definition)
R_{JB}:	6.69 km	☒	Calculated / graphically	☐	Same as Rx (by definition)
R_X:	20.42 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

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Project Information

Dist – EA: 12-0F0401 County: ORA Route: 57 PM: 12.54

Bridge/Facility Name: Katella Ave. OC widening Bridge/Facility No.: 55-0401

Latitude: 33.806074 Longitude: -117.879825

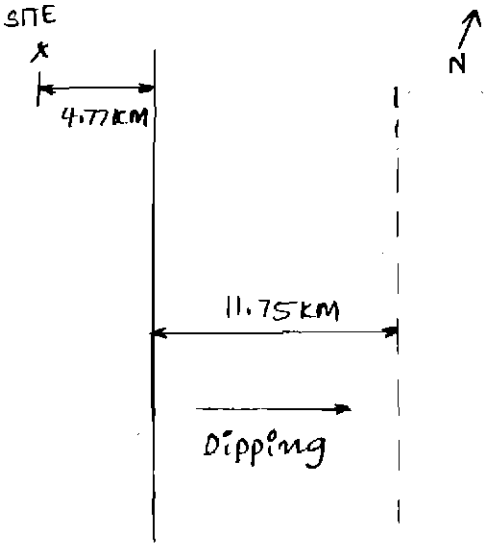
Deterministic Fault Information

Fault Name: Peralta Hills Fault ID#: 146 M_{MAX}: 6.2 Fault Type: R

Fault Dip: 50° Dip Direction: N Top of Rupture: 0 km Bottom of Rupture: 14 km.

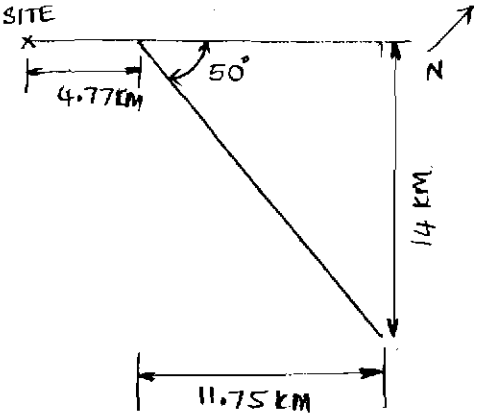
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	4.77 km	☒	Calculated / graphically	☒	Same as Rx (by definition)
R_{JB}:	4.77 km	☐	Calculated / graphically	☒	Same as Rx (by definition)
R_X:	4.77 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

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Project Information

Dist – EA: 12-0P0401 County: ORA Route: 57 PM: 12.54

Bridge/Facility Name: Katella UC widening Bridge/Facility No.: 55-0401

Latitude: 33.806074 Longitude: -117.879825

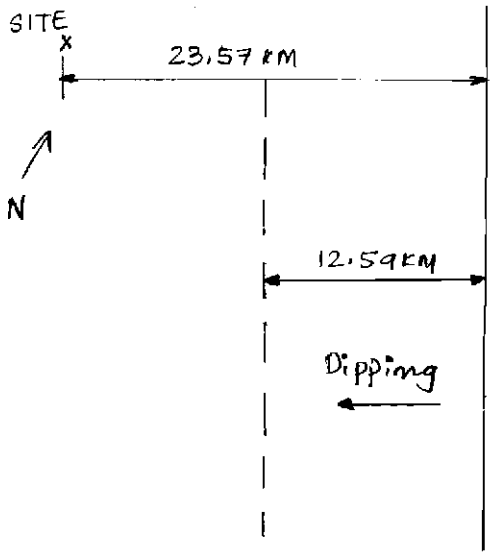
Deterministic Fault Information

Fault Name: Elsinore (Chino) Fault ID#: 242 M_{MAX}: 7.6 Fault Type: R

Fault Dip: 50° Dip Direction: W Top of Rupture: 0 Bottom of Rupture: 15 km

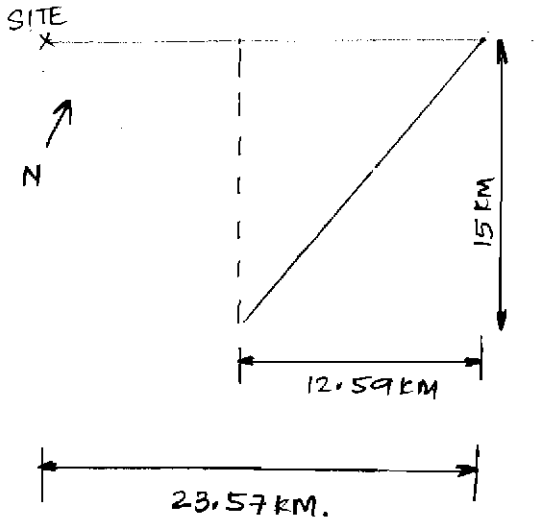
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	18.58 km	☒	Calculated / graphically	☐	Same as Rx (by definition)
R_{JB}:	10.98 km	☒	Calculated / graphically	☐	Same as Rx (by definition)
R_X:	23.57 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

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Project Information

Dist – EA: Puente Hills County: ORA Route: 57 PM: 12.54

Bridge/Facility Name: Katella Ave. UC widening Bridge/Facility No.: 55-0401

Latitude: 33.806074 Longitude: -117.879825

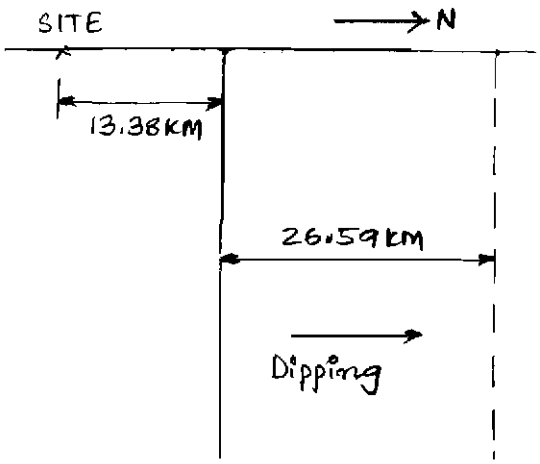
Deterministic Fault Information

Fault Name: Puente Hills Fault ID#: 240 M_{MAX}: 7.3 Fault Type: R

Fault Dip: 25° Dip Direction: N Top of Rupture: 2.6km Bottom of Rupture: 15 km

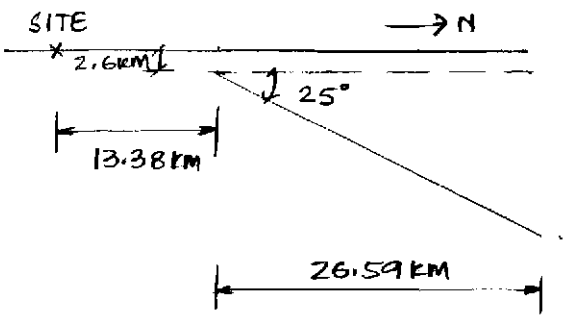
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	13.63 km	☒	Calculated / graphically	☒	Same as Rx (by definition)
R_{JB}:	13.38 km	☐	Calculated / graphically	☒	Same as Rx (by definition)
R_X:	13.38 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

This document is to be filled out by *checker* to evaluate the fault parameters and design response spectrum used for seismic design recommendations for bridge structures. To facilitate the quality check, the designer shall provide the checker all pertinent project information, geologic information and approved exceptions (if applicable) needed to complete this form. The *checker* must be familiar with the Seismic Design Criteria (Appendix B), Deterministic PGA Map and ARS Online Report, and Geotechnical Services Design Manual in order to successfully perform a quality check. Tools available to checkers include the Deterministic Response Spectrum Spreadsheet, Probabilistic Response Spectrum Spreadsheet (after USGS), 2008 USGS National Seismic Hazard Map and the ARS Online web tool. The above documents and tools are available at http://dap3.dot.ca.gov/shake_stable/technical.php.

Project Information

Dist – EA: 12-0F0401 County: ORA Route: 57 PM: 12.54

Bridge/Facility Name: Katella Ave. UC Widening Bridge/Facility No.: 55-0401

Latitude: 33.806074 Longitude: -117.879825

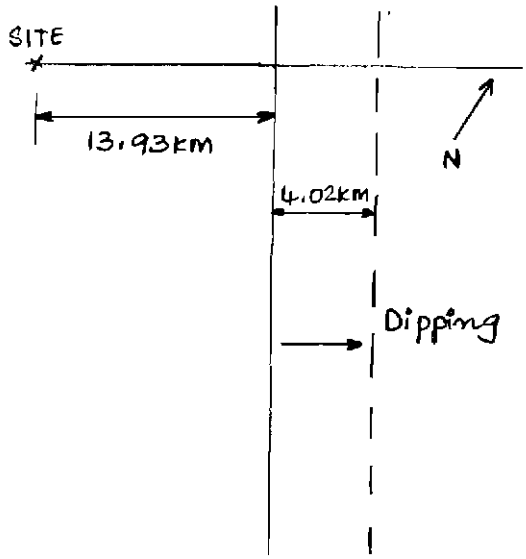
Deterministic Fault Information

Fault Name: Elsinore (Whittier) Fault ID#: 241 M_{MAX}: 7.6 Fault Type: RLSS

Fault Dip: 75° Dip Direction: NE Top of Rupture: 0 Bottom of Rupture: 15 km

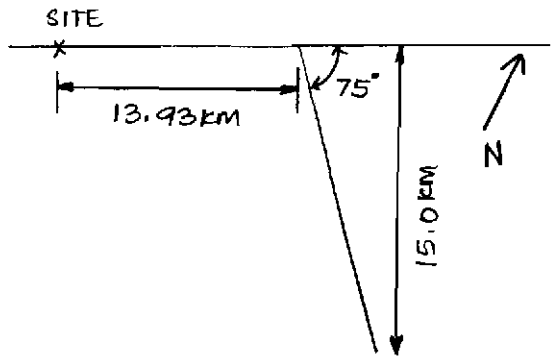
Plan View

(rough sketch; show dimensions)



Elevation View

(rough sketch; show dimensions)



Calculated or Measured Distances

R_{RUP}:	13.93 km	☐	Calculated / graphically	☒	Same as Rx (by definition)
R_{JB}:	13.93 km	☐	Calculated / graphically	☒	Same as Rx (by definition)
R_X:	13.93 km	☒	"Ruler" function on ARS Online	☐	Deterministic PGA Map

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

Determination of V_{S30}

V_{S30} (m/s): 270 m/s

Method of Determining V_{S30}: SPT correlations (e.g. P-S logging, Geophysics, SPT correlations, etc)

Additional Explanation (if needed): _____

Determination of Z1.0 and Z2.5 (if site located in designated California deep basin)

$Z_{1.0}$ (m/s): 405 m/s $Z_{2.5}$ (km/s): 2 km/s

Method of Determining $Z_{1.0}$ & $Z_{2.5}$: ARS Online (e.g. ARS Online, SDC figure, other)

Additional Explanation (if needed): _____

Deterministic - Special Conditions

Yes	No	N/A	
☒	☐		Was the Errata Deterministic Fault Database Spreadsheet reviewed to ensure that the correct fault parameters used in the analysis.
☒	☐	☐	Were the Near-Fault Factors applied correctly? *Applies to sites with a R_{RUP} distance of 25 km or less, as defined in the SDC.*
☒	☐	☐	Were deep basin depths ($Z_{1.0}$ & $Z_{2.5}$) estimated correctly? *Applies to sites located in deep basins as shown in Figures B.5 - B.11 of the SDC or ARS Online.*
☐	☐	☒	If the site is located within the Eastern California Shear Zone (ECSZ), was the design ARS larger than the minimum spectrum for the ECSZ (as defined in the SDC, Appendix B, Figure B.2)?
☐	☐	☒	If the controlling fault is the Cascadia Subduction Zone, was the alternate seismic procedure applied correctly (as defined in the SDC, Appendix B)?
☐	☒	☐	If the deterministic ARS falls below the Minimum Deterministic Spectra (as defined in the SDC), did the Minimum Deterministic Spectra control the deterministic design spectrum?
☒	☐		Did the ARS Online deterministic spectrum correspond within 10% of the calculated deterministic spectrum? If not, note it in the comments section of this document and email a copy to the ARS Online development team, ARS_Online@dot.ca.gov, so that they may address the potential bug.

Probabilistic - Special Conditions

Yes	No	N/A	
☒	☐	☐	Were Near-Fault Factors applied correctly (as defined by SDC)? *Applies to sites with a deaggregation R distance of 25 km or less.*
☒	☐	☐	Were deep basin depths ($Z_{1.0}$ & $Z_{2.5}$) estimated correctly? *Applies to sites located in deep basins as shown in Figures B.5 - B.11 of the SDC or ARS Online.*
☒	☐	☐	If the site has a V_{S30} of less than 300 m/s, was the resulting ARS curve checked against spectral acceleration from USGS Interactive Deaggregation tool?
☒	☐	☐	If the USGS Interactive Deaggregation tool and spectral acceleration data were used, were the appropriate near-fault and basin correction factors applied?

2009 Deterministic Fault Information & Seismic Procedure QC/QA Checklist

Yes	No	N/A	
☐	☒	☐	If the probabilistic ARS falls below the Minimum Deterministic Spectra (as defined in the SDC), did the Minimum Deterministic Spectra control the design spectrum?
☒	☐		Did the ARS Online design spectrum correspond within 10% of the USGS spectral acceleration data from the verification spreadsheet? If not, note it in the comments section of this document and email a copy to the ARS Online development team, ARS_Online@dot.ca.gov, so that they may address the potential bug.

Comments / Observations Encountered during QC/QA process:

I certify that I have performed a quality check of the referenced fault information and design response spectrum provided by the geotechnical designer. The quality check is based on Seismic Design Criteria (Appendix B), Deterministic PGA Map and ARS Online Report, and the Geotechnical Services Design Manual.

SREEKAR PULIJALA — Sr. STAFF ENGINEER
Checker (Print) — Title

P. Sreekar — 01/25/2010
Checker (Signature) — Date

I certify that the referenced project complies with Geotechnical Service's Quality Control/Quality Assurance procedures, as described in the memorandum, "Quality Control/Quality Assurance for the 2009 Seismic Design Procedures", dated August 12, 2009.

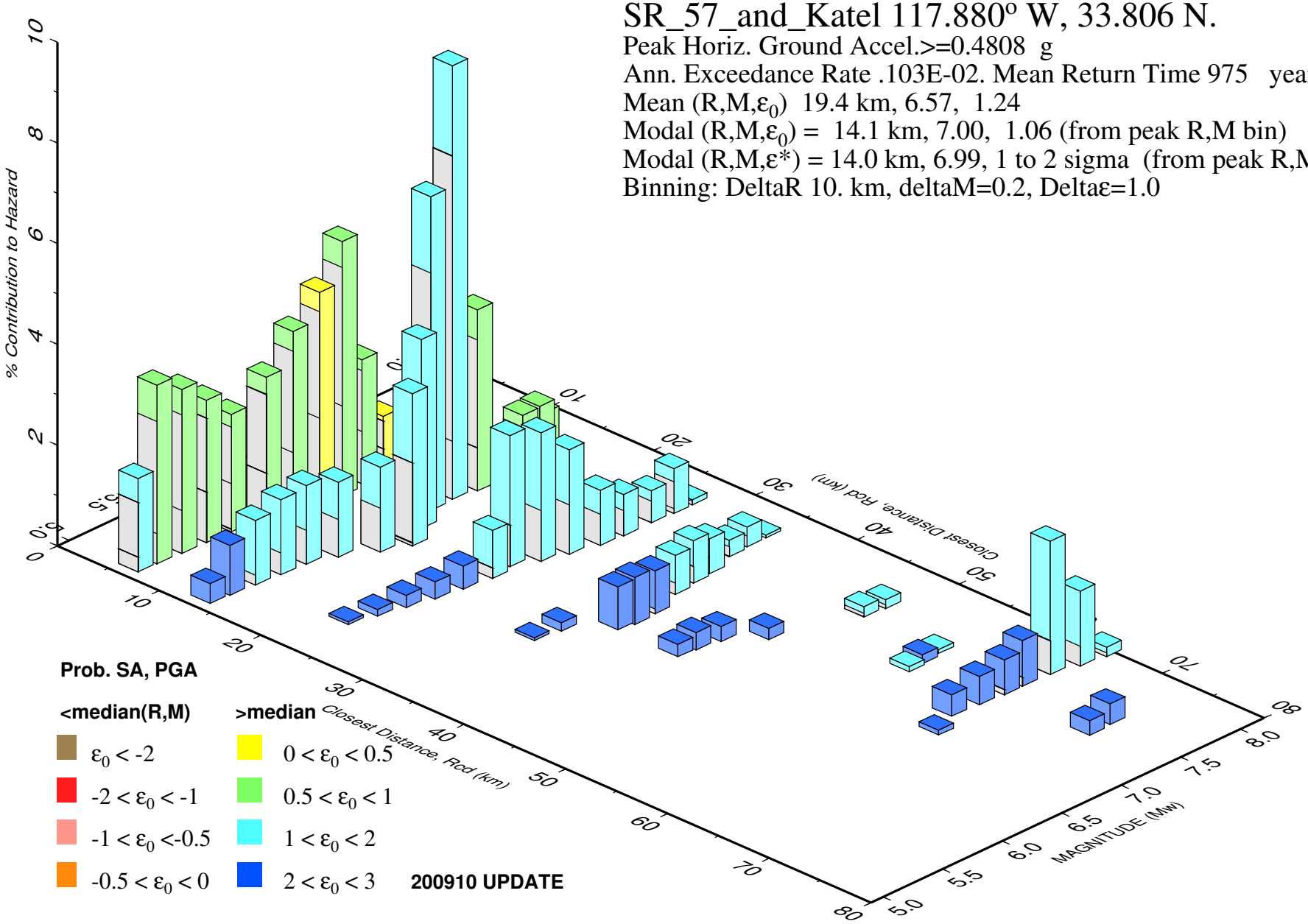
DJAN CHANDRA — Sr. Principal Engineer
Functional Supervisor (Print) — Title

Djan Chandra — 2/1/2010
Functional Supervisor (Signature) — Date

(This original checklist and signature sheet shall be placed in the geotechnical project file, and a copy sent to the Mark Willian of the Geotechnical Services Corporate Unit).

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880° W, 33.806 N.

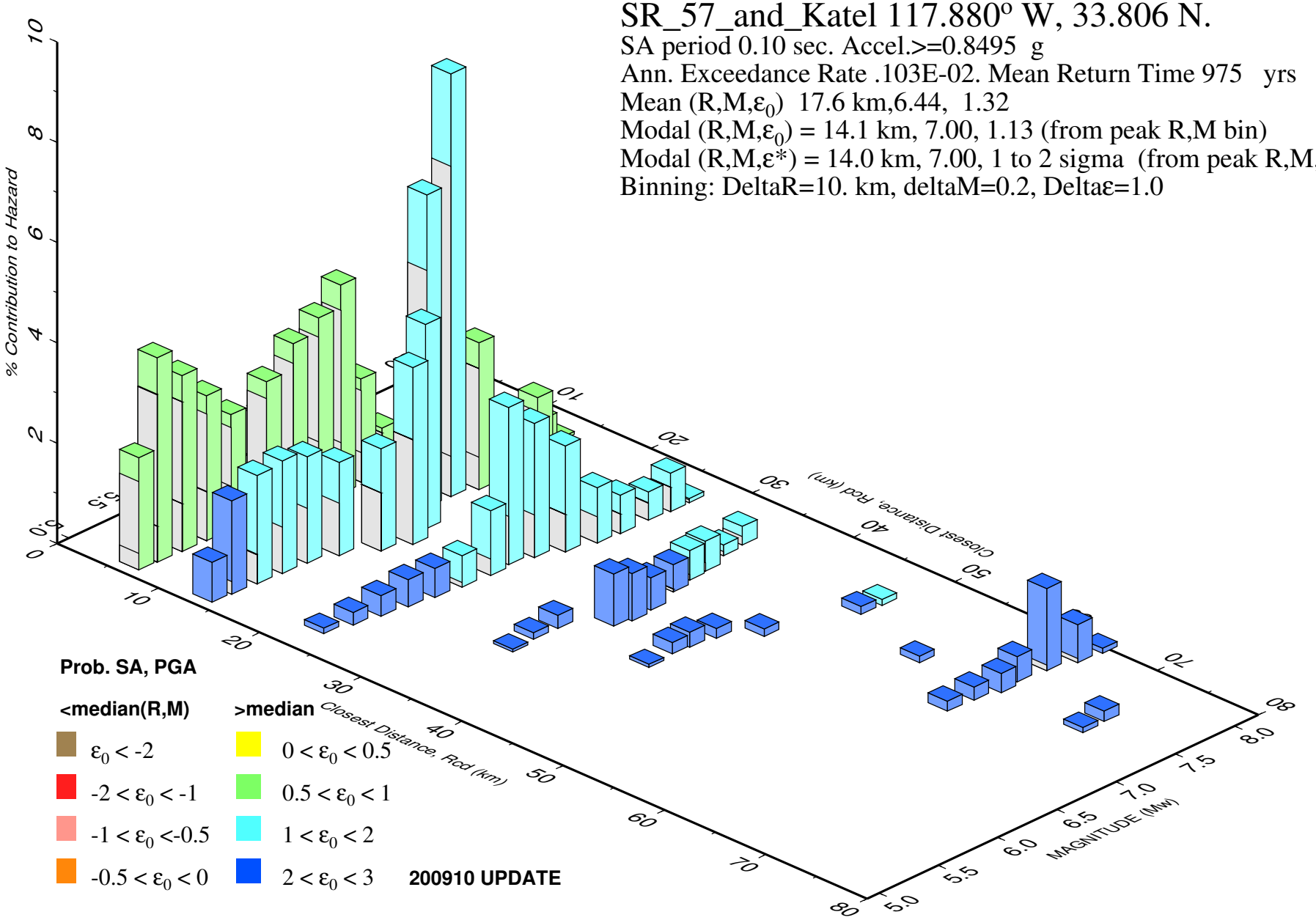
Peak Horiz. Ground Accel.>=0.4808 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 years
Mean (R,M,ε_0) 19.4 km, 6.57, 1.24
Modal (R,M,ε_0) = 14.1 km, 7.00, 1.06 (from peak R,M bin)
Modal (R,M,ε*) = 14.0 km, 6.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 19:10:18 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880º W, 33.806 N.

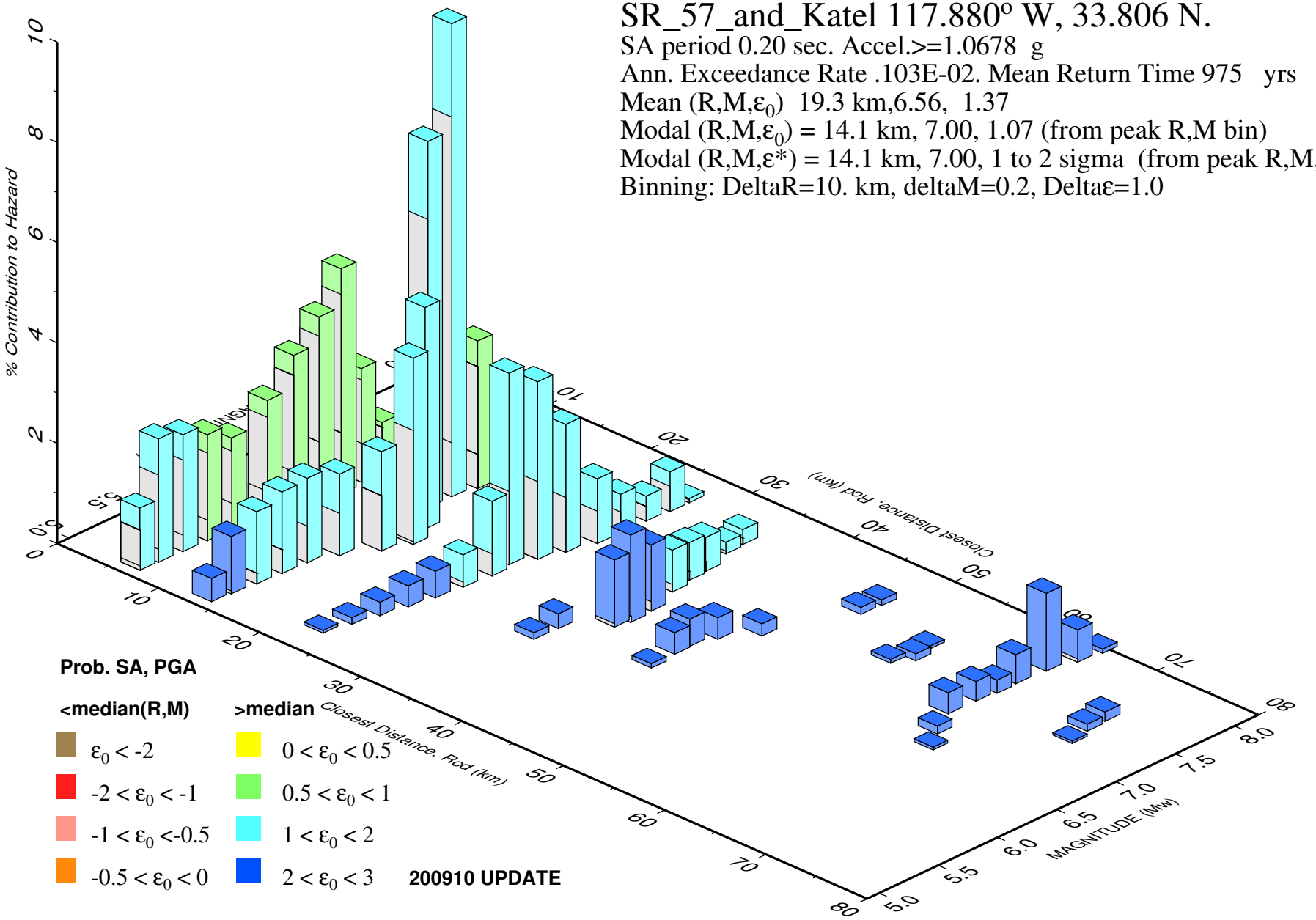
SA period 0.10 sec. Accel.>=0.8495 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 17.6 km,6.44, 1.32
Modal (R,M,ε_0) = 14.1 km, 7.00, 1.13 (from peak R,M bin)
Modal (R,M,ε*) = 14.0 km, 7.00, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 19:10:54 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880° W, 33.806 N.

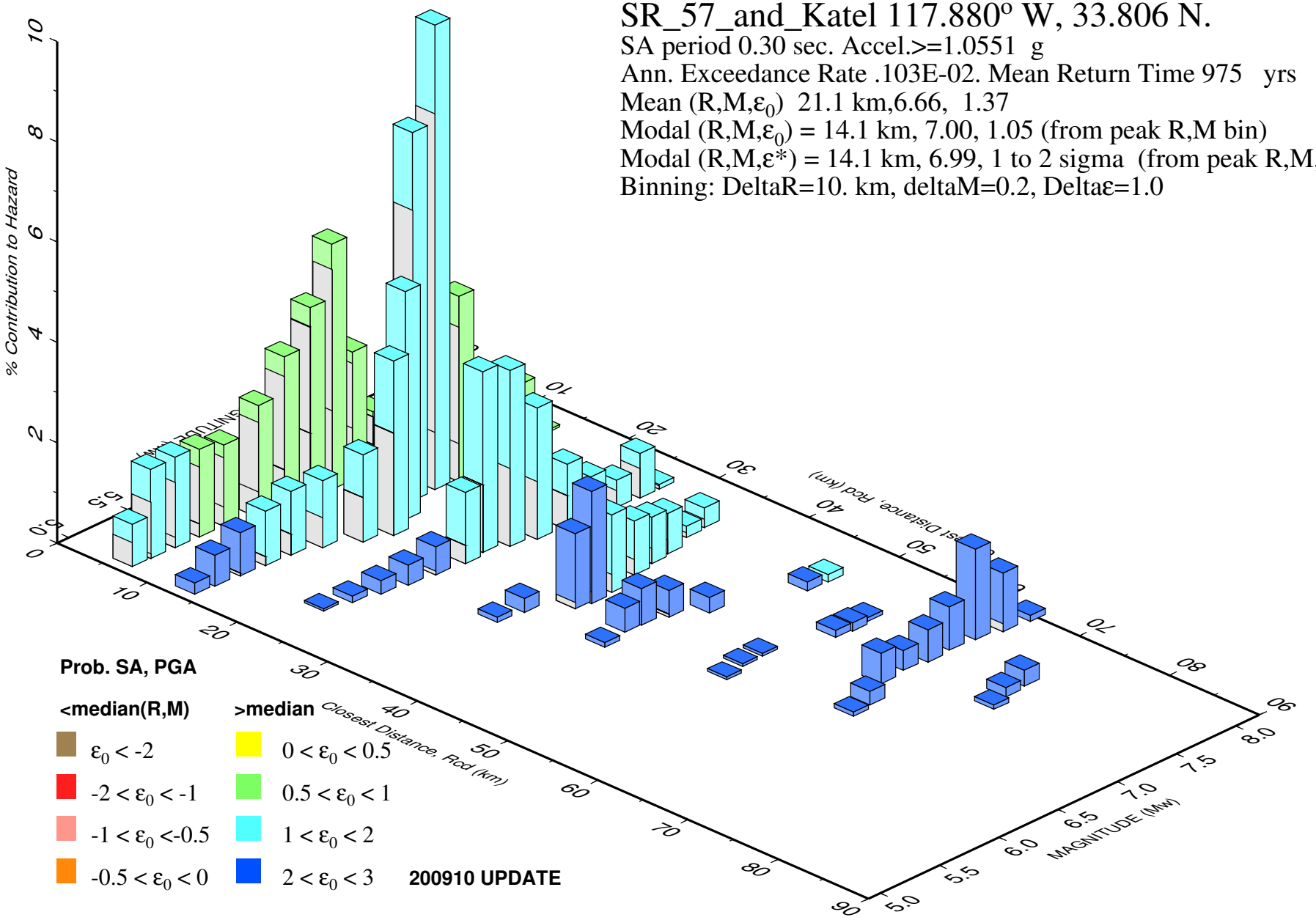
SA period 0.20 sec. Accel.>=1.0678 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 19.3 km,6.56, 1.37
Modal (R,M,ε_0) = 14.1 km, 7.00, 1.07 (from peak R,M bin)
Modal (R,M,ε*) = 14.1 km, 7.00, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 19:11:35 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880° W, 33.806 N.

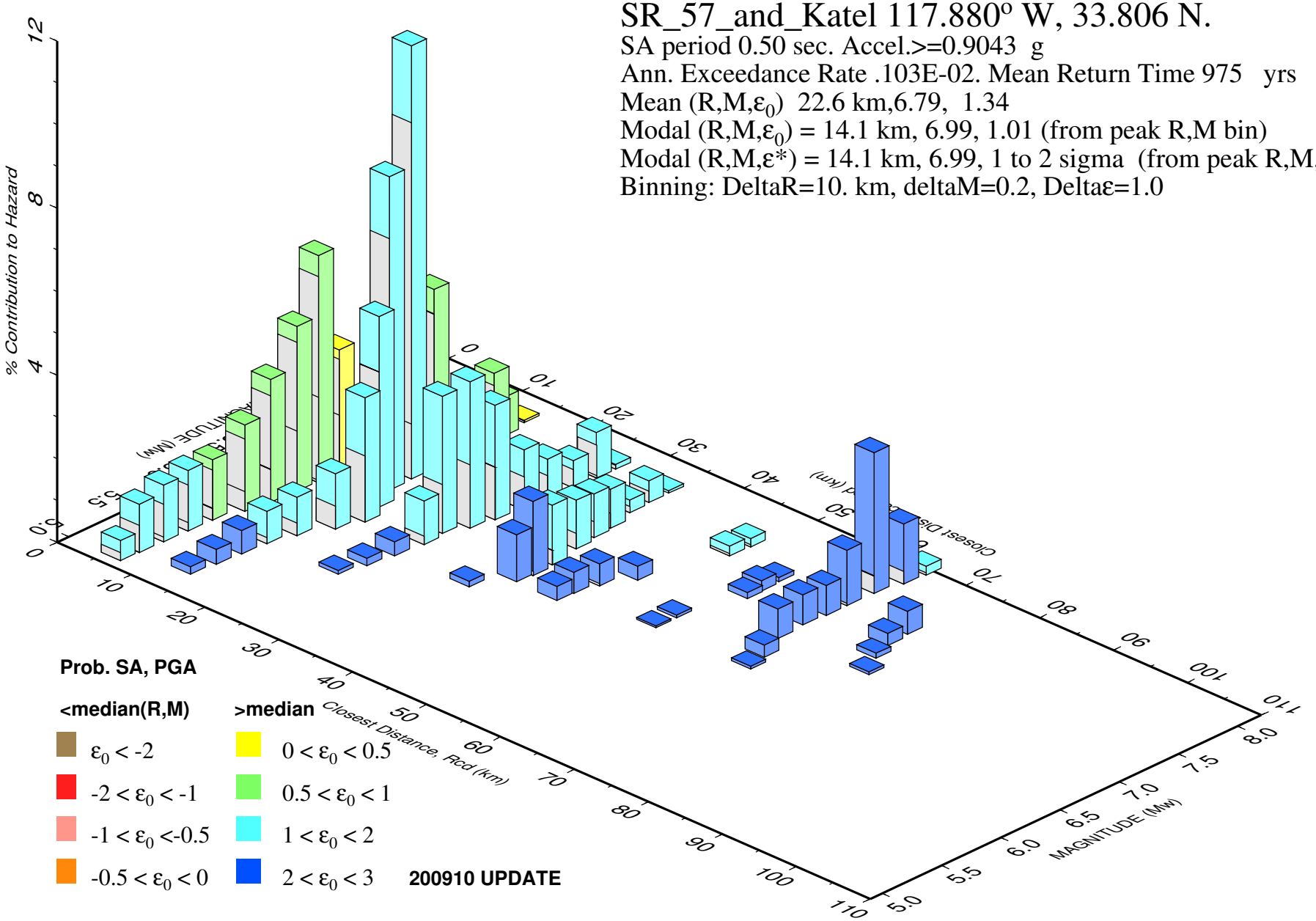
SA period 0.30 sec. Accel.>=1.0551 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 21.1 km,6.66, 1.37
Modal (R,M,ε_0) = 14.1 km, 7.00, 1.05 (from peak R,M bin)
Modal (R,M,ε*) = 14.1 km, 6.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 19:12:22 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880° W, 33.806 N.

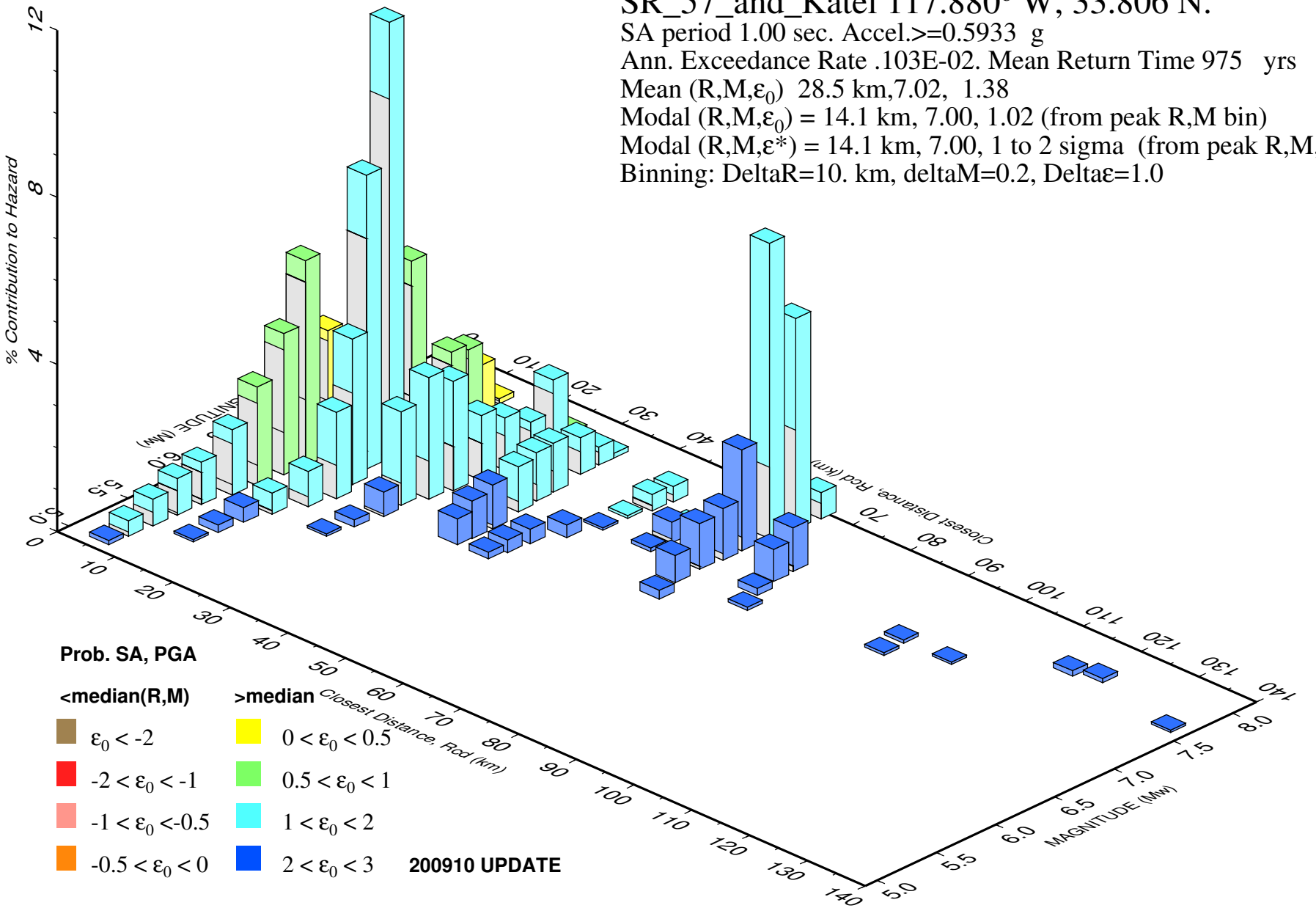
SA period 0.50 sec. Accel.>=0.9043 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 22.6 km,6.79, 1.34
Modal (R,M,ε_0) = 14.1 km, 6.99, 1.01 (from peak R,M bin)
Modal (R,M,ε*) = 14.1 km, 6.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 19:13:04 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880° W, 33.806 N.

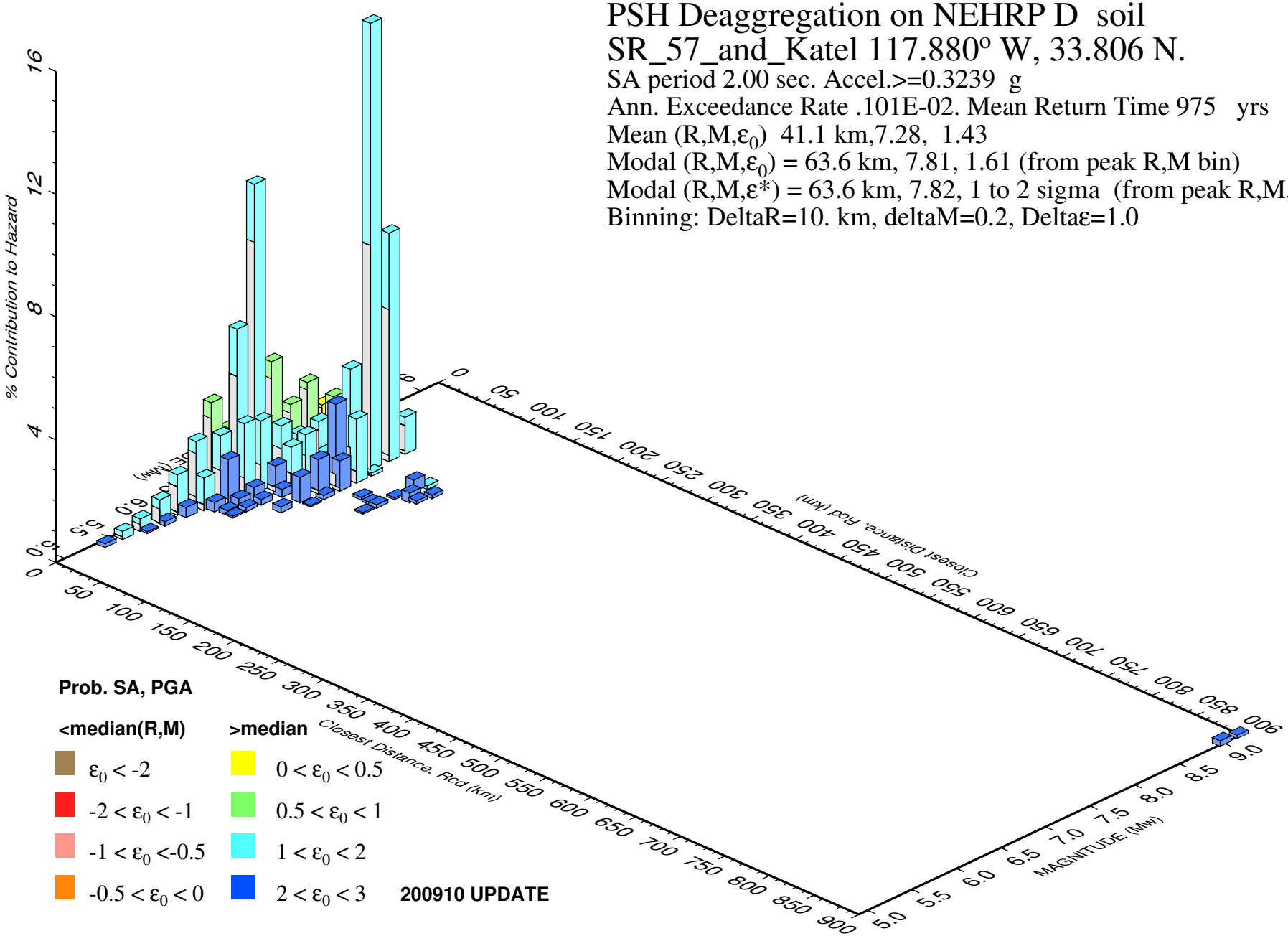
SA period 1.00 sec. Accel.>=0.5933 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 28.5 km,7.02, 1.38
Modal (R,M,ε_0) = 14.1 km, 7.00, 1.02 (from peak R,M bin)
Modal (R,M,ε*) = 14.1 km, 7.00, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 19:13:42 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880° W, 33.806 N.

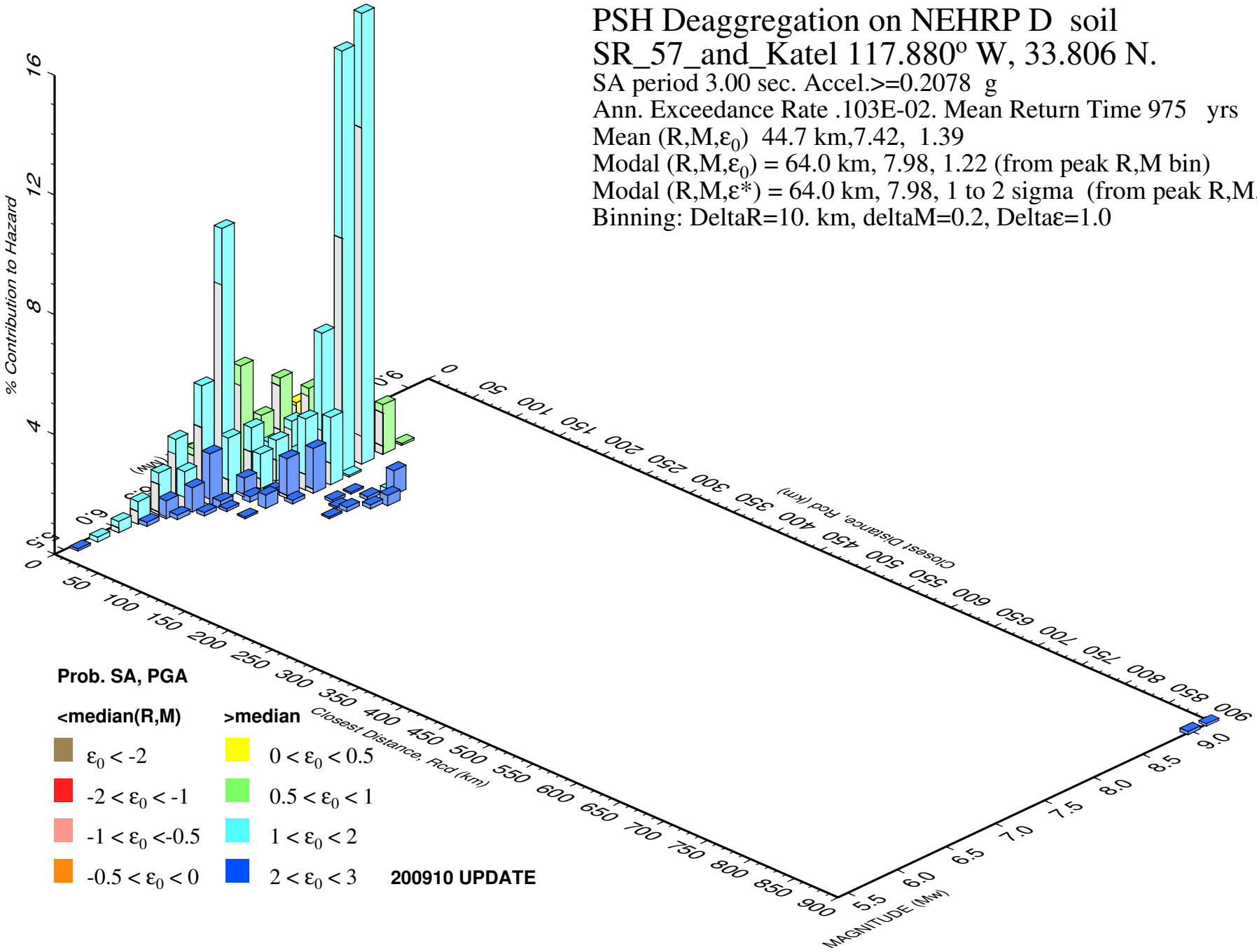
SA period 2.00 sec. Accel.>=0.3239 g
Ann. Exceedance Rate .101E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 41.1 km,7.28, 1.43
Modal (R,M,ε_0) = 63.6 km, 7.81, 1.61 (from peak R,M bin)
Modal (R,M,ε*) = 63.6 km, 7.82, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 19:14:51 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880° W, 33.806 N.

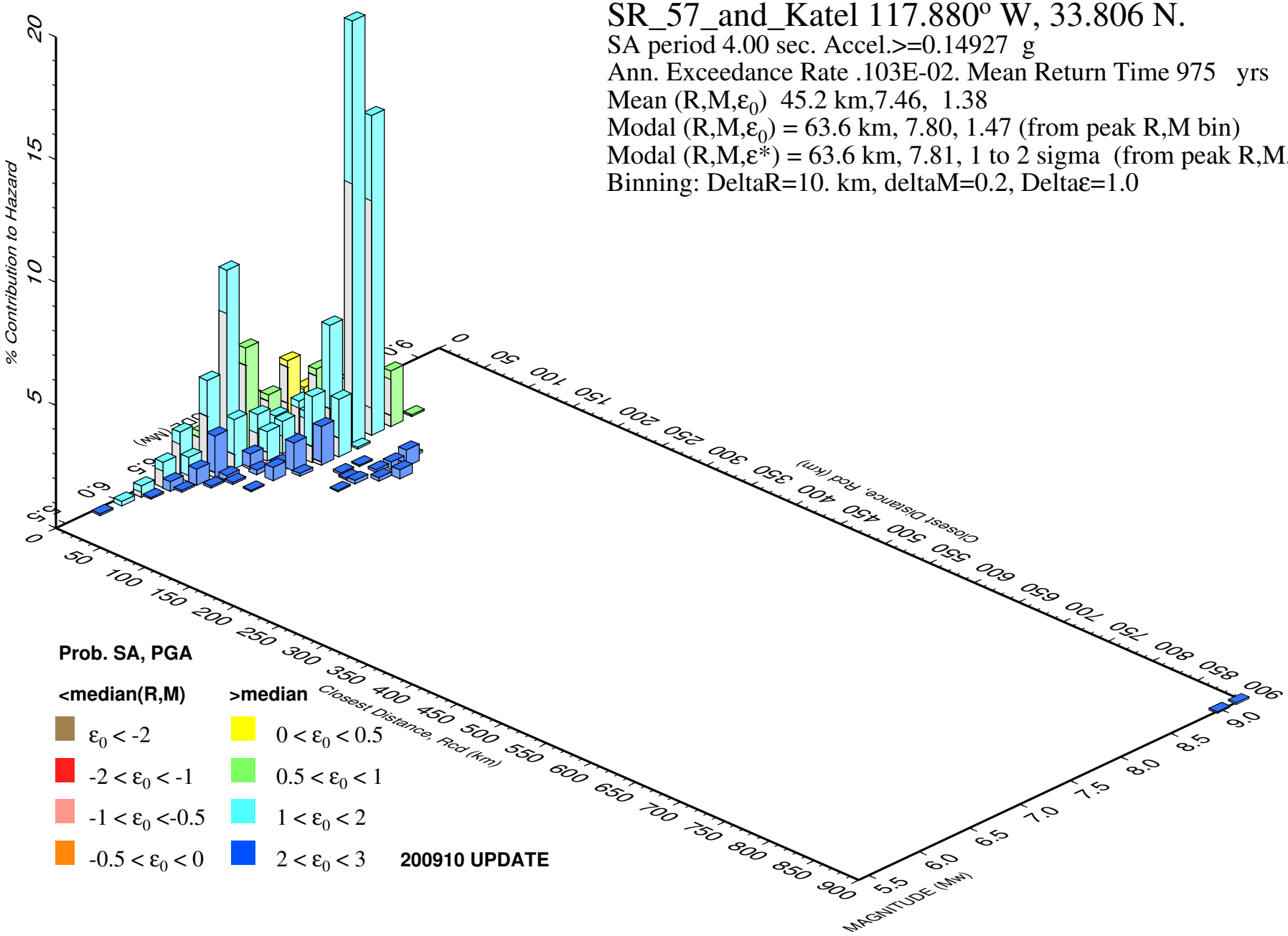
SA period 3.00 sec. Accel.>=0.2078 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 44.7 km,7.42, 1.39
Modal (R,M,ε_0) = 64.0 km, 7.98, 1.22 (from peak R,M bin)
Modal (R,M,ε*) = 64.0 km, 7.98, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 19:15:36 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880° W, 33.806 N.

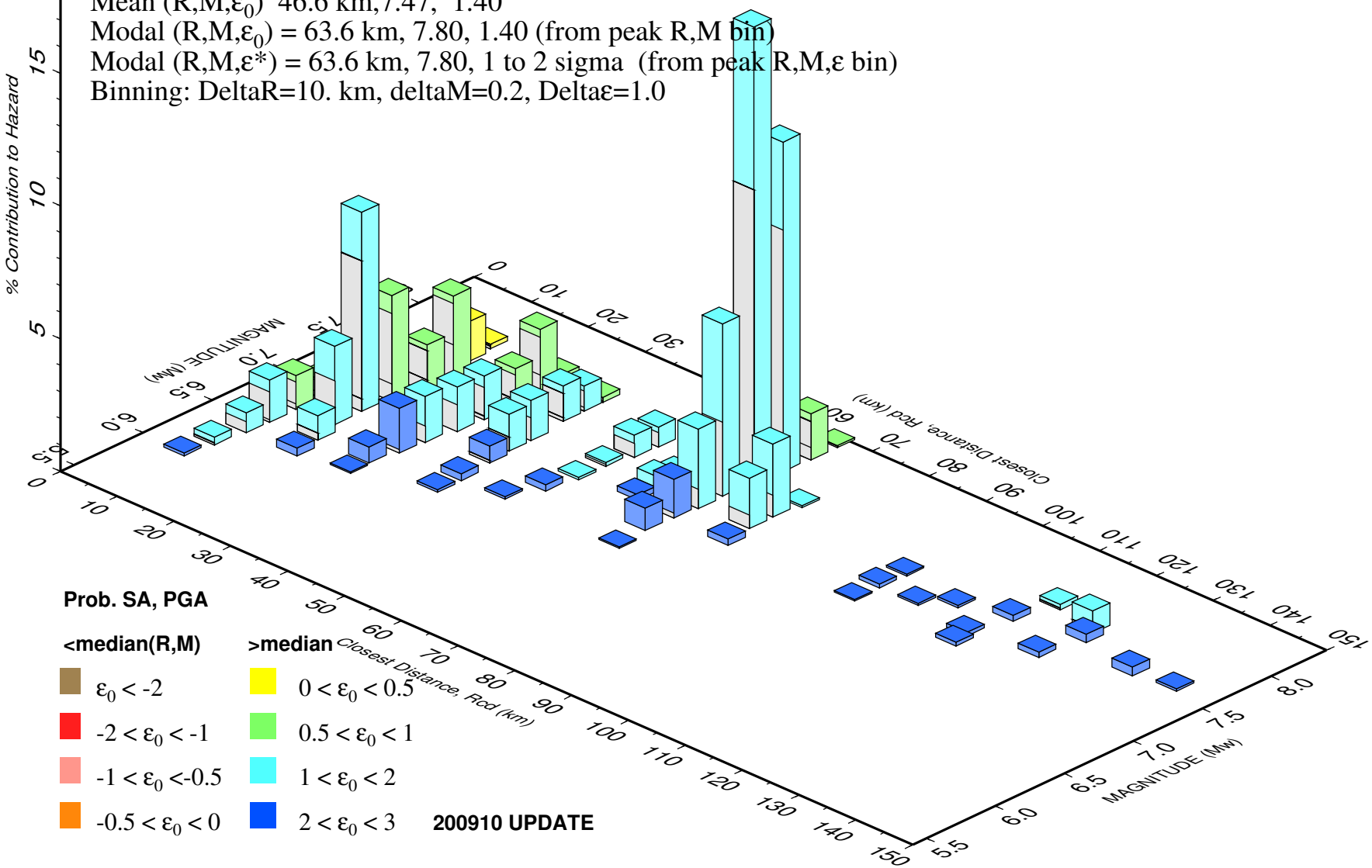
SA period 4.00 sec. Accel.>=0.14927 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 45.2 km,7.46, 1.38
Modal (R,M,ε_0) = 63.6 km, 7.80, 1.47 (from peak R,M bin)
Modal (R,M,ε*) = 63.6 km, 7.81, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



GMT 2009 Dec 8 19:16:25 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

PSH Deaggregation on NEHRP D soil
SR_57_and_Katel 117.880° W, 33.806 N.

SA period 5.00 sec. Accel.>=0.12316 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 yrs
Mean (R,M,ε_0) 46.6 km,7.47, 1.40
Modal (R,M,ε_0) = 63.6 km, 7.80, 1.40 (from peak R,M bin)
Modal (R,M,ε*) = 63.6 km, 7.80, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR=10. km, deltaM=0.2, Deltaε=1.0



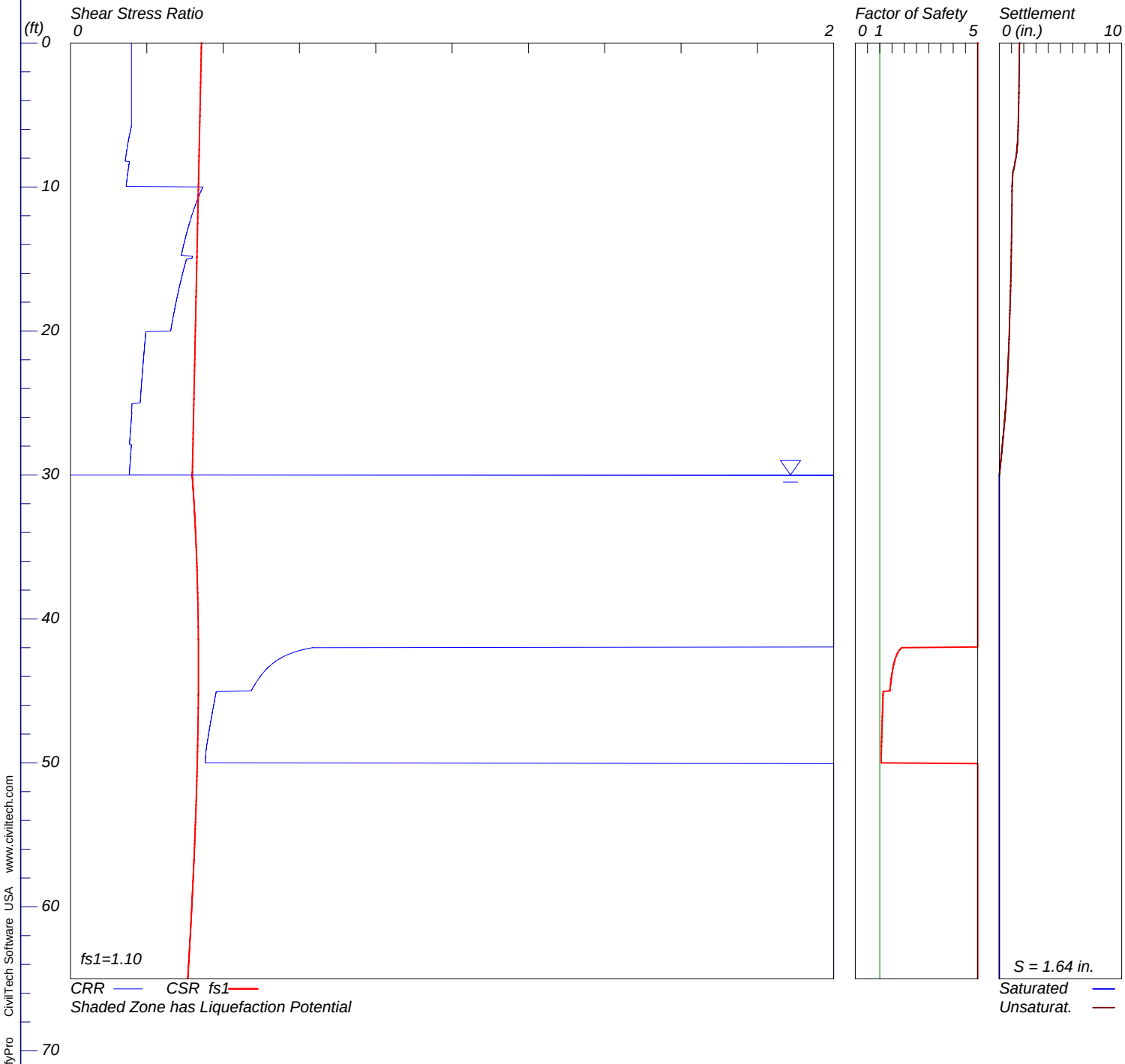
GMT 2009 Dec 8 19:16:56 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 260. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

LIQUEFACTION ANALYSIS

Katella Avenue Overcrossing

Hole No.=A-09-001 Water Depth=30 ft Surface Elev.=164

Magnitude=6.6
Acceleration=0.48g

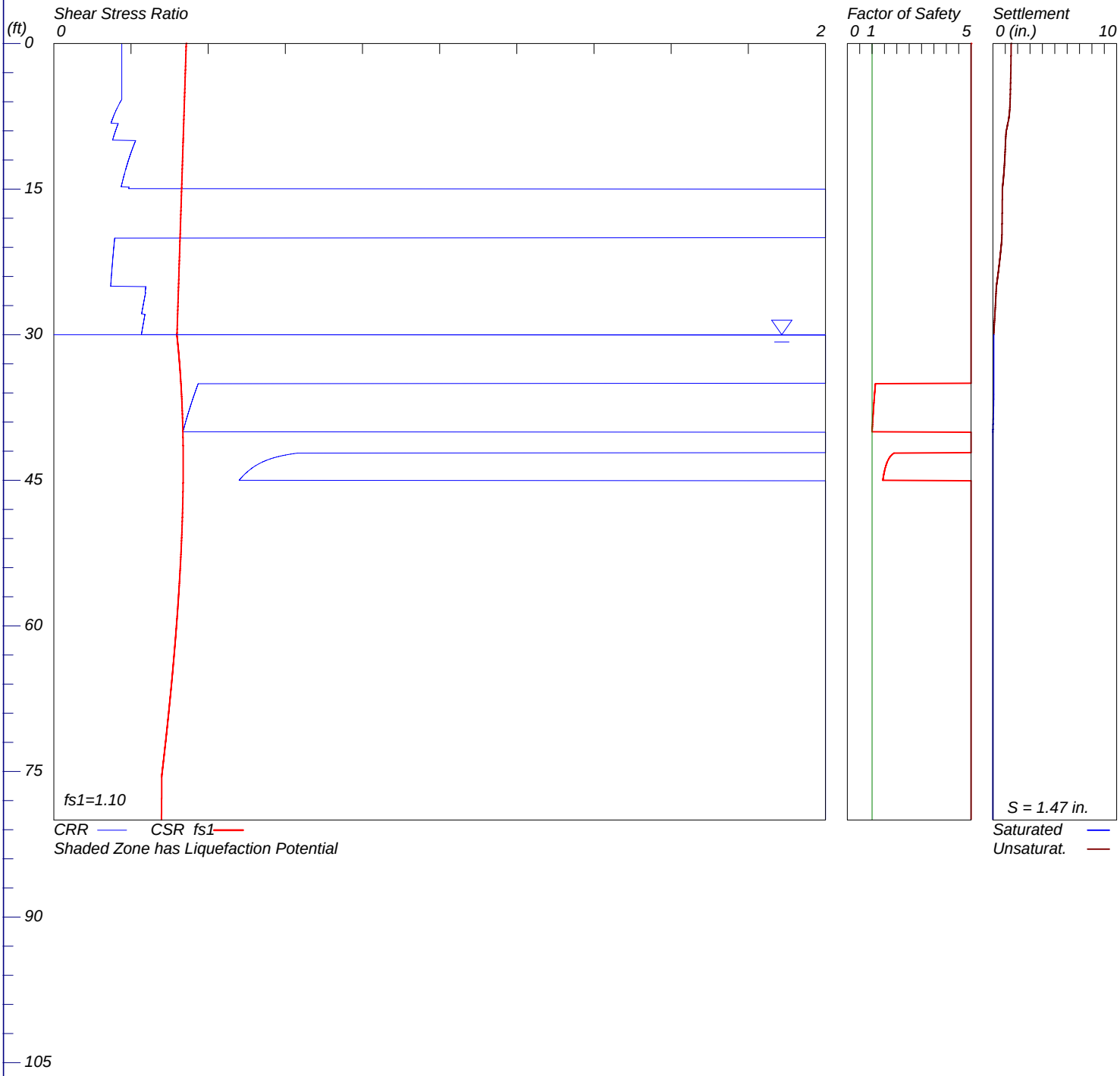


LIQUEFACTION ANALYSIS

Katella Avenue Overcrossing

Hole No.=A-09-002 Water Depth=30 ft Surface Elev.=162

Magnitude=6.6
Acceleration=0.48g



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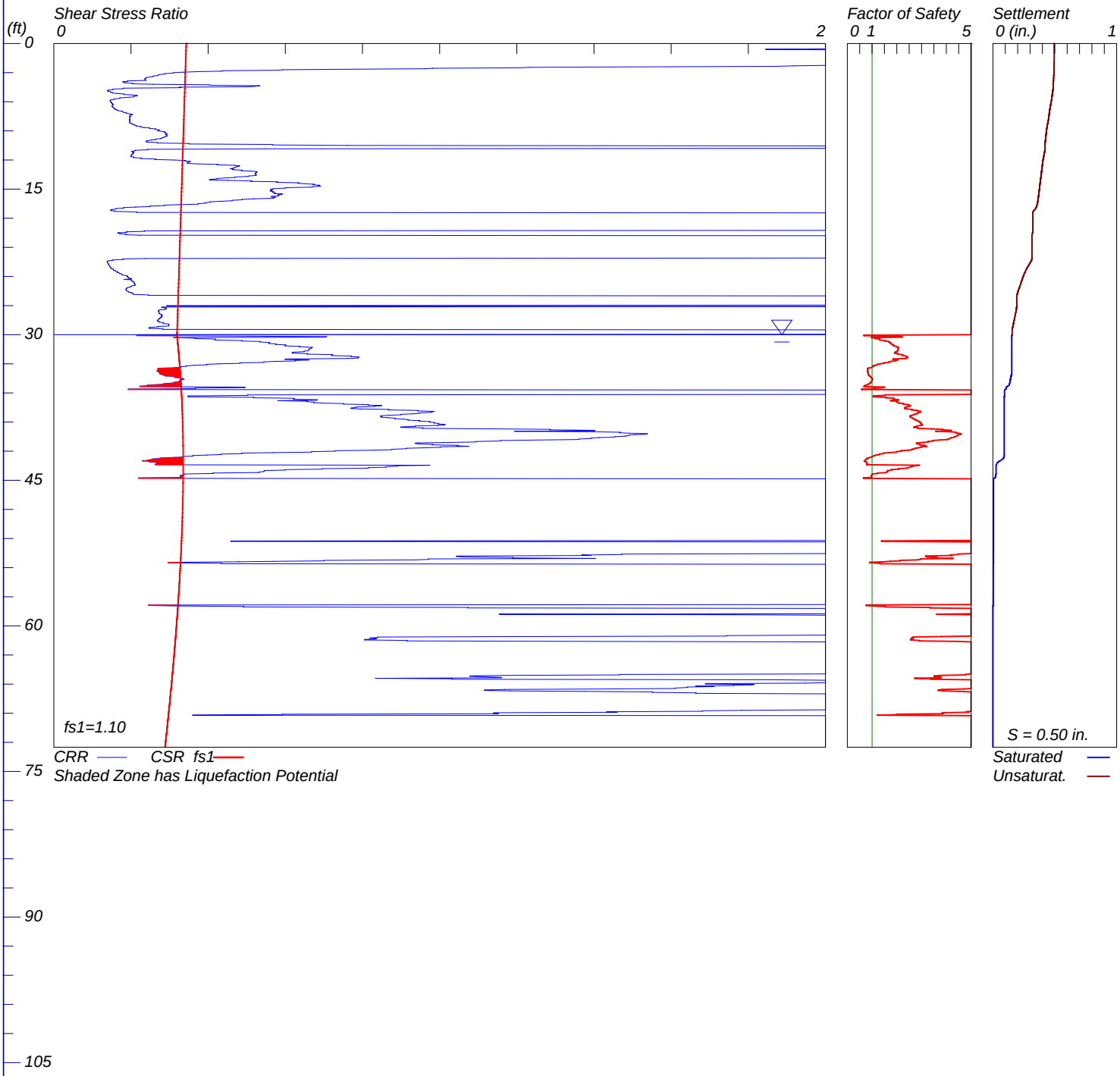
LIQUEFACTION ANALYSIS

Katella Avenue Overcrossing

Hole No.=CPT-09-003 Water Depth=30 ft Surface Elev.=164

Magnitude=6.6
Acceleration=0.48g



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LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\B-1.liq
Title: Katella Avenue Overcrossing
Subtitle: 602231-002

Surface Elev.=164
Hole No.=A-09-001
Depth of Hole= 65.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 49.00 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:
Surface Elev.=164
Hole No.=A-09-001
Depth of Hole=65.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 49.00 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.333
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	3.00	120.00	20.00
10.00	9.50	120.00	20.00
15.00	11.00	120.00	5.00
20.00	6.00	120.00	20.00
25.00	5.00	120.00	20.00
30.00	16.00	120.00	NoLiq
35.00	5.00	120.00	NoLiq
40.00	26.00	120.00	5.00
45.00	18.00	120.00	30.80
49.99	18.00	120.00	30.80
50.00	9.00	120.00	NoLiq
54.99	9.00	120.00	NoLiq
55.00	33.00	120.00	20.00
60.00	65.00	120.00	20.00
65.00	100.00	120.00	5.00

Output Results:
Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=1.64 in.
Total Settlement of Saturated and Unsaturated Sands=1.64 in.
Differential Settlement=0.821 to 1.084 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.16	0.34	5.00	0.00	1.64	1.64
5.00	0.16	0.34	5.00	0.00	1.57	1.57
10.00	0.35	0.34	5.00	0.00	1.05	1.05
15.00	0.30	0.33	5.00	0.00	0.97	0.97
20.00	0.26	0.33	5.00	0.00	0.82	0.82
25.00	0.18	0.32	5.00	0.00	0.55	0.55
30.00	0.15	0.32	5.00	0.00	0.01	0.01
35.00	2.00	0.33	5.00	0.00	0.00	0.00
40.00	2.00	0.33	5.00	0.00	0.00	0.00
45.00	0.47	0.34	1.41	0.00	0.00	0.00
50.00	0.35	0.33	1.06	0.00	0.00	0.00
55.00	2.00	0.33	5.00	0.00	0.00	0.00
60.00	2.38	0.32	5.00	0.00	0.00	0.00
65.00	2.36	0.31	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

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LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\B-2.liq
Title: Katella Avenue Overcrossing
Subtitle: 602231-002

Surface Elev.=162
Hole No.=A-09-002
Depth of Hole= 80.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 49.00 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:
Surface Elev.=162
Hole No.=A-09-002
Depth of Hole=80.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 49.00 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.333
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	5.00	120.00	5.00
10.00	7.00	120.00	5.00
15.00	19.00	120.00	5.00
20.00	4.00	120.00	20.00
25.00	8.00	120.00	20.00
30.00	7.60	120.00	NoLiq
35.00	18.00	120.00	11.90
40.00	24.00	120.00	11.90
45.00	8.00	120.00	NoLiq
50.00	15.00	120.00	NoLiq
55.00	18.00	120.00	NoLiq
60.00	100.00	120.00	20.00
65.00	87.00	120.00	20.00
70.00	13.00	120.00	NoLiq
75.00	100.00	120.00	5.00
80.00	48.00	120.00	5.00

Output Results:
Settlement of Saturated Sands=0.06 in.
Settlement of Unsaturated Sands=1.41 in.
Total Settlement of Saturated and Unsaturated Sands=1.47 in.
Differential Settlement=0.736 to 0.972 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.18	0.34	5.00	0.06	1.41	1.47
5.00	0.18	0.34	5.00	0.06	1.35	1.41
10.00	0.21	0.34	5.00	0.06	0.96	1.02
15.00	2.77	0.33	5.00	0.06	0.71	0.77
20.00	2.77	0.33	5.00	0.06	0.67	0.73
25.00	0.15	0.32	5.00	0.06	0.22	0.28
30.00	0.23	0.32	5.00	0.06	0.00	0.06
35.00	2.00	0.33	5.00	0.06	0.00	0.06
40.00	0.33	0.33	1.00	0.00	0.00	0.00
45.00	0.48	0.34	1.43	0.00	0.00	0.00
50.00	2.00	0.33	5.00	0.00	0.00	0.00
55.00	2.00	0.33	5.00	0.00	0.00	0.00
60.00	2.00	0.32	5.00	0.00	0.00	0.00
65.00	2.36	0.31	5.00	0.00	0.00	0.00
70.00	2.33	0.29	5.00	0.00	0.00	0.00
75.00	2.00	0.28	5.00	0.00	0.00	0.00
80.00	2.28	0.28	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

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*******************************************************************************
                                    LIQUEFACTION ANALYSIS SUMMARY
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        Font: Courier New, Regular, Size 8 is recommended for this report.
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        Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase
2\ENG\Liquefaction\CPT-1a.liq
        Title:  Katella Avenue Overcrossing
        Subtitle:  602231-002

        Surface Elev.=164
        Hole No.=CPT-09-003
        Depth of Hole= 72.50 ft
        Water Table during Earthquake= 30.00 ft
        Water Table during In-Situ Testing= 49.00 ft
        Max. Acceleration= 0.48 g
        Earthquake Magnitude= 6.60

 Input Data:
        Surface Elev.=164
        Hole No.=CPT-09-003
        Depth of Hole=72.50 ft
        Water Table during Earthquake= 30.00 ft
        Water Table during In-Situ Testing= 49.00 ft
        Max. Acceleration=0.48 g
        Earthquake Magnitude=6.60

        1. CPT Calculation Method: Modify Robertson*
        2. Settlement Analysis Method: Tokimatsu, M-correction
        3. Fines Correction for Liquefaction: Stark/Olson et al.*
        4. Fine Correction for Settlement: During Liquefaction*
        5. Settlement Calculation in: All zones*
        6. Hammer Energy Ratio,                                  Ce = 1
        7. Borehole Diameter,                                     Cb= 1
        8. Sampling Method,                                      Cs= 1
        9. User request factor of safety (apply to CSR) ,   User= 1.1
           Plot one CSR curve (fs1=User)
        10. Use Curve Smoothing: No
        * Recommended Options
```

In-Situ Test Data:

Depth ft	qc atm	fs atm	gamma pcf	Fines %	D50 mm
0.00	4.40	2.08	120.00	0.00	0.50
0.34	11.60	2.05	120.00	0.00	0.50
0.41	12.50	2.19	120.00	0.00	0.50
0.47	30.50	1.42	120.00	0.00	0.50
0.55	41.70	0.61	120.00	0.00	0.50
0.62	50.00	0.56	120.00	0.00	0.50
0.70	52.60	0.99	120.00	0.00	0.50
0.77	70.00	1.32	120.00	0.00	0.50
0.83	246.60	1.46	120.00	0.00	0.50
0.90	426.50	1.90	120.00	0.00	0.50
0.98	440.90	2.52	120.00	0.00	0.50
1.04	434.20	2.64	120.00	0.00	0.50
1.11	422.90	2.74	120.00	0.00	0.50
1.19	385.50	2.68	120.00	0.00	0.50
1.26	362.10	2.80	120.00	0.00	0.50
1.34	326.00	2.88	120.00	0.00	0.50
1.40	290.70	2.73	120.00	0.00	0.50
1.47	262.50	2.33	120.00	0.00	0.50
1.55	216.50	1.99	120.00	0.00	0.50
1.64	188.90	1.84	120.00	0.00	0.50
1.73	164.90	1.70	120.00	0.00	0.50
1.81	142.80	1.56	120.00	0.00	0.50
1.88	128.60	1.57	120.00	0.00	0.50
1.96	114.00	1.58	120.00	0.00	0.50
2.05	105.70	1.50	120.00	0.00	0.50
2.13	96.70	1.38	120.00	0.00	0.50
2.21	88.40	1.30	120.00	0.00	0.50
2.29	82.60	1.23	120.00	0.00	0.50
2.37	76.80	1.16	120.00	0.00	0.50
2.45	70.50	1.04	120.00	0.00	0.50
2.53	64.50	0.96	120.00	0.00	0.50
2.62	57.80	0.87	120.00	0.00	0.50
2.70	51.60	0.76	120.00	0.00	0.50
2.79	42.80	0.68	120.00	0.00	0.50
2.86	38.10	0.63	120.00	0.00	0.50
2.92	35.40	0.59	120.00	0.00	0.50
3.00	31.10	0.58	120.00	0.00	0.50
3.07	27.60	0.55	120.00	0.00	0.50
3.15	25.60	0.52	120.00	0.00	0.50
3.23	23.10	0.50	120.00	0.00	0.50
3.32	23.00	0.48	120.00	0.00	0.50
3.40	21.40	0.45	120.00	0.00	0.50
3.48	19.70	0.41	120.00	0.00	0.50
3.57	17.80	0.37	120.00	0.00	0.50
3.65	16.90	0.35	120.00	0.00	0.50
3.73	16.40	0.34	120.00	0.00	0.50
3.82	18.40	0.31	120.00	0.00	0.50
3.90	19.20	0.29	120.00	0.00	0.50
3.99	18.70	0.30	120.00	0.00	0.50
4.07	17.50	0.32	120.00	0.00	0.50
4.16	15.30	0.32	120.00	0.00	0.50
4.24	12.70	0.33	120.00	0.00	0.50
4.33	11.60	0.31	120.00	0.00	0.50
4.41	11.50	0.30	120.00	0.00	0.50
4.50	12.50	0.25	120.00	0.00	0.50
4.58	13.70	0.21	120.00	0.00	0.50
4.67	15.20	0.19	120.00	0.00	0.50
4.76	18.00	0.17	120.00	0.00	0.50
4.84	21.00	0.16	120.00	0.00	0.50
4.93	25.10	0.18	120.00	0.00	0.50
5.02	28.50	0.18	120.00	0.00	0.50
5.10	34.20	0.20	120.00	0.00	0.50
5.18	39.60	0.22	120.00	0.00	0.50
5.25	45.40	0.24	120.00	0.00	0.50
5.34	48.20	0.26	120.00	0.00	0.50
5.42	45.90	0.27	120.00	0.00	0.50
5.51	41.60	0.25	120.00	0.00	0.50
5.59	37.10	0.23	120.00	0.00	0.50
5.68	31.30	0.22	120.00	0.00	0.50
5.76	27.40	0.21	120.00	0.00	0.50
5.85	24.40	0.21	120.00	0.00	0.50

5.93	23.20	0.22	120.00	0.00	0.50
6.01	22.70	0.24	120.00	0.00	0.50
6.07	22.90	0.24	120.00	0.00	0.50
6.16	22.30	0.25	120.00	0.00	0.50
6.22	22.40	0.26	120.00	0.00	0.50
6.29	22.60	0.26	120.00	0.00	0.50
6.36	23.40	0.25	120.00	0.00	0.50
6.42	23.40	0.25	120.00	0.00	0.50
6.49	23.70	0.26	120.00	0.00	0.50
6.58	25.00	0.27	120.00	0.00	0.50
6.64	24.90	0.29	120.00	0.00	0.50
6.72	24.90	0.30	120.00	0.00	0.50
6.81	25.80	0.33	120.00	0.00	0.50
6.90	27.10	0.37	120.00	0.00	0.50
6.98	28.50	0.40	120.00	0.00	0.50
7.06	28.80	0.42	120.00	0.00	0.50
7.14	30.30	0.45	120.00	0.00	0.50
7.22	31.00	0.49	120.00	0.00	0.50
7.29	32.10	0.52	120.00	0.00	0.50
7.37	33.60	0.50	120.00	0.00	0.50
7.45	35.10	0.51	120.00	0.00	0.50
7.53	36.20	0.50	120.00	0.00	0.50
7.63	39.40	0.49	120.00	0.00	0.50
7.72	41.20	0.48	120.00	0.00	0.50
7.80	43.50	0.45	120.00	0.00	0.50
7.89	45.30	0.44	120.00	0.00	0.50
7.98	46.80	0.42	120.00	0.00	0.50
8.07	48.20	0.41	120.00	0.00	0.50
8.16	48.50	0.41	120.00	0.00	0.50
8.25	50.40	0.42	120.00	0.00	0.50
8.33	51.50	0.45	120.00	0.00	0.50
8.42	52.80	0.47	120.00	0.00	0.50
8.51	56.30	0.49	120.00	0.00	0.50
8.60	58.90	0.50	120.00	0.00	0.50
8.69	61.40	0.55	120.00	0.00	0.50
8.78	64.00	0.60	120.00	0.00	0.50
8.86	65.60	0.63	120.00	0.00	0.50
8.93	64.50	0.64	120.00	0.00	0.50
9.01	66.30	0.66	120.00	0.00	0.50
9.09	68.10	0.68	120.00	0.00	0.50
9.17	68.40	0.70	120.00	0.00	0.50
9.25	69.10	0.72	120.00	0.00	0.50
9.33	69.00	0.71	120.00	0.00	0.50
9.40	69.40	0.73	120.00	0.00	0.50
9.48	69.70	0.73	120.00	0.00	0.50
9.55	68.30	0.73	120.00	0.00	0.50
9.62	68.20	0.74	120.00	0.00	0.50
9.69	66.30	0.75	120.00	0.00	0.50
9.77	65.80	0.74	120.00	0.00	0.50
9.84	63.00	0.72	120.00	0.00	0.50
9.90	60.30	0.71	120.00	0.00	0.50
9.98	57.10	0.71	120.00	0.00	0.50
10.05	53.30	0.74	120.00	0.00	0.50
10.12	48.60	0.79	120.00	0.00	0.50
10.20	41.70	0.88	120.00	0.00	0.50
10.29	33.60	0.89	120.00	0.00	0.50
10.37	29.10	0.88	120.00	0.00	0.50
10.46	24.80	0.85	120.00	0.00	0.50
10.55	20.90	0.82	120.00	0.00	0.50
10.64	20.20	0.77	120.00	0.00	0.50
10.72	21.40	0.68	120.00	0.00	0.50
10.81	24.20	0.66	120.00	0.00	0.50
10.90	30.40	0.64	120.00	0.00	0.50
10.99	35.70	0.64	120.00	0.00	0.50
11.08	42.70	0.64	120.00	0.00	0.50
11.17	50.60	0.63	120.00	0.00	0.50
11.26	54.60	0.57	120.00	0.00	0.50
11.35	56.80	0.55	120.00	0.00	0.50
11.44	56.50	0.53	120.00	0.00	0.50
11.52	56.90	0.52	120.00	0.00	0.50
11.61	56.60	0.53	120.00	0.00	0.50
11.70	60.60	0.52	120.00	0.00	0.50
11.79	67.30	0.56	120.00	0.00	0.50
11.88	77.90	0.61	120.00	0.00	0.50
11.96	89.10	0.66	120.00	0.00	0.50
12.05	96.30	0.66	120.00	0.00	0.50
12.13	100.30	0.64	120.00	0.00	0.50
12.22	100.30	0.61	120.00	0.00	0.50
12.30	101.50	0.58	120.00	0.00	0.50
12.37	106.50	0.60	120.00	0.00	0.50
12.44	115.20	0.64	120.00	0.00	0.50
12.52	121.90	0.67	120.00	0.00	0.50
12.60	123.50	0.70	120.00	0.00	0.50
12.69	122.80	0.70	120.00	0.00	0.50
12.77	122.60	0.69	120.00	0.00	0.50
12.86	122.30	0.67	120.00	0.00	0.50
12.94	123.50	0.66	120.00	0.00	0.50
13.03	126.60	0.67	120.00	0.00	0.50
13.12	129.60	0.66	120.00	0.00	0.50
13.20	131.50	0.65	120.00	0.00	0.50
13.29	131.80	0.64	120.00	0.00	0.50
13.37	132.10	0.65	120.00	0.00	0.50
13.46	132.70	0.64	120.00	0.00	0.50
13.55	133.00	0.65	120.00	0.00	0.50
13.64	131.30	0.62	120.00	0.00	0.50
13.72	127.80	0.62	120.00	0.00	0.50
13.81	125.20	0.59	120.00	0.00	0.50
13.89	122.80	0.61	120.00	0.00	0.50
13.98	120.60	0.54	120.00	0.00	0.50
14.06	127.20	0.54	120.00	0.00	0.50
14.15	134.60	0.56	120.00	0.00	0.50
14.23	142.20	0.59	120.00	0.00	0.50
14.32	148.10	0.64	120.00	0.00	0.50
14.41	150.30	0.71	120.00	0.00	0.50
14.49	152.50	0.73	120.00	0.00	0.50
14.58	154.30	0.80	120.00	0.00	0.50
14.67	155.10	0.85	120.00	0.00	0.50
14.75	153.50	0.87	120.00	0.00	0.50
14.84	147.40	0.88	120.00	0.00	0.50
14.92	144.60	0.87	120.00	0.00	0.50
14.99	144.20	0.86	120.00	0.00	0.50
15.07	145.00	0.84	120.00	0.00	0.50
15.15	144.80	0.82	120.00	0.00	0.50
15.23	145.90	0.81	120.00	0.00	0.50
15.31	146.50	0.80	120.00	0.00	0.50
15.39	147.20	0.80	120.00	0.00	0.50
15.48	149.60	0.81	120.00	0.00	0.50
15.56	148.80	0.82	120.00	0.00	0.50
15.65	149.40	0.83	120.00	0.00	0.50
15.73	147.90	0.84	120.00	0.00	0.50

15.81	149.40	0.85	120.00	0.00	0.50
15.89	149.10	0.85	120.00	0.00	0.50
15.97	143.80	0.82	120.00	0.00	0.50
16.04	140.30	0.80	120.00	0.00	0.50
16.14	137.20	0.77	120.00	0.00	0.50
16.21	134.20	0.71	120.00	0.00	0.50
16.30	130.30	0.66	120.00	0.00	0.50
16.39	128.70	0.64	120.00	0.00	0.50
16.47	126.30	0.60	120.00	0.00	0.50
16.56	117.10	0.54	120.00	0.00	0.50
16.64	108.40	0.49	120.00	0.00	0.50
16.73	98.90	0.44	120.00	0.00	0.50
16.82	86.10	0.40	120.00	0.00	0.50
16.90	72.30	0.37	120.00	0.00	0.50
16.99	61.70	0.33	120.00	0.00	0.50
17.07	52.30	0.31	120.00	0.00	0.50
17.16	42.90	0.35	120.00	0.00	0.50
17.25	36.00	0.45	120.00	0.00	0.50
17.33	31.40	0.58	120.00	0.00	0.50
17.42	26.50	0.60	120.00	0.00	0.50
17.50	23.50	0.63	120.00	0.00	0.50
17.59	21.20	0.68	120.00	0.00	0.50
17.67	20.50	0.70	120.00	0.00	0.50
17.76	24.80	0.76	120.00	0.00	0.50
17.85	25.80	0.80	120.00	0.00	0.50
17.93	26.00	0.80	120.00	0.00	0.50
18.02	24.80	0.77	120.00	0.00	0.50
18.11	23.90	0.67	120.00	0.00	0.50
18.19	21.40	0.63	120.00	0.00	0.50
18.28	20.20	0.59	120.00	0.00	0.50
18.36	19.30	0.54	120.00	0.00	0.50
18.44	20.30	0.52	120.00	0.00	0.50
18.52	23.30	0.51	120.00	0.00	0.50
18.61	24.90	0.55	120.00	0.00	0.50
18.68	26.10	0.59	120.00	0.00	0.50
18.76	27.40	0.64	120.00	0.00	0.50
18.84	26.70	0.67	120.00	0.00	0.50
18.93	27.00	0.65	120.00	0.00	0.50
19.02	26.10	0.62	120.00	0.00	0.50
19.10	25.80	0.60	120.00	0.00	0.50
19.19	25.90	0.52	120.00	0.00	0.50
19.28	26.40	0.46	120.00	0.00	0.50
19.36	28.10	0.44	120.00	0.00	0.50
19.45	30.70	0.43	120.00	0.00	0.50
19.53	30.90	0.45	120.00	0.00	0.50
19.62	29.70	0.47	120.00	0.00	0.50
19.70	29.20	0.52	120.00	0.00	0.50
19.79	27.30	0.56	120.00	0.00	0.50
19.88	25.80	0.61	120.00	0.00	0.50
19.97	23.70	0.64	120.00	0.00	0.50
20.05	22.50	0.69	120.00	0.00	0.50
20.14	22.50	0.70	120.00	0.00	0.50
20.23	23.30	0.71	120.00	0.00	0.50
20.32	21.90	0.72	120.00	0.00	0.50
20.40	21.20	0.73	120.00	0.00	0.50
20.48	20.00	0.71	120.00	0.00	0.50
20.57	19.90	0.70	120.00	0.00	0.50
20.65	19.50	0.70	120.00	0.00	0.50
20.74	19.00	0.69	120.00	0.00	0.50
20.83	17.00	0.62	120.00	0.00	0.50
20.91	14.50	0.55	120.00	0.00	0.50
21.00	12.60	0.49	120.00	0.00	0.50
21.09	12.10	0.39	120.00	0.00	0.50
21.18	13.20	0.45	120.00	0.00	0.50
21.26	15.20	0.54	120.00	0.00	0.50
21.35	17.40	0.63	120.00	0.00	0.50
21.43	19.70	0.68	120.00	0.00	0.50
21.51	20.30	0.69	120.00	0.00	0.50
21.60	20.00	0.68	120.00	0.00	0.50
21.70	22.20	0.67	120.00	0.00	0.50
21.77	24.80	0.70	120.00	0.00	0.50
21.85	28.20	0.74	120.00	0.00	0.50
21.93	29.40	0.72	120.00	0.00	0.50
22.01	30.10	0.66	120.00	0.00	0.50
22.10	32.30	0.61	120.00	0.00	0.50
22.19	36.00	0.56	120.00	0.00	0.50
22.27	39.10	0.45	120.00	0.00	0.50
22.36	42.00	0.36	120.00	0.00	0.50
22.44	45.10	0.32	120.00	0.00	0.50
22.54	48.20	0.31	120.00	0.00	0.50
22.64	50.50	0.33	120.00	0.00	0.50
22.75	52.40	0.34	120.00	0.00	0.50
22.86	54.10	0.35	120.00	0.00	0.50
22.98	56.40	0.36	120.00	0.00	0.50
23.11	58.50	0.39	120.00	0.00	0.50
23.23	60.80	0.43	120.00	0.00	0.50
23.36	64.80	0.46	120.00	0.00	0.50
23.48	68.40	0.49	120.00	0.00	0.50
23.61	72.70	0.51	120.00	0.00	0.50
23.73	76.00	0.54	120.00	0.00	0.50
23.86	80.10	0.60	120.00	0.00	0.50
23.93	82.20	0.63	120.00	0.00	0.50
24.05	86.60	0.59	120.00	0.00	0.50
24.18	89.50	0.63	120.00	0.00	0.50
24.25	76.10	0.63	120.00	0.00	0.50
24.33	90.20	0.64	120.00	0.00	0.50
24.43	90.50	0.65	120.00	0.00	0.50
24.52	91.90	0.68	120.00	0.00	0.50
24.62	92.20	0.69	120.00	0.00	0.50
24.71	92.80	0.71	120.00	0.00	0.50
24.78	92.30	0.72	120.00	0.00	0.50
24.85	91.90	0.74	120.00	0.00	0.50
24.91	89.30	0.72	120.00	0.00	0.50
24.98	86.10	0.72	120.00	0.00	0.50
25.05	83.50	0.71	120.00	0.00	0.50
25.12	81.20	0.71	120.00	0.00	0.50
25.19	79.10	0.70	120.00	0.00	0.50
25.25	77.30	0.71	120.00	0.00	0.50
25.33	75.50	0.73	120.00	0.00	0.50
25.39	74.10	0.76	120.00	0.00	0.50
25.46	71.90	0.81	120.00	0.00	0.50
25.53	70.50	0.86	120.00	0.00	0.50
25.63	67.20	0.93	120.00	0.00	0.50
25.74	62.30	0.98	120.00	0.00	0.50
25.87	55.40	1.14	120.00	0.00	0.50
25.99	45.70	1.31	120.00	0.00	0.50
26.11	32.50	1.35	120.00	0.00	0.50
26.23	25.40	1.17	120.00	0.00	0.50
26.36	21.00	1.01	120.00	0.00	0.50
26.48	17.90	0.88	120.00	0.00	0.50

26.61	21.30	0.72	120.00	0.00	0.50
26.73	28.70	0.71	120.00	0.00	0.50
26.86	38.90	0.84	120.00	0.00	0.50
26.98	44.10	1.01	120.00	0.00	0.50
27.10	46.70	1.06	120.00	0.00	0.50
27.23	52.90	1.25	120.00	0.00	0.50
27.35	59.10	1.38	120.00	0.00	0.50
27.42	67.40	1.45	120.00	0.00	0.50
27.50	75.40	1.50	120.00	0.00	0.50
27.57	81.70	1.52	120.00	0.00	0.50
27.64	83.20	1.53	120.00	0.00	0.50
27.71	88.90	1.51	120.00	0.00	0.50
27.80	93.50	1.50	120.00	0.00	0.50
27.89	95.10	1.52	120.00	0.00	0.50
27.97	94.40	1.55	120.00	0.00	0.50
28.06	91.00	1.56	120.00	0.00	0.50
28.13	91.60	1.57	120.00	0.00	0.50
28.24	88.00	1.56	120.00	0.00	0.50
28.36	86.50	1.54	120.00	0.00	0.50
28.48	86.60	1.53	120.00	0.00	0.50
28.61	90.40	1.55	120.00	0.00	0.50
28.73	97.50	1.59	120.00	0.00	0.50
28.85	106.80	1.61	120.00	0.00	0.50
28.98	107.50	1.61	120.00	0.00	0.50
29.10	94.40	1.52	120.00	0.00	0.50
29.23	76.60	1.41	120.00	0.00	0.50
29.35	60.20	1.40	120.00	0.00	0.50
29.48	43.40	1.34	120.00	0.00	0.50
29.60	34.50	1.32	120.00	0.00	0.50
29.73	38.50	1.33	120.00	0.00	0.50
29.86	48.80	1.23	120.00	0.00	0.50
29.98	66.20	1.16	120.00	0.00	0.50
30.11	196.50	1.19	120.00	0.00	0.50
30.17	226.10	1.25	120.00	0.00	0.50
30.25	132.60	1.34	120.00	0.00	0.50
30.34	148.60	1.49	120.00	0.00	0.50
30.44	159.80	1.66	120.00	0.00	0.50
30.55	173.50	1.85	120.00	0.00	0.50
30.66	181.70	1.99	120.00	0.00	0.50
30.78	185.00	2.08	120.00	0.00	0.50
30.91	186.80	2.17	120.00	0.00	0.50
31.04	189.70	2.28	120.00	0.00	0.50
31.16	195.30	2.38	120.00	0.00	0.50
31.28	200.30	2.46	120.00	0.00	0.50
31.41	198.80	2.48	120.00	0.00	0.50
31.53	199.00	2.49	120.00	0.00	0.50
31.66	197.60	2.47	120.00	0.00	0.50
31.79	193.50	2.41	120.00	0.00	0.50
31.91	200.50	2.48	120.00	0.00	0.50
32.03	206.20	2.75	120.00	0.00	0.50
32.16	204.90	3.14	120.00	0.00	0.50
32.28	197.90	3.49	120.00	0.00	0.50
32.41	188.90	3.59	120.00	0.00	0.50
32.47	135.20	3.55	120.00	0.00	0.50
32.55	169.10	3.47	120.00	0.00	0.50
32.62	165.70	3.33	120.00	0.00	0.50
32.70	160.20	3.11	120.00	0.00	0.50
32.77	150.70	3.10	120.00	0.00	0.50
32.87	137.80	2.89	120.00	0.00	0.50
32.96	123.00	2.68	120.00	0.00	0.50
33.03	115.80	2.53	120.00	0.00	0.50
33.11	108.60	2.36	120.00	0.00	0.50
33.19	103.50	2.23	120.00	0.00	0.50
33.27	97.80	2.14	120.00	0.00	0.50
33.35	91.60	2.02	120.00	0.00	0.50
33.43	89.00	1.73	120.00	0.00	0.50
33.51	83.70	1.71	120.00	0.00	0.50
33.59	84.10	1.72	120.00	0.00	0.50
33.69	85.40	1.71	120.00	0.00	0.50
33.76	84.10	1.73	120.00	0.00	0.50
33.83	93.50	1.76	120.00	0.00	0.50
33.91	105.00	1.75	120.00	0.00	0.50
33.99	112.10	1.66	120.00	0.00	0.50
34.08	124.20	1.53	120.00	0.00	0.50
34.15	134.00	1.43	120.00	0.00	0.50
34.25	146.60	1.34	120.00	0.00	0.50
34.32	151.20	1.29	120.00	0.00	0.50
34.40	155.90	1.26	120.00	0.00	0.50
34.48	161.10	1.26	120.00	0.00	0.50
34.56	161.90	1.29	120.00	0.00	0.50
34.64	158.80	1.31	120.00	0.00	0.50
34.72	156.80	1.32	120.00	0.00	0.50
34.80	154.60	1.32	120.00	0.00	0.50
34.88	151.60	1.32	120.00	0.00	0.50
34.96	146.50	1.32	120.00	0.00	0.50
35.03	140.20	1.30	120.00	0.00	0.50
35.11	132.90	1.23	120.00	0.00	0.50
35.19	125.40	1.13	120.00	0.00	0.50
35.27	116.20	1.07	120.00	0.00	0.50
35.35	214.50	1.04	120.00	0.00	0.50
35.45	182.90	1.07	120.00	0.00	0.50
35.55	76.80	1.14	120.00	0.00	0.50
35.68	54.20	1.38	120.00	0.00	0.50
35.80	40.00	1.39	120.00	0.00	0.50
35.92	42.00	1.30	120.00	0.00	0.50
36.05	47.30	1.25	120.00	0.00	0.50
36.17	218.70	1.23	120.00	0.00	0.50
36.29	173.10	1.27	120.00	0.00	0.50
36.42	215.00	1.60	120.00	0.00	0.50
36.54	238.70	1.65	120.00	0.00	0.50
36.67	241.50	2.04	120.00	0.00	0.50
36.76	212.90	2.26	120.00	0.00	0.50
36.84	227.80	2.37	120.00	0.00	0.50
36.92	230.60	2.42	120.00	0.00	0.50
37.00	233.80	2.51	120.00	0.00	0.50
37.09	240.20	2.68	120.00	0.00	0.50
37.17	249.20	2.82	120.00	0.00	0.50
37.26	254.30	2.89	120.00	0.00	0.50
37.34	249.70	2.95	120.00	0.00	0.50
37.43	240.50	2.97	120.00	0.00	0.50
37.51	240.00	2.91	120.00	0.00	0.50
37.60	246.00	2.88	120.00	0.00	0.50
37.69	259.40	2.90	120.00	0.00	0.50
37.77	267.00	3.13	120.00	0.00	0.50
37.85	267.50	3.41	120.00	0.00	0.50
37.93	261.30	3.62	120.00	0.00	0.50
38.01	254.20	3.70	120.00	0.00	0.50
38.10	250.70	3.73	120.00	0.00	0.50
38.18	244.90	3.75	120.00	0.00	0.50
38.26	239.50	3.75	120.00	0.00	0.50

38.34	234.90	3.77	120.00	0.00	0.50
38.42	236.50	3.75	120.00	0.00	0.50
38.50	242.00	3.69	120.00	0.00	0.50
38.58	247.20	3.64	120.00	0.00	0.50
38.66	254.50	3.55	120.00	0.00	0.50
38.74	259.60	3.45	120.00	0.00	0.50
38.83	266.00	3.42	120.00	0.00	0.50
38.92	271.90	3.39	120.00	0.00	0.50
39.02	277.00	3.29	120.00	0.00	0.50
39.11	282.10	3.18	120.00	0.00	0.50
39.20	287.00	3.11	120.00	0.00	0.50
39.30	287.20	3.00	120.00	0.00	0.50
39.39	281.80	2.84	120.00	0.00	0.50
39.48	282.70	2.57	120.00	0.00	0.50
39.57	296.90	1.98	120.00	0.00	0.50
39.66	316.40	2.08	120.00	0.00	0.50
39.73	331.80	2.13	120.00	0.00	0.50
39.83	342.80	2.12	120.00	0.00	0.50
39.90	323.80	2.08	120.00	0.00	0.50
39.96	343.10	2.06	120.00	0.00	0.50
40.04	349.40	2.09	120.00	0.00	0.50
40.11	352.00	2.16	120.00	0.00	0.50
40.19	356.10	2.20	120.00	0.00	0.50
40.27	353.90	2.21	120.00	0.00	0.50
40.33	352.90	2.18	120.00	0.00	0.50
40.41	352.50	2.13	120.00	0.00	0.50
40.49	350.60	2.09	120.00	0.00	0.50
40.56	347.40	2.07	120.00	0.00	0.50
40.64	345.90	2.05	120.00	0.00	0.50
40.72	343.50	2.08	120.00	0.00	0.50
40.80	334.20	2.10	120.00	0.00	0.50
40.88	324.70	2.10	120.00	0.00	0.50
40.97	318.50	2.09	120.00	0.00	0.50
41.05	311.40	2.05	120.00	0.00	0.50
41.13	301.40	2.03	120.00	0.00	0.50
41.21	302.70	1.99	120.00	0.00	0.50
41.29	307.20	2.03	120.00	0.00	0.50
41.37	315.10	2.05	120.00	0.00	0.50
41.45	318.70	2.05	120.00	0.00	0.50
41.53	310.70	2.08	120.00	0.00	0.50
41.61	306.60	2.05	120.00	0.00	0.50
41.69	300.80	1.99	120.00	0.00	0.50
41.78	296.60	1.91	120.00	0.00	0.50
41.86	290.70	1.87	120.00	0.00	0.50
41.94	277.10	1.80	120.00	0.00	0.50
42.02	268.10	1.66	120.00	0.00	0.50
42.10	251.60	1.51	120.00	0.00	0.50
42.19	236.30	1.40	120.00	0.00	0.50
42.27	223.70	1.30	120.00	0.00	0.50
42.35	212.80	1.26	120.00	0.00	0.50
42.44	202.40	1.20	120.00	0.00	0.50
42.52	193.40	1.17	120.00	0.00	0.50
42.61	188.40	0.98	120.00	0.00	0.50
42.69	173.20	1.01	120.00	0.00	0.50
42.77	159.70	1.07	120.00	0.00	0.50
42.87	152.00	1.11	120.00	0.00	0.50
42.95	143.50	1.10	120.00	0.00	0.50
43.02	153.40	1.14	120.00	0.00	0.50
43.10	159.20	1.23	120.00	0.00	0.50
43.18	160.10	1.27	120.00	0.00	0.50
43.25	159.80	1.28	120.00	0.00	0.50
43.33	158.30	1.27	120.00	0.00	0.50
43.41	315.60	1.25	120.00	0.00	0.50
43.48	305.30	1.24	120.00	0.00	0.50
43.56	302.00	1.23	120.00	0.00	0.50
43.65	296.10	1.23	120.00	0.00	0.50
43.76	279.10	1.23	120.00	0.00	0.50
43.86	263.40	1.21	120.00	0.00	0.50
43.98	254.00	1.18	120.00	0.00	0.50
44.10	251.90	1.22	120.00	0.00	0.50
44.22	224.20	1.30	120.00	0.00	0.50
44.34	198.90	1.23	120.00	0.00	0.50
44.47	200.30	1.07	120.00	0.00	0.50
44.59	201.90	1.04	120.00	0.00	0.50
44.72	141.30	1.12	120.00	0.00	0.50
44.84	38.50	0.95	120.00	0.00	0.50
44.97	23.80	0.71	120.00	0.00	0.50
45.09	18.10	0.52	120.00	0.00	0.50
45.22	17.30	0.31	120.00	0.00	0.50
45.35	16.80	0.22	120.00	0.00	0.50
45.47	15.90	0.17	120.00	0.00	0.50
45.60	15.90	0.17	120.00	0.00	0.50
45.73	15.70	0.17	120.00	0.00	0.50
45.85	16.50	0.19	120.00	0.00	0.50
45.98	15.90	0.19	120.00	0.00	0.50
46.05	14.00	0.18	120.00	0.00	0.50
46.13	14.30	0.19	120.00	0.00	0.50
46.22	12.80	0.21	120.00	0.00	0.50
46.31	12.10	0.22	120.00	0.00	0.50
46.41	11.90	0.22	120.00	0.00	0.50
46.49	11.20	0.22	120.00	0.00	0.50
46.57	11.40	0.21	120.00	0.00	0.50
46.66	11.60	0.18	120.00	0.00	0.50
46.78	10.90	0.16	120.00	0.00	0.50
46.89	11.90	0.16	120.00	0.00	0.50
47.02	11.30	0.15	120.00	0.00	0.50
47.15	11.20	0.17	120.00	0.00	0.50
47.22	11.00	0.19	120.00	0.00	0.50
47.29	10.90	0.20	120.00	0.00	0.50
47.36	11.50	0.17	120.00	0.00	0.50
47.43	11.80	0.15	120.00	0.00	0.50
47.51	11.50	0.05	120.00	0.00	0.50
47.58	10.70	0.03	120.00	0.00	0.50
47.65	10.30	0.05	120.00	0.00	0.50
47.72	9.70	0.09	120.00	0.00	0.50
47.80	10.70	0.15	120.00	0.00	0.50
47.87	8.70	0.34	120.00	0.00	0.50
47.95	9.90	0.40	120.00	0.00	0.50
48.02	15.50	0.41	120.00	0.00	0.50
48.09	19.30	0.61	120.00	0.00	0.50
48.16	26.70	1.01	120.00	0.00	0.50
48.24	43.10	1.35	120.00	0.00	0.50
48.31	47.70	1.63	120.00	0.00	0.50
48.39	44.80	1.87	120.00	0.00	0.50
48.46	34.20	1.82	120.00	0.00	0.50
48.54	25.30	1.63	120.00	0.00	0.50
48.61	20.00	1.37	120.00	0.00	0.50
48.69	15.60	0.95	120.00	0.00	0.50
48.76	13.30	0.83	120.00	0.00	0.50
48.83	11.50	0.90	120.00	0.00	0.50

48.91	11.80	0.98	120.00	0.00	0.50
48.98	15.20	1.02	120.00	0.00	0.50
49.06	15.90	0.91	120.00	0.00	0.50
49.13	16.60	0.80	120.00	0.00	0.50
49.23	15.80	0.78	120.00	0.00	0.50
49.29	14.90	0.85	120.00	0.00	0.50
49.36	14.20	0.89	120.00	0.00	0.50
49.43	14.30	0.86	120.00	0.00	0.50
49.51	19.10	0.95	120.00	0.00	0.50
49.59	17.60	1.05	120.00	0.00	0.50
49.68	20.00	1.18	120.00	0.00	0.50
49.78	21.60	1.33	120.00	0.00	0.50
49.88	23.60	1.43	120.00	0.00	0.50
49.99	22.20	1.55	120.00	0.00	0.50
50.09	22.20	1.50	120.00	0.00	0.50
50.20	21.10	1.35	120.00	0.00	0.50
50.30	18.80	1.24	120.00	0.00	0.50
50.41	15.90	1.17	120.00	0.00	0.50
50.50	15.20	1.08	120.00	0.00	0.50
50.58	14.10	1.01	120.00	0.00	0.50
50.67	15.00	0.95	120.00	0.00	0.50
50.80	16.10	0.97	120.00	0.00	0.50
50.87	14.30	0.95	120.00	0.00	0.50
50.94	14.00	0.96	120.00	0.00	0.50
51.02	15.40	1.13	120.00	0.00	0.50
51.10	22.30	1.35	120.00	0.00	0.50
51.17	53.70	1.54	120.00	0.00	0.50
51.24	250.00	1.69	120.00	0.00	0.50
51.32	479.00	1.83	120.00	0.00	0.50
51.39	698.30	1.77	120.00	0.00	0.50
51.46	909.40	2.69	120.00	0.00	0.50
51.53	991.80	3.69	120.00	0.00	0.50
51.60	1051.00	7.21	120.00	0.00	0.50
51.67	545.00	6.65	120.00	0.00	0.50
51.74	552.60	4.89	120.00	0.00	0.50
51.82	596.60	4.12	120.00	0.00	0.50
51.89	624.90	3.83	120.00	0.00	0.50
51.96	621.50	5.89	120.00	0.00	0.50
52.03	593.70	7.47	120.00	0.00	0.50
52.10	575.10	6.97	120.00	0.00	0.50
52.17	567.10	6.20	120.00	0.00	0.50
52.24	598.90	7.28	120.00	0.00	0.50
52.31	565.50	4.17	120.00	0.00	0.50
52.38	541.90	2.71	120.00	0.00	0.50
52.45	499.20	2.36	120.00	0.00	0.50
52.52	447.80	2.60	120.00	0.00	0.50
52.58	401.80	2.52	120.00	0.00	0.50
52.65	391.60	2.42	120.00	0.00	0.50
52.72	394.10	3.06	120.00	0.00	0.50
52.79	347.90	3.34	120.00	0.00	0.50
52.86	357.80	3.02	120.00	0.00	0.50
52.93	372.90	3.30	120.00	0.00	0.50
53.01	392.70	3.90	120.00	0.00	0.50
53.09	344.20	2.97	120.00	0.00	0.50
53.16	342.10	2.44	120.00	0.00	0.50
53.23	306.50	2.18	120.00	0.00	0.50
53.31	271.20	2.27	120.00	0.00	0.50
53.37	247.40	2.13	120.00	0.00	0.50
53.44	179.90	1.84	120.00	0.00	0.50
53.52	235.90	2.01	120.00	0.00	0.50
53.61	81.20	2.14	120.00	0.00	0.50
53.69	59.30	1.82	120.00	0.00	0.50
53.76	43.60	1.36	120.00	0.00	0.50
53.84	29.70	1.23	120.00	0.00	0.50
53.92	22.80	1.06	120.00	0.00	0.50
54.00	19.40	0.84	120.00	0.00	0.50
54.09	19.90	0.52	120.00	0.00	0.50
54.17	21.60	0.42	120.00	0.00	0.50
54.26	24.30	0.46	120.00	0.00	0.50
54.34	25.70	0.50	120.00	0.00	0.50
54.43	23.50	0.57	120.00	0.00	0.50
54.50	26.00	0.63	120.00	0.00	0.50
54.58	27.50	0.63	120.00	0.00	0.50
54.66	29.50	0.65	120.00	0.00	0.50
54.74	32.60	0.72	120.00	0.00	0.50
54.82	34.10	0.79	120.00	0.00	0.50
54.90	35.80	0.91	120.00	0.00	0.50
54.99	36.10	1.05	120.00	0.00	0.50
55.07	44.20	1.18	120.00	0.00	0.50
55.16	36.70	1.21	120.00	0.00	0.50
55.24	36.10	1.29	120.00	0.00	0.50
55.33	35.70	1.33	120.00	0.00	0.50
55.41	35.30	1.39	120.00	0.00	0.50
55.50	34.30	1.42	120.00	0.00	0.50
55.58	34.80	1.51	120.00	0.00	0.50
55.66	35.40	1.61	120.00	0.00	0.50
55.75	36.10	1.70	120.00	0.00	0.50
55.84	36.10	1.77	120.00	0.00	0.50
55.93	35.60	1.81	120.00	0.00	0.50
56.00	35.30	1.80	120.00	0.00	0.50
56.08	34.50	1.76	120.00	0.00	0.50
56.16	34.10	1.72	120.00	0.00	0.50
56.25	33.60	1.69	120.00	0.00	0.50
56.32	33.00	1.66	120.00	0.00	0.50
56.39	33.20	1.60	120.00	0.00	0.50
56.48	32.70	1.54	120.00	0.00	0.50
56.57	32.40	1.59	120.00	0.00	0.50
56.65	31.80	1.69	120.00	0.00	0.50
56.74	31.10	1.75	120.00	0.00	0.50
56.83	30.80	1.75	120.00	0.00	0.50
56.92	31.30	1.79	120.00	0.00	0.50
57.01	32.30	1.87	120.00	0.00	0.50
57.10	34.80	1.95	120.00	0.00	0.50
57.19	39.00	1.96	120.00	0.00	0.50
57.27	42.70	1.92	120.00	0.00	0.50
57.37	44.40	1.95	120.00	0.00	0.50
57.45	43.90	1.86	120.00	0.00	0.50
57.54	45.40	1.58	120.00	0.00	0.50
57.63	49.90	1.36	120.00	0.00	0.50
57.72	60.80	1.30	120.00	0.00	0.50
57.81	172.20	1.41	120.00	0.00	0.50
57.90	215.90	1.44	120.00	0.00	0.50
57.99	273.10	1.47	120.00	0.00	0.50
58.08	369.40	1.72	120.00	0.00	0.50
58.16	496.70	1.77	120.00	0.00	0.50
58.25	577.90	1.87	120.00	0.00	0.50
58.34	594.40	1.74	120.00	0.00	0.50
58.43	619.50	2.17	120.00	0.00	0.50
58.49	549.20	2.49	120.00	0.00	0.50
58.58	625.50	2.66	120.00	0.00	0.50

58.66	602.70	2.73	120.00	0.00	0.50
58.75	380.70	0.88	120.00	0.00	0.50
58.82	442.90	0.53	120.00	0.00	0.50
58.89	500.70	0.58	120.00	0.00	0.50
58.96	559.00	1.14	120.00	0.00	0.50
59.03	636.00	3.21	120.00	0.00	0.50
59.10	636.20	3.94	120.00	0.00	0.50
59.17	716.30	3.38	120.00	0.00	0.50
59.24	745.40	3.48	120.00	0.00	0.50
59.31	827.60	4.54	120.00	0.00	0.50
59.38	853.00	4.28	120.00	0.00	0.50
59.45	818.60	3.49	120.00	0.00	0.50
59.52	804.80	3.16	120.00	0.00	0.50
59.60	788.00	3.53	120.00	0.00	0.50
59.67	829.90	4.32	120.00	0.00	0.50
59.74	849.90	4.67	120.00	0.00	0.50
59.81	852.80	4.93	120.00	0.00	0.50
59.89	779.80	4.44	120.00	0.00	0.50
59.96	700.40	3.88	120.00	0.00	0.50
60.03	725.30	2.34	120.00	0.00	0.50
60.10	735.90	1.40	120.00	0.00	0.50
60.18	747.30	1.43	120.00	0.00	0.50
60.26	793.50	2.03	120.00	0.00	0.50
60.34	822.80	2.64	120.00	0.00	0.50
60.41	812.00	2.41	120.00	0.00	0.50
60.48	806.20	2.27	120.00	0.00	0.50
60.54	732.10	2.15	120.00	0.00	0.50
60.62	733.60	2.31	120.00	0.00	0.50
60.69	719.50	2.51	120.00	0.00	0.50
60.76	653.60	3.05	120.00	0.00	0.50
60.83	586.30	3.42	120.00	0.00	0.50
60.91	504.10	3.43	120.00	0.00	0.50
60.98	446.30	3.40	120.00	0.00	0.50
61.05	390.70	3.44	120.00	0.00	0.50
61.12	323.60	3.47	120.00	0.00	0.50
61.20	310.40	3.81	120.00	0.00	0.50
61.29	306.00	4.13	120.00	0.00	0.50
61.37	315.20	3.52	120.00	0.00	0.50
61.46	354.60	2.70	120.00	0.00	0.50
61.55	415.50	2.54	120.00	0.00	0.50
61.64	510.30	2.90	120.00	0.00	0.50
61.74	585.20	3.15	120.00	0.00	0.50
61.81	612.20	3.16	120.00	0.00	0.50
61.89	612.80	3.48	120.00	0.00	0.50
61.96	644.30	3.53	120.00	0.00	0.50
62.03	635.50	3.71	120.00	0.00	0.50
62.10	687.10	4.04	120.00	0.00	0.50
62.17	697.90	5.01	120.00	0.00	0.50
62.25	718.00	5.77	120.00	0.00	0.50
62.33	740.60	4.80	120.00	0.00	0.50
62.41	761.00	3.93	120.00	0.00	0.50
62.49	779.90	3.60	120.00	0.00	0.50
62.56	773.30	3.57	120.00	0.00	0.50
62.64	800.10	3.71	120.00	0.00	0.50
62.71	831.70	4.15	120.00	0.00	0.50
62.78	833.20	4.15	120.00	0.00	0.50
62.86	841.20	4.25	120.00	0.00	0.50
62.93	821.60	3.67	120.00	0.00	0.50
63.00	825.40	4.26	120.00	0.00	0.50
63.07	834.10	4.17	120.00	0.00	0.50
63.14	825.20	2.46	120.00	0.00	0.50
63.21	825.20	1.92	120.00	0.00	0.50
63.28	821.90	0.73	120.00	0.00	0.50
63.36	830.00	0.65	120.00	0.00	0.50
63.43	837.70	2.15	120.00	0.00	0.50
63.50	863.40	3.43	120.00	0.00	0.50
63.57	903.70	3.43	120.00	0.00	0.50
63.64	858.80	3.42	120.00	0.00	0.50
63.71	848.20	7.59	120.00	0.00	0.50
63.77	848.50	10.16	120.00	0.00	0.50
63.84	871.10	6.12	120.00	0.00	0.50
63.91	696.20	5.01	120.00	0.00	0.50
63.98	761.00	4.90	120.00	0.00	0.50
64.06	842.00	13.66	120.00	0.00	0.50
64.13	833.90	6.10	120.00	0.00	0.50
64.20	814.70	5.47	120.00	0.00	0.50
64.27	825.10	4.82	120.00	0.00	0.50
64.33	831.20	6.55	120.00	0.00	0.50
64.40	796.60	7.63	120.00	0.00	0.50
64.47	908.60	7.04	120.00	0.00	0.50
64.54	847.00	8.11	120.00	0.00	0.50
64.61	788.70	9.25	120.00	0.00	0.50
64.68	586.70	9.23	120.00	0.00	0.50
64.75	548.90	8.21	120.00	0.00	0.50
64.84	567.40	4.54	120.00	0.00	0.50
64.91	505.50	3.24	120.00	0.00	0.50
64.99	428.50	2.82	120.00	0.00	0.50
65.05	395.80	2.25	120.00	0.00	0.50
65.14	383.90	2.17	120.00	0.00	0.50
65.21	389.20	2.07	120.00	0.00	0.50
65.28	394.50	2.67	120.00	0.00	0.50
65.37	349.30	2.48	120.00	0.00	0.50
65.44	373.80	3.44	120.00	0.00	0.50
65.51	456.00	5.45	120.00	0.00	0.50
65.59	546.50	6.08	120.00	0.00	0.50
65.65	535.20	5.61	120.00	0.00	0.50
65.73	485.60	5.25	120.00	0.00	0.50
65.79	488.50	5.16	120.00	0.00	0.50
65.86	475.70	4.82	120.00	0.00	0.50
65.93	452.70	3.87	120.00	0.00	0.50
66.00	464.40	3.21	120.00	0.00	0.50
66.08	459.80	2.57	120.00	0.00	0.50
66.15	450.70	2.25	120.00	0.00	0.50
66.22	455.30	2.19	120.00	0.00	0.50
66.29	448.90	2.46	120.00	0.00	0.50
66.36	446.10	2.48	120.00	0.00	0.50
66.45	427.70	2.57	120.00	0.00	0.50
66.52	398.00	3.07	120.00	0.00	0.50
66.59	391.50	2.94	120.00	0.00	0.50
66.66	400.00	2.58	120.00	0.00	0.50
66.72	422.30	2.25	120.00	0.00	0.50
66.79	441.10	2.24	120.00	0.00	0.50
66.87	452.40	2.39	120.00	0.00	0.50
66.96	489.80	3.96	120.00	0.00	0.50
67.05	550.20	6.97	120.00	0.00	0.50
67.12	613.00	9.74	120.00	0.00	0.50
67.19	681.30	9.64	120.00	0.00	0.50
67.26	760.40	5.40	120.00	0.00	0.50
67.34	855.60	5.39	120.00	0.00	0.50
67.41	681.30	3.62	120.00	0.00	0.50

67.48	692.80	6.36	120.00	0.00	0.50
67.55	670.30	7.75	120.00	0.00	0.50
67.62	602.90	5.74	120.00	0.00	0.50
67.69	628.90	4.28	120.00	0.00	0.50
67.76	715.00	3.07	120.00	0.00	0.50
67.84	726.50	2.83	120.00	0.00	0.50
67.91	712.30	3.00	120.00	0.00	0.50
67.98	681.50	3.99	120.00	0.00	0.50
68.06	676.80	5.25	120.00	0.00	0.50
68.13	568.70	6.31	120.00	0.00	0.50
68.20	558.30	7.12	120.00	0.00	0.50
68.28	521.00	6.75	120.00	0.00	0.50
68.36	539.00	5.77	120.00	0.00	0.50
68.45	550.50	5.23	120.00	0.00	0.50
68.52	501.40	5.27	120.00	0.00	0.50
68.59	497.90	4.33	120.00	0.00	0.50
68.66	467.60	4.46	120.00	0.00	0.50
68.73	458.20	4.28	120.00	0.00	0.50
68.80	433.10	3.07	120.00	0.00	0.50
68.87	436.10	2.46	120.00	0.00	0.50
68.94	399.20	3.04	120.00	0.00	0.50
69.01	399.00	3.67	120.00	0.00	0.50
69.08	273.40	3.51	120.00	0.00	0.50
69.16	148.70	3.47	120.00	0.00	0.50
69.22	114.20	3.25	120.00	0.00	0.50
69.29	82.60	2.48	120.00	0.00	0.50
69.36	66.00	2.07	120.00	0.00	0.50
69.43	58.10	1.69	120.00	0.00	0.50
69.51	57.70	1.30	120.00	0.00	0.50
69.58	57.00	1.11	120.00	0.00	0.50
69.65	56.10	1.09	120.00	0.00	0.50
69.72	59.70	1.18	120.00	0.00	0.50
69.80	67.70	1.20	120.00	0.00	0.50
69.88	67.10	1.20	120.00	0.00	0.50
69.97	63.80	1.17	120.00	0.00	0.50
70.06	64.00	1.09	120.00	0.00	0.50
70.15	64.90	0.99	120.00	0.00	0.50
70.23	65.20	0.97	120.00	0.00	0.50
70.30	65.90	1.03	120.00	0.00	0.50
70.37	64.90	1.05	120.00	0.00	0.50
70.44	63.00	1.04	120.00	0.00	0.50
70.52	61.50	1.05	120.00	0.00	0.50
70.59	61.30	1.07	120.00	0.00	0.50
70.67	58.80	1.06	120.00	0.00	0.50
70.74	57.70	1.02	120.00	0.00	0.50
70.81	56.40	1.03	120.00	0.00	0.50
70.89	53.10	1.04	120.00	0.00	0.50
70.96	51.20	1.03	120.00	0.00	0.50
71.04	50.20	0.93	120.00	0.00	0.50
71.11	48.90	0.87	120.00	0.00	0.50
71.19	49.10	0.86	120.00	0.00	0.50
71.26	49.40	0.86	120.00	0.00	0.50
71.33	51.70	0.89	120.00	0.00	0.50
71.40	52.60	1.02	120.00	0.00	0.50
71.49	54.60	1.25	120.00	0.00	0.50
71.59	59.20	1.48	120.00	0.00	0.50
71.66	61.10	1.57	120.00	0.00	0.50
71.74	56.60	1.69	120.00	0.00	0.50
71.81	54.20	1.79	120.00	0.00	0.50
71.88	46.40	1.83	120.00	0.00	0.50
71.96	45.10	1.84	120.00	0.00	0.50
72.03	45.20	1.74	120.00	0.00	0.50
72.11	41.60	1.69	120.00	0.00	0.50
72.18	40.30	1.67	120.00	0.00	0.50
72.25	40.90	1.63	120.00	0.00	0.50
72.33	43.10	1.97	120.00	0.00	0.50
72.40	47.50	2.13	120.00	0.00	0.50
72.48	60.60	3.36	120.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.15 in.
Settlement of Unsaturated Sands=0.34 in.
Total Settlement of Saturated and Unsaturated Sands=0.50 in.
Differential Settlement=0.248 to 0.327 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.34	5.00	0.15	0.34	0.50
5.00	0.15	0.34	5.00	0.15	0.33	0.48
10.00	0.24	0.34	5.00	0.15	0.27	0.42
15.00	0.56	0.33	5.00	0.15	0.22	0.38
20.00	2.00	0.33	5.00	0.15	0.16	0.32
25.00	0.20	0.32	5.00	0.15	0.06	0.22
30.00	0.22	0.32	5.00	0.15	0.00	0.16
35.00	0.30	0.33	0.91*	0.14	0.00	0.14
40.00	1.40	0.33	4.18	0.09	0.00	0.09
45.00	2.00	0.34	5.00	0.00	0.00	0.00
50.00	2.00	0.33	5.00	0.00	0.00	0.00
55.00	2.00	0.33	5.00	0.00	0.00	0.00
60.00	2.48	0.32	5.00	0.00	0.00	0.00
65.00	1.47	0.31	4.77	0.00	0.00	0.00
70.00	2.00	0.29	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Table 3 per MTD 3-1 – General Foundation Information

Foundation Design Data Sheet								
Support	Design Method	Pile Type	Finished Grade Elevation (feet)	Cut-off Elevation (feet)	Pile Cap Size (feet)		Permissible Settlement under Service Load (inches)	Number of Piles per Support
					B	L		
Abut 1	WSD	12-inch square precast concrete pile (Class 140)	186.09	174.83	2.5	15.25	1	4
Bent 2	LRFD	12-inch square precast concrete pile (Class 140)	161.70	155.43	9.0	18.0	1	18
Abut 3	WSD	12-inch square precast concrete pile (Class 140)	184.02	172.83	2.5	18.13	1	4

Table 4 per MTD 3-1 – Design Loads

Foundation Design Load											
Support	Service Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Maximum Per Pile	Per Support	Per Support	Maximum Per Pile	Per Support	Maximum Per Pile	Per Support	Maximum Per Pile	Per Support	Maximum Per Pile
Abut 1	450	111	240	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	1230	N/A	1040	2070	156	-	-	2210	223	-	69
Abut 3	470	117	260	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5 per MTD 3-1 – Foundation Recommendations for Abutments 1 and 3

Abutment Foundation Design Recommendations									
Support	Pile Type	Cut-off Elevation (feet)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elevations (feet)	Specified Tip Elevation (feet)	Nominal Driving Resistance Required (kips)
			Total	Permanent					
Abut 1	12-inch square precast concrete pile (Class 140)	174.9	450	240	111	230	124[a], 125[c] 154[d]	124	230
Abut 3	12-inch square precast concrete pile (Class 140)	172.9	470	260	117	240	122[a] 125[c], 152[d]	122	240
Design tip elevations are controlled by: (a) Compression, (c) Settlement, and (d) Lateral Load The specified tip elevation shall not be raised above the design tip elevations for tension, lateral, and tolerable settlement.									

Table 6 per MTD 3-1 – Foundation Recommendations for Bent 2

Bent Foundation Design Recommendations											
Support	Pile Type	Cut-off Elevation (feet)	Service-I Limit State Load (kips) per Support	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevation (feet)	Specified Tip Elevation (feet)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (ϕ=0.7)	Tension (ϕ=0.7)	Comp. (ϕ=1)	Tension (ϕ=1)			
Bent 2	12-inch square precast concrete pile (Class 140)	155.5	1230	1	156	-	223	69	115 [a-I] 115 [a-II] 128 [b-II] 115 [c] 135 [d]	115	230
Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (c) Settlement, and (d) Lateral Load. The specified tip elevation shall not be raised above the design tip elevations for tension, lateral, and tolerable settlement.											

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AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Katella Abutment 1/12-inch Square Concrete Pile/ Ignore upper 13 feet

DESIGNER : TK

DATE : 1/12/2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 48.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 1.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 80.00 FT.
MODULUS OF ELASTICITY = 0.380E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 13.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	110.00	0.00	0.00
15.00	CLAY	0.00	110.00	0.00	0.00
15.00	SAND	1.00	120.00	32.00	8.00
56.00	SAND	1.00	120.00	32.00	8.00
56.00	CLAY	0.00	110.00	0.00	0.00
60.00	CLAY	0.00	110.00	0.00	0.00
60.00	CLAY	0.00	47.60	0.00	0.00
71.00	CLAY	0.00	47.60	0.00	0.00
71.00	SAND	1.00	57.60	35.00	8.00
92.00	SAND	1.00	57.60	35.00	8.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	1.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00

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* COMPUTATION RESULT *
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PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
1.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
2.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
3.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
4.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
5.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
6.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
7.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
8.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
9.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
10.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
11.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
12.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
13.0	2.0	14.2	16.2	1.5	16.1	17.6	0.0	10.0	10.0
14.0	6.0	23.6	29.6	4.5	29.1	33.6	8.6	12.0	20.6
15.0	10.0	33.0	43.0	7.8	42.0	49.8	10.3	14.4	24.7
16.0	14.1	33.0	47.1	11.1	42.0	53.1	12.0	15.4	27.4
17.0	18.4	33.0	51.4	14.4	42.0	56.4	13.9	16.3	30.2
18.0	22.9	33.0	55.9	17.6	42.0	59.7	16.1	17.3	33.4
19.0	27.8	33.0	60.8	20.9	42.0	63.0	18.7	18.3	37.0
20.0	32.9	33.0	65.9	24.2	42.0	66.2	21.5	19.2	40.7
21.0	38.3	33.0	71.3	27.5	42.0	69.5	24.4	20.2	44.5
22.0	44.0	33.0	77.0	30.8	42.0	72.8	27.4	21.1	48.6
23.0	50.0	33.0	83.0	34.1	42.0	76.1	30.6	22.1	52.7
24.0	56.3	33.0	89.3	37.4	42.0	79.4	34.0	23.1	57.1
25.0	62.8	33.0	95.8	40.7	42.0	82.7	37.5	24.0	61.5
26.0	69.6	33.0	102.6	43.9	42.0	86.0	41.2	25.0	66.2
27.0	76.8	33.0	109.8	47.2	42.0	89.2	45.0	25.9	70.9
28.0	84.1	33.0	117.1	50.5	42.0	92.5	49.0	26.9	75.9
29.0	91.8	33.0	124.8	53.8	42.0	95.8	53.1	27.9	81.0
30.0	99.8	33.0	132.8	57.1	42.0	99.1	57.4	28.8	86.2
31.0	108.0	33.0	141.0	60.4	42.0	102.4	61.8	29.8	91.6
32.0	116.5	33.0	149.5	63.7	42.0	105.7	66.4	30.7	97.1
33.0	125.3	33.0	158.3	66.9	42.0	109.0	71.1	31.7	102.8
34.0	134.4	33.0	167.4	70.2	42.0	112.3	76.0	32.7	108.6

35.0	143.7	33.0	176.7	73.5	42.0	115.5	81.0	33.6	114.6
36.0	153.4	33.0	186.4	76.8	42.0	118.8	86.2	34.6	120.7
37.0	163.3	33.0	196.3	80.1	42.0	122.1	91.5	35.5	127.0
38.0	173.5	33.0	206.5	83.4	42.0	125.4	97.0	36.5	133.5
39.0	184.0	33.0	217.0	86.7	42.0	128.7	102.6	37.5	140.1
40.0	194.7	33.0	227.7	90.0	42.0	132.0	108.4	38.4	146.8
41.0	205.8	33.0	238.8	93.2	42.0	135.3	114.3	39.4	153.7
42.0	217.1	33.0	250.1	96.5	42.0	138.5	120.4	40.3	160.7
43.0	228.7	33.0	261.7	99.8	42.0	141.8	126.6	41.3	167.9
44.0	240.6	33.0	273.6	103.1	42.0	145.1	133.0	42.3	175.3
45.0	252.8	33.0	285.8	106.4	42.0	148.4	139.6	43.2	182.8
46.0	265.2	33.0	298.2	109.7	42.0	151.7	146.3	44.2	190.4
47.0	277.9	33.0	310.9	113.0	42.0	155.0	153.1	45.1	198.2
48.0	291.0	33.0	324.0	116.3	42.0	158.3	160.1	46.1	206.2
49.0	304.3	33.0	337.3	119.5	42.0	161.6	167.2	47.1	214.3
50.0	317.8	33.0	350.8	122.8	42.0	164.8	174.5	48.0	222.5
51.0	331.7	33.0	364.7	126.1	42.0	168.1	182.0	49.0	231.0
52.0	345.8	33.0	378.8	129.4	42.0	171.4	189.6	49.9	239.5
53.0	360.3	33.0	393.3	132.7	42.0	174.7	197.3	50.9	248.2
54.0	375.0	28.2	403.2	136.0	35.3	171.3	205.2	42.8	248.1
55.0	389.9	19.5	409.5	139.3	23.1	162.3	213.3	27.0	240.3
56.0	405.2	10.8	416.0	142.5	10.8	153.3	221.5	10.8	232.3
57.0	415.0	10.8	425.8	145.7	10.8	156.5	226.5	10.8	237.3
58.0	419.5	10.8	430.3	148.9	10.8	159.7	231.6	10.8	242.4
59.0	424.3	10.8	435.1	152.0	10.8	162.8	236.8	10.8	247.6
60.0	429.1	10.8	439.9	155.1	10.8	165.9	242.1	10.8	252.9
61.0	433.9	10.8	444.7	158.2	10.8	169.0	247.3	10.8	258.1
62.0	438.7	10.8	449.5	161.3	10.8	172.1	252.6	10.8	263.4
63.0	443.5	10.8	454.3	164.5	10.8	175.3	258.0	10.8	268.8
64.0	448.3	10.8	459.1	167.6	10.8	178.4	263.3	10.8	274.1
65.0	453.1	10.8	463.9	170.7	10.8	181.5	268.7	10.8	279.5
66.0	457.9	10.8	468.7	173.8	10.8	184.6	274.1	10.8	284.9
67.0	462.7	10.8	473.5	176.9	10.8	187.7	279.6	10.8	290.4
68.0	467.5	10.8	478.3	180.1	10.8	190.9	285.1	10.8	295.9
69.0	472.3	31.6	503.8	183.2	31.2	214.4	290.6	21.4	312.0
70.0	477.1	69.6	546.6	186.3	68.6	254.9	296.1	41.1	337.1
71.0	481.9	107.6	589.5	191.9	106.0	297.9	301.6	60.9	362.5
72.0	496.3	107.6	603.9	197.5	106.0	303.6	311.8	61.3	373.1
73.0	520.4	107.6	628.0	203.2	106.0	309.2	322.0	61.8	383.8
74.0	544.7	107.6	652.3	208.8	106.0	314.8	332.4	62.2	394.6
75.0	569.2	107.6	676.8	214.4	106.0	320.4	342.8	62.7	405.5
76.0	593.9	107.6	701.5	220.0	106.0	326.0	353.2	63.2	416.4
77.0	618.7	107.6	726.3	225.6	106.0	331.6	363.8	63.6	427.4
78.0	643.7	107.6	751.3	231.2	106.0	337.3	374.4	64.1	438.5
79.0	669.0	107.6	776.6	236.9	106.0	342.9	385.1	64.5	449.7
80.0	694.4	107.6	802.0	242.5	106.0	348.5	395.9	65.0	460.9

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* API RP-2A (1994) *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	9.0	9.0
1.00	0.0	9.0	9.0
2.00	0.0	9.0	9.0
3.00	0.0	9.0	9.0
4.00	0.0	9.0	9.0
5.00	0.0	9.0	9.0
6.00	0.0	9.0	9.0
7.00	0.0	9.0	9.0
8.00	0.0	9.0	9.0
9.00	0.0	9.0	9.0
10.00	0.0	9.0	9.0
11.00	0.0	9.0	9.0
12.00	0.0	9.0	9.0
13.00	1.2	10.0	11.2
14.00	3.6	12.0	15.6
15.00	6.2	14.4	20.6
16.00	9.2	15.4	24.6
17.00	13.0	16.3	29.3
18.00	17.0	17.3	34.3
19.00	21.2	18.3	39.4
20.00	25.6	19.2	44.9
21.00	30.3	20.2	50.5
22.00	35.3	21.1	56.4
23.00	40.5	22.1	62.6
24.00	45.9	23.1	69.0
25.00	51.6	24.0	75.6
26.00	57.5	25.0	82.5
27.00	63.7	25.9	89.7
28.00	70.1	26.9	97.0
29.00	76.8	27.9	104.7
30.00	83.7	28.8	112.5
31.00	90.9	29.8	120.7
32.00	98.2	30.7	128.9
33.00	105.4	31.7	137.1
34.00	112.7	32.7	145.4
35.00	120.0	33.6	153.6
36.00	127.3	34.6	161.9
37.00	134.6	35.5	170.1
38.00	141.8	36.5	178.3
39.00	149.1	37.5	186.6
40.00	156.4	38.4	194.8
41.00	163.7	39.4	203.1
42.00	171.0	40.3	211.3
43.00	178.2	41.3	219.5
44.00	185.5	42.3	227.8
45.00	192.8	43.2	236.0
46.00	200.1	44.2	244.3
47.00	207.4	45.1	252.5
48.00	214.6	46.1	260.7
49.00	221.9	47.1	269.0
50.00	229.2	48.0	277.2
51.00	236.5	49.0	285.5
52.00	243.8	49.9	293.7
53.00	251.0	50.9	301.9
54.00	258.3	42.8	301.2
55.00	265.6	27.0	292.6
56.00	278.9	10.8	289.7
57.00	288.0	10.8	298.8
58.00	292.8	10.8	303.6
59.00	297.6	10.8	308.4
60.00	302.4	10.8	313.2
61.00	307.2	10.8	318.0
62.00	312.0	10.8	322.8
63.00	316.8	10.8	327.6

64.00	321.6	10.8	332.4
65.00	326.4	10.8	337.2
66.00	331.2	10.8	342.0
67.00	336.0	10.8	346.8
68.00	340.8	10.8	351.6
69.00	345.6	21.4	367.0
70.00	350.4	41.1	391.4
71.00	355.2	60.9	416.0
72.00	363.2	61.3	424.5
73.00	371.2	61.8	432.9
74.00	379.2	62.2	441.4
75.00	387.2	62.7	449.9
76.00	395.2	63.2	458.3
77.00	403.2	63.6	466.8
78.00	411.2	64.1	475.2
79.00	419.2	64.5	483.7
80.00	427.2	65.0	492.2

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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************************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2445E-01
			0.0000E+00	0.4736E-01
			0.0000E+00	0.8709E-01
			0.0000E+00	0.1222E+00
			0.0000E+00	0.1528E+00
			0.0000E+00	0.3056E+00
			0.0000E+00	0.4584E+00
			0.0000E+00	0.7639E+00
			0.0000E+00	0.3056E+01
2	10	0.7525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2445E-01
			0.0000E+00	0.4736E-01
			0.0000E+00	0.8709E-01
			0.0000E+00	0.1222E+00
			0.0000E+00	0.1528E+00
			0.0000E+00	0.3056E+00
			0.0000E+00	0.4584E+00
			0.0000E+00	0.7639E+00
			0.0000E+00	0.3056E+01
3	10	0.1496E+02		
			0.0000E+00	0.0000E+00
			0.1315E+01	0.2445E-01
			0.2192E+01	0.4736E-01
			0.3288E+01	0.8709E-01
			0.3946E+01	0.1222E+00
			0.4385E+01	0.1528E+00
			0.3946E+01	0.3056E+00
			0.3946E+01	0.4584E+00
			0.3946E+01	0.7639E+00
			0.3946E+01	0.3056E+01
4	10	0.1500E+02		
			0.0000E+00	0.0000E+00
			0.5362E+00	0.1000E-01
			0.1072E+01	0.2000E-01
			0.2145E+01	0.4000E-01
			0.3217E+01	0.6000E-01
			0.4289E+01	0.8000E-01
			0.4825E+01	0.9000E-01
			0.5362E+01	0.1000E+00
			0.5362E+01	0.5000E+00
			0.5362E+01	0.2000E+01
5	10	0.3552E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
6	10	0.5596E+02		
			0.0000E+00	0.0000E+00
			0.2303E+01	0.1000E-01
			0.4607E+01	0.2000E-01
			0.9214E+01	0.4000E-01
			0.1382E+02	0.6000E-01
			0.1843E+02	0.8000E-01
			0.2073E+02	0.9000E-01
			0.2303E+02	0.1000E+00
			0.2303E+02	0.5000E+00
			0.2303E+02	0.2000E+01
7	10	0.5600E+02		
			0.0000E+00	0.0000E+00
			0.4737E+01	0.2445E-01
			0.7895E+01	0.4736E-01
			0.1184E+02	0.8709E-01
			0.1421E+02	0.1222E+00
			0.1579E+02	0.1528E+00
			0.1421E+02	0.3056E+00
			0.1421E+02	0.4584E+00
			0.1421E+02	0.7639E+00
			0.1421E+02	0.3056E+01
8	10	0.5802E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00

			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
9	10	0.5996E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
10	10	0.6000E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
11	10	0.6553E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
12	10	0.7096E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
13	10	0.7100E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
14	10	0.8153E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
15	10	0.9196E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.4063E+01	0.7639E-02
0.8125E+01	0.1528E-01
0.1625E+02	0.3056E-01
0.3250E+02	0.1986E+00
0.4875E+02	0.6417E+00
0.5850E+02	0.1115E+01
0.6500E+02	0.1528E+01
0.6500E+02	0.2292E+01
0.6500E+02	0.3056E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1576E+01	0.1444E-02	0.5318E-01	0.1000E-03
0.1589E+02	0.1450E-01	0.5318E+00	0.1000E-02
0.7979E+02	0.7327E-01	0.2659E+01	0.5000E-02
0.1580E+03	0.1464E+00	0.5318E+01	0.1000E-01
0.4252E+03	0.4860E+00	0.1813E+02	0.5000E-01
0.4924E+03	0.6387E+00	0.2297E+02	0.1000E+00
0.5110E+03	0.1072E+01	0.4355E+02	0.5000E+00
0.5235E+03	0.1594E+01	0.5613E+02	0.1000E+01
0.5324E+03	0.2610E+01	0.6500E+02	0.2000E+01

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Katella Bent 2/12-inch Square Concrete Pile/Pile Cut off 7 ft below gr

DESIGNER : TK

DATE : 1/12/2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 48.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 1.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 70.00 FT.
MODULUS OF ELASTICITY = 0.380E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 7.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	SAND	1.00	120.00	32.00	8.00
45.00	SAND	1.00	120.00	32.00	8.00
45.00	CLAY	0.00	110.00	0.00	0.00
49.00	CLAY	0.00	110.00	0.00	0.00
49.00	CLAY	0.00	47.60	0.00	0.00
60.00	CLAY	0.00	47.60	0.00	0.00
60.00	SAND	1.00	57.60	35.00	20.00
81.50	SAND	1.00	57.60	35.00	20.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00

****
* COMPUTATION RESULT *
****

PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD **********			********** ARMY CORPS METHOD **********			********** LAMBDA 2 METHOD **********		
0.0	0.0	3.9	3.9	0.0	4.6	4.6	0.0	1.2	1.2
1.0	0.0	6.9	6.9	0.0	8.2	8.2	0.0	2.2	2.2
2.0	0.0	9.9	9.9	0.0	11.8	11.8	0.0	3.1	3.1
3.0	0.0	13.0	13.0	0.0	15.4	15.4	0.0	4.1	4.1
4.0	0.0	16.0	16.0	0.0	19.0	19.0	0.0	5.1	5.1
5.0	0.0	19.0	19.0	0.0	22.6	22.6	0.0	6.0	6.0
6.0	0.0	22.1	22.1	0.0	26.2	26.2	0.0	7.0	7.0
7.0	1.0	25.1	26.1	1.0	29.8	30.8	0.0	7.9	7.9
8.0	3.1	28.1	31.2	3.1	33.4	36.5	3.7	8.9	12.6
9.0	5.5	30.8	36.3	5.5	37.0	42.5	5.0	9.9	14.9
10.0	8.2	32.5	40.6	8.2	40.9	49.1	6.4	10.8	17.3
11.0	11.1	33.0	44.1	11.1	44.1	55.2	7.9	11.8	19.7
12.0	14.4	33.0	47.4	14.4	45.8	60.2	11.2	12.7	24.0
13.0	17.9	33.0	50.9	17.9	45.8	63.8	12.9	13.7	26.6
14.0	21.7	33.0	54.7	21.5	45.8	67.4	14.5	14.7	29.2
15.0	25.7	33.0	58.7	25.1	45.8	71.0	16.1	15.6	31.8
16.0	30.1	33.0	63.1	28.7	45.8	74.5	17.8	16.6	34.4
17.0	34.8	33.0	67.8	32.3	45.8	78.1	19.8	17.5	37.3
18.0	39.7	33.0	72.7	35.9	45.8	81.7	22.4	18.5	40.9
19.0	44.9	33.0	77.9	39.5	45.8	85.3	25.2	19.5	44.7
20.0	50.4	33.0	83.4	43.0	45.8	88.9	28.2	20.4	48.6
21.0	56.1	33.0	89.1	46.6	45.8	92.5	31.3	21.4	52.7
22.0	62.2	33.0	95.2	50.2	45.8	96.1	34.5	22.3	56.9
23.0	68.5	33.0	101.5	53.8	45.8	99.6	37.9	23.3	61.2
24.0	75.1	33.0	108.1	57.4	45.8	103.2	41.5	24.3	65.7
25.0	82.0	33.0	115.0	61.0	45.8	106.8	45.2	25.2	70.4
26.0	89.2	33.0	122.2	64.6	45.8	110.4	49.0	26.2	75.2
27.0	96.7	33.0	129.7	68.1	45.8	114.0	53.0	27.1	80.2
28.0	104.4	33.0	137.4	71.7	45.8	117.6	57.2	28.1	85.3
29.0	112.4	33.0	145.4	75.3	45.8	121.2	61.5	29.1	90.6
30.0	120.7	33.0	153.7	78.9	45.8	124.7	66.0	30.0	96.0
31.0	129.3	33.0	162.3	82.5	45.8	128.3	70.6	31.0	101.6
32.0	138.2	33.0	171.2	86.1	45.8	131.9	75.3	31.9	107.3
33.0	147.3	33.0	180.3	89.7	45.8	135.5	80.3	32.9	113.2
34.0	156.7	33.0	189.7	93.2	45.8	139.1	85.3	33.9	119.2
35.0	166.4	33.0	199.4	96.8	45.8	142.7	90.5	34.8	125.4
36.0	176.4	33.0	209.4	100.4	45.8	146.3	95.9	35.8	131.7
37.0	186.7	33.0	219.7	104.0	45.8	149.8	101.4	36.7	138.2
38.0	197.3	33.0	230.3	107.6	45.8	153.4	107.1	37.7	144.8

39.0	208.1	33.0	241.1	111.2	45.8	157.0	112.9	38.7	151.6
40.0	219.2	33.0	252.2	114.8	45.8	160.6	118.9	39.6	158.5
41.0	230.6	33.0	263.6	118.3	45.8	164.2	125.0	40.6	165.6
42.0	242.3	33.0	275.3	121.9	45.8	167.8	131.3	41.5	172.8
43.0	254.2	28.2	282.5	125.5	38.3	163.8	137.7	35.5	173.2
44.0	266.5	19.5	286.0	129.1	24.6	153.7	144.3	23.3	167.6
45.0	279.0	10.8	289.8	132.7	10.8	143.5	151.0	10.8	161.8
46.0	287.4	10.8	298.2	136.0	10.8	146.8	155.4	10.8	166.2
47.0	291.9	10.8	302.7	139.2	10.8	150.0	159.9	10.8	170.7
48.0	296.7	10.8	307.5	142.3	10.8	153.1	164.4	10.8	175.2
49.0	301.5	10.8	312.3	145.4	10.8	156.2	169.0	10.8	179.8
50.0	306.3	10.8	317.1	148.5	10.8	159.3	173.6	10.8	184.4
51.0	311.1	10.8	321.9	151.6	10.8	162.4	178.3	10.8	189.1
52.0	315.9	10.8	326.7	154.8	10.8	165.6	182.9	10.8	193.7
53.0	320.7	10.8	331.5	157.9	10.8	168.7	187.6	10.8	198.4
54.0	325.5	10.8	336.3	161.0	10.8	171.8	192.4	10.8	203.2
55.0	330.3	10.8	341.1	164.1	10.8	174.9	197.1	10.8	207.9
56.0	335.1	10.8	345.9	167.2	10.8	178.0	201.9	10.8	212.7
57.0	339.9	10.8	350.7	170.4	10.8	181.2	206.7	10.8	217.5
58.0	344.7	31.6	376.3	173.5	32.8	206.3	211.6	35.9	247.5
59.0	349.5	69.6	419.1	176.6	73.1	249.7	216.5	82.1	298.5
60.0	354.3	107.6	461.9	182.6	113.4	296.1	221.3	128.7	350.1
61.0	366.8	107.6	474.4	188.6	113.4	302.1	229.9	129.9	359.8
62.0	387.3	107.6	494.9	194.6	113.4	308.1	238.6	131.0	369.7
63.0	407.9	107.6	515.5	200.6	113.4	314.1	247.4	132.2	379.6
64.0	428.6	107.6	536.2	206.7	113.4	320.1	256.2	133.3	389.5
65.0	449.6	107.6	557.2	212.7	113.4	326.1	265.1	134.5	399.6
66.0	470.8	107.6	578.4	218.7	113.4	332.1	274.1	135.7	409.7
67.0	492.1	107.6	599.7	224.7	113.4	338.1	283.1	136.8	419.9
68.0	513.6	107.6	621.2	230.7	113.4	344.1	292.3	138.0	430.2
69.0	535.3	107.6	642.9	236.7	113.4	350.1	301.5	139.1	440.6
70.0	557.2	107.6	664.8	242.7	113.4	356.2	310.8	140.3	451.0

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*  API RP-2A (1994)  *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	1.2	1.2
1.00	0.0	2.2	2.2
2.00	0.0	3.1	3.1
3.00	0.0	4.1	4.1
4.00	0.0	5.1	5.1
5.00	0.0	6.0	6.0
6.00	0.0	7.0	7.0
7.00	0.9	7.9	8.8
8.00	2.7	8.9	11.6
9.00	4.8	9.9	14.6
10.00	7.1	10.8	17.9
11.00	9.7	11.8	21.4
12.00	12.5	12.7	25.2
13.00	15.5	13.7	29.2
14.00	18.8	14.7	33.5
15.00	22.4	15.6	38.0
16.00	26.2	16.6	42.8
17.00	30.2	17.5	47.7
18.00	34.5	18.5	53.0
19.00	39.0	19.5	58.5
20.00	43.8	20.4	64.2
21.00	48.8	21.4	70.2
22.00	54.1	22.3	76.4
23.00	59.6	23.3	82.9
24.00	65.3	24.3	89.6
25.00	71.3	25.2	96.5
26.00	77.5	26.2	103.7
27.00	84.0	27.1	111.2
28.00	90.7	28.1	118.8
29.00	97.7	29.1	126.8
30.00	104.9	30.0	134.9
31.00	112.2	31.0	143.2
32.00	119.5	31.9	151.4
33.00	126.8	32.9	159.7
34.00	134.0	33.9	167.9
35.00	141.3	34.8	176.1
36.00	148.6	35.8	184.4
37.00	155.9	36.7	192.6
38.00	163.2	37.7	200.9
39.00	170.4	38.7	209.1
40.00	177.7	39.6	217.3
41.00	185.0	40.6	225.6
42.00	192.3	41.5	233.8
43.00	199.6	35.5	235.1
44.00	206.8	23.3	230.2
45.00	217.7	10.8	228.5
46.00	225.6	10.8	236.4
47.00	230.4	10.8	241.2
48.00	235.2	10.8	246.0
49.00	240.0	10.8	250.8
50.00	244.8	10.8	255.6
51.00	249.6	10.8	260.4
52.00	254.4	10.8	265.2
53.00	259.2	10.8	270.0
54.00	264.0	10.8	274.8
55.00	268.8	10.8	279.6
56.00	273.6	10.8	284.4
57.00	278.4	10.8	289.2
58.00	283.2	35.9	319.1
59.00	288.0	82.1	370.1
60.00	292.8	128.7	421.6
61.00	300.8	129.9	430.7
62.00	308.8	131.0	439.9
63.00	316.8	132.2	449.0
64.00	324.8	133.3	458.2
65.00	332.8	134.5	467.3
66.00	340.8	135.7	476.5
67.00	348.8	136.8	485.6
68.00	356.8	138.0	494.8
69.00	364.8	139.1	503.9
70.00	372.8	140.3	513.1

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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**************************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.1000E-01
			0.0000E+00	0.2000E-01
			0.0000E+00	0.4000E-01
			0.0000E+00	0.6000E-01
			0.0000E+00	0.8000E-01
			0.0000E+00	0.9000E-01
			0.0000E+00	0.1000E+00
			0.0000E+00	0.5000E+00
			0.0000E+00	0.2000E+01
2	10	0.2252E+02		
			0.0000E+00	0.0000E+00
			0.9554E+00	0.1000E-01
			0.1911E+01	0.2000E-01
			0.3821E+01	0.4000E-01
			0.5732E+01	0.6000E-01
			0.7643E+01	0.8000E-01
			0.8598E+01	0.9000E-01
			0.9554E+01	0.1000E+00
			0.9554E+01	0.5000E+00
			0.9554E+01	0.2000E+01
3	10	0.4496E+02		
			0.0000E+00	0.0000E+00
			0.1889E+01	0.1000E-01
			0.3779E+01	0.2000E-01
			0.7558E+01	0.4000E-01
			0.1134E+02	0.6000E-01
			0.1512E+02	0.8000E-01
			0.1701E+02	0.9000E-01
			0.1889E+02	0.1000E+00
			0.1889E+02	0.5000E+00
			0.1889E+02	0.2000E+01
4	10	0.4500E+02		
			0.0000E+00	0.0000E+00
			0.4116E+01	0.2445E-01
			0.6860E+01	0.4736E-01
			0.1029E+02	0.8709E-01
			0.1235E+02	0.1222E+00
			0.1372E+02	0.1528E+00
			0.1235E+02	0.3056E+00
			0.1235E+02	0.4584E+00
			0.1235E+02	0.7639E+00
			0.1235E+02	0.3056E+01
5	10	0.4702E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
6	10	0.4896E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
7	10	0.4900E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
8	10	0.5452E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
9	10	0.5996E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
10	10	0.6000E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

11	10	0.7078E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
12	10	0.8146E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.8766E+01	0.7639E-02
0.1753E+02	0.1528E-01
0.3506E+02	0.3056E-01
0.7013E+02	0.1986E+00
0.1052E+03	0.6417E+00
0.1262E+03	0.1115E+01
0.1403E+03	0.1528E+01
0.1403E+03	0.2292E+01
0.1403E+03	0.3056E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1446E+01	0.1184E-02	0.1147E+00	0.1000E-03
0.1456E+02	0.1187E-01	0.1147E+01	0.1000E-02
0.7402E+02	0.6021E-01	0.5737E+01	0.5000E-02
0.1481E+03	0.1207E+00	0.1147E+02	0.1000E-01
0.3841E+03	0.3965E+00	0.3912E+02	0.5000E-01
0.4486E+03	0.5348E+00	0.4955E+02	0.1000E+00
0.4887E+03	0.9982E+00	0.9398E+02	0.5000E+00
0.5158E+03	0.1540E+01	0.1211E+03	0.1000E+01
0.5350E+03	0.2569E+01	0.1403E+03	0.2000E+01

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Katella Abutment 3/12-inch Square Concrete Pile/ Ignore upper 11 feet

DESIGNER : TK

DATE : 1/12/2010

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION= 48.00 IN.
TIP AREA OF PILE WITH NONCIRCULAR SECTION = 1.00 SQF
OUTSIDE DIAMETER OF CIRCULAR PILE = 0.00 IN.
INTERNAL DIAMETER OF CIRCULAR PILE = 0.00 IN.
PILE LENGTH = 80.00 FT.
MODULUS OF ELASTICITY = 0.380E+07 PSI

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 11.00 FT.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 1.00 FT.

SOIL INFORMATIONS :

DEPTH FT.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT LB/CF	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	110.00	0.00	0.00
11.00	CLAY	0.00	110.00	0.00	0.00
11.00	SAND	1.00	120.00	32.00	8.00
56.00	SAND	1.00	120.00	32.00	8.00
56.00	CLAY	0.00	110.00	0.00	0.00
60.00	CLAY	0.00	110.00	0.00	0.00
60.00	CLAY	0.00	47.60	0.00	0.00
71.00	CLAY	0.00	47.60	0.00	0.00
71.00	SAND	1.00	57.60	35.00	8.00
92.00	SAND	1.00	57.60	35.00	8.00

MAXIMUM UNIT FRICTION KSF	MAXIMUM UNIT BEARING KSF	UNDISTURB SHEAR STRENGTH KSF	REMOLDED SHEAR STRENGTH KSF	BLOW COUNT	UNIT SKIN FRICTION KSF	UNIT END BEARING KSF
9999.00	99999.00	1.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	1.20	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00
9999.00	99999.00	0.00	0.00	0.00	0.00	0.00

****
* COMPUTATION RESULT *
****

PILE PENETR-ATION FT.	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP	TOTAL SKIN FRIC KIP	END BEARING KIP	ULTIM CAPAC-ITY KIP
	********** FED. HWY. METHOD *			********** ARMY CORPS METHOD *			********** LAMBDA 2 METHOD *		
0.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
1.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
2.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
3.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
4.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
5.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
6.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
7.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
8.0	0.0	9.0	9.0	0.0	9.0	9.0	0.0	9.0	9.0
9.0	0.0	13.8	13.8	0.0	15.1	15.1	0.0	9.2	9.2
10.0	0.0	23.1	23.1	0.0	27.6	27.6	0.0	9.9	9.9
11.0	2.0	32.5	34.5	1.5	40.8	42.3	0.0	10.9	10.9
12.0	5.6	33.0	38.6	4.6	42.5	47.1	6.7	11.9	18.5
13.0	8.8	33.0	41.8	7.9	42.5	50.4	8.2	12.8	21.0
14.0	12.4	33.0	45.4	11.2	42.5	53.8	9.8	13.8	23.6
15.0	16.2	33.0	49.2	14.5	42.5	57.1	11.6	14.7	26.3
16.0	20.3	33.0	53.3	17.9	42.5	60.4	13.4	15.7	29.1
17.0	24.7	33.0	57.7	21.2	42.5	63.7	15.6	16.7	32.3
18.0	29.3	33.0	62.3	24.5	42.5	67.1	18.1	17.6	35.7
19.0	34.3	33.0	67.3	27.9	42.5	70.4	20.8	18.6	39.3
20.0	39.5	33.0	72.5	31.2	42.5	73.7	23.6	19.5	43.1
21.0	45.0	33.0	78.0	34.5	42.5	77.0	26.5	20.5	47.0
22.0	50.8	33.0	83.8	37.8	42.5	80.4	29.6	21.5	51.1
23.0	56.9	33.0	89.9	41.2	42.5	83.7	32.9	22.4	55.3
24.0	63.2	33.0	96.2	44.5	42.5	87.0	36.3	23.4	59.7
25.0	69.9	33.0	102.9	47.8	42.5	90.4	39.9	24.3	64.2
26.0	76.8	33.0	109.8	51.1	42.5	93.7	43.6	25.3	68.9
27.0	84.0	33.0	117.0	54.5	42.5	97.0	47.5	26.3	73.7
28.0	91.5	33.0	124.5	57.8	42.5	100.3	51.5	27.2	78.7
29.0	99.2	33.0	132.2	61.1	42.5	103.7	55.7	28.2	83.8
30.0	107.3	33.0	140.3	64.5	42.5	107.0	60.0	29.1	89.1
31.0	115.6	33.0	148.6	67.8	42.5	110.3	64.5	30.1	94.6
32.0	124.2	33.0	157.2	71.1	42.5	113.6	69.1	31.1	100.1
33.0	133.1	33.0	166.1	74.4	42.5	117.0	73.9	32.0	105.9
34.0	142.3	33.0	175.3	77.8	42.5	120.3	78.8	33.0	111.8

35.0	151.7	33.0	184.7	81.1	42.5	123.6	83.9	33.9	117.8
36.0	161.4	33.0	194.4	84.4	42.5	127.0	89.1	34.9	124.0
37.0	171.5	33.0	204.5	87.7	42.5	130.3	94.5	35.9	130.3
38.0	181.8	33.0	214.8	91.1	42.5	133.6	100.0	36.8	136.8
39.0	192.3	33.0	225.3	94.4	42.5	136.9	105.7	37.8	143.5
40.0	203.2	33.0	236.2	97.7	42.5	140.3	111.5	38.7	150.2
41.0	214.3	33.0	247.3	101.1	42.5	143.6	117.5	39.7	157.2
42.0	225.7	33.0	258.7	104.4	42.5	146.9	123.6	40.7	164.3
43.0	237.4	33.0	270.4	107.7	42.5	150.2	129.9	41.6	171.5
44.0	249.4	33.0	282.4	111.0	42.5	153.6	136.4	42.6	178.9
45.0	261.7	33.0	294.7	114.4	42.5	156.9	142.9	43.5	186.5
46.0	274.2	33.0	307.2	117.7	42.5	160.2	149.7	44.5	194.2
47.0	287.1	33.0	320.1	121.0	42.5	163.6	156.6	45.5	202.0
48.0	300.2	33.0	333.2	124.3	42.5	166.9	163.6	46.4	210.0
49.0	313.6	33.0	346.6	127.7	42.5	170.2	170.8	47.4	218.2
50.0	327.2	33.0	360.2	131.0	42.5	173.5	178.2	48.3	226.5
51.0	341.2	33.0	374.2	134.3	42.5	176.9	185.6	49.3	235.0
52.0	355.4	33.0	388.4	137.7	42.5	180.2	193.3	50.3	243.6
53.0	369.9	33.0	402.9	141.0	42.5	183.5	201.1	51.2	252.3
54.0	384.7	28.2	413.0	144.3	35.7	180.0	209.0	43.1	252.1
55.0	399.8	19.5	419.3	147.6	23.3	170.9	217.1	27.1	244.3
56.0	415.2	10.8	426.0	151.0	10.8	161.8	225.4	10.8	236.2
57.0	425.0	10.8	435.8	154.2	10.8	165.0	230.5	10.8	241.3
58.0	429.5	10.8	440.3	157.3	10.8	168.1	235.6	10.8	246.4
59.0	434.3	10.8	445.1	160.4	10.8	171.2	240.8	10.8	251.6
60.0	439.1	10.8	449.9	163.6	10.8	174.4	246.1	10.8	256.9
61.0	443.9	10.8	454.7	166.7	10.8	177.5	251.4	10.8	262.2
62.0	448.7	10.8	459.5	169.8	10.8	180.6	256.7	10.8	267.5
63.0	453.5	10.8	464.3	172.9	10.8	183.7	262.1	10.8	272.9
64.0	458.3	10.8	469.1	176.0	10.8	186.8	267.5	10.8	278.3
65.0	463.1	10.8	473.9	179.2	10.8	190.0	272.9	10.8	283.7
66.0	467.9	10.8	478.7	182.3	10.8	193.1	278.3	10.8	289.1
67.0	472.7	10.8	483.5	185.4	10.8	196.2	283.8	10.8	294.6
68.0	477.5	10.8	488.3	188.5	10.8	199.3	289.3	10.8	300.1
69.0	482.3	31.6	513.8	191.6	31.7	223.3	294.8	21.5	316.3
70.0	487.1	69.6	556.7	194.8	69.8	264.6	300.3	41.3	341.6
71.0	491.9	107.6	599.5	200.5	108.0	308.5	305.9	61.2	367.1
72.0	506.4	107.6	614.0	206.2	108.0	314.2	316.1	61.6	377.8
73.0	530.6	107.6	638.2	211.9	108.0	319.9	326.4	62.1	388.5
74.0	555.0	107.6	662.6	217.6	108.0	325.6	336.8	62.6	399.3
75.0	579.6	107.6	687.2	223.4	108.0	331.4	347.2	63.0	410.3
76.0	604.4	107.6	712.0	229.1	108.0	337.1	357.8	63.5	421.2
77.0	629.4	107.6	737.0	234.8	108.0	342.8	368.4	63.9	432.3
78.0	654.6	107.6	762.2	240.5	108.0	348.5	379.1	64.4	443.5
79.0	679.9	107.6	787.5	246.2	108.0	354.2	389.8	64.9	454.7
80.0	705.4	107.6	813.0	252.0	108.0	360.0	400.7	65.3	466.0

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*  API RP-2A (1994)  *
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PILE PENETRATION FT.	TOTAL SKIN FRICTION KIP	END BEARING KIP	ULTIMATE CAPACITY KIP
0.00	0.0	9.0	9.0
1.00	0.0	9.0	9.0
2.00	0.0	9.0	9.0
3.00	0.0	9.0	9.0
4.00	0.0	9.0	9.0
5.00	0.0	9.0	9.0
6.00	0.0	9.0	9.0
7.00	0.0	9.0	9.0
8.00	0.0	9.0	9.0
9.00	0.0	9.2	9.2
10.00	0.0	9.9	9.9
11.00	1.1	10.9	12.0
12.00	3.6	11.9	15.4
13.00	6.4	12.8	19.2
14.00	9.5	13.8	23.2
15.00	12.8	14.7	27.5
16.00	16.4	15.7	32.1
17.00	20.2	16.7	36.8
18.00	24.2	17.6	41.8
19.00	28.5	18.6	47.1
20.00	33.1	19.5	52.6
21.00	37.9	20.5	58.4
22.00	42.9	21.5	64.4
23.00	48.2	22.4	70.6
24.00	53.7	23.4	77.1
25.00	59.5	24.3	83.8
26.00	65.5	25.3	90.8
27.00	71.7	26.3	98.0
28.00	78.2	27.2	105.5
29.00	85.0	28.2	113.2
30.00	92.0	29.1	121.1
31.00	99.2	30.1	129.3
32.00	106.5	31.1	137.5
33.00	113.8	32.0	145.8
34.00	121.0	33.0	154.0
35.00	128.3	33.9	162.3
36.00	135.6	34.9	170.5
37.00	142.9	35.9	178.7
38.00	150.2	36.8	187.0
39.00	157.4	37.8	195.2
40.00	164.7	38.7	203.5
41.00	172.0	39.7	211.7
42.00	179.3	40.7	219.9
43.00	186.6	41.6	228.2
44.00	193.8	42.6	236.4
45.00	201.1	43.5	244.7
46.00	208.4	44.5	252.9
47.00	215.7	45.5	261.1
48.00	223.0	46.4	269.4
49.00	230.2	47.4	277.6
50.00	237.5	48.3	285.9
51.00	244.8	49.3	294.1
52.00	252.1	50.3	302.3
53.00	259.4	51.2	310.6
54.00	266.6	43.1	309.7
55.00	273.9	27.1	301.1
56.00	287.3	10.8	298.1
57.00	296.4	10.8	307.2
58.00	301.2	10.8	312.0
59.00	306.0	10.8	316.8
60.00	310.8	10.8	321.6
61.00	315.6	10.8	326.4
62.00	320.4	10.8	331.2
63.00	325.2	10.8	336.0

64.00	330.0	10.8	340.8
65.00	334.8	10.8	345.6
66.00	339.6	10.8	350.4
67.00	344.4	10.8	355.2
68.00	349.2	10.8	360.0
69.00	354.0	21.5	375.5
70.00	358.8	41.3	400.1
71.00	363.6	61.2	424.8
72.00	371.6	61.6	433.2
73.00	379.6	62.1	441.7
74.00	387.6	62.6	450.2
75.00	395.6	63.0	458.6
76.00	403.6	63.5	467.1
77.00	411.6	63.9	475.5
78.00	419.6	64.4	484.0
79.00	427.6	64.9	492.5
80.00	435.6	65.3	500.9

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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**************************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                      *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE FT.	LOAD TRANSFER PSI	PILE MOVEMENT IN.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2445E-01
			0.0000E+00	0.4736E-01
			0.0000E+00	0.8709E-01
			0.0000E+00	0.1222E+00
			0.0000E+00	0.1528E+00
			0.0000E+00	0.3056E+00
			0.0000E+00	0.4584E+00
			0.0000E+00	0.7639E+00
			0.0000E+00	0.3056E+01
2	10	0.5525E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.2445E-01
			0.0000E+00	0.4736E-01
			0.0000E+00	0.8709E-01
			0.0000E+00	0.1222E+00
			0.0000E+00	0.1528E+00
			0.0000E+00	0.3056E+00
			0.0000E+00	0.4584E+00
			0.0000E+00	0.7639E+00
			0.0000E+00	0.3056E+01
3	10	0.1096E+02		
			0.0000E+00	0.0000E+00
			0.5729E+00	0.2445E-01
			0.9549E+00	0.4736E-01
			0.1432E+01	0.8709E-01
			0.1719E+01	0.1222E+00
			0.1910E+01	0.1528E+00
			0.1719E+01	0.3056E+00
			0.1719E+01	0.4584E+00
			0.1719E+01	0.7639E+00
			0.1719E+01	0.3056E+01
4	10	0.1100E+02		
			0.0000E+00	0.0000E+00
			0.4263E+00	0.1000E-01
			0.8525E+00	0.2000E-01
			0.1705E+01	0.4000E-01
			0.2558E+01	0.6000E-01
			0.3410E+01	0.8000E-01
			0.3836E+01	0.9000E-01
			0.4263E+01	0.1000E+00
			0.4263E+01	0.5000E+00
			0.4263E+01	0.2000E+01
5	10	0.3352E+02		
			0.0000E+00	0.0000E+00
			0.1264E+01	0.1000E-01
			0.2528E+01	0.2000E-01
			0.5056E+01	0.4000E-01
			0.7583E+01	0.6000E-01
			0.1011E+02	0.8000E-01
			0.1137E+02	0.9000E-01
			0.1264E+02	0.1000E+00
			0.1264E+02	0.5000E+00
			0.1264E+02	0.2000E+01
6	10	0.5596E+02		
			0.0000E+00	0.0000E+00
			0.2318E+01	0.1000E-01
			0.4635E+01	0.2000E-01
			0.9270E+01	0.4000E-01
			0.1391E+02	0.6000E-01
			0.1854E+02	0.8000E-01
			0.2086E+02	0.9000E-01
			0.2318E+02	0.1000E+00
			0.2318E+02	0.5000E+00
			0.2318E+02	0.2000E+01
7	10	0.5600E+02		
			0.0000E+00	0.0000E+00
			0.4758E+01	0.2445E-01
			0.7930E+01	0.4736E-01
			0.1190E+02	0.8709E-01
			0.1427E+02	0.1222E+00
			0.1586E+02	0.1528E+00
			0.1427E+02	0.3056E+00
			0.1427E+02	0.4584E+00
			0.1427E+02	0.7639E+00
			0.1427E+02	0.3056E+01
8	10	0.5802E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00

			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
9	10	0.5996E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
10	10	0.6000E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
11	10	0.6553E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
12	10	0.7096E+02		
			0.0000E+00	0.0000E+00
			0.2500E+01	0.2445E-01
			0.4167E+01	0.4736E-01
			0.6250E+01	0.8709E-01
			0.7500E+01	0.1222E+00
			0.8333E+01	0.1528E+00
			0.7500E+01	0.3056E+00
			0.7500E+01	0.4584E+00
			0.7500E+01	0.7639E+00
			0.7500E+01	0.3056E+01
13	10	0.7100E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
14	10	0.8153E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01
15	10	0.9196E+02		
			0.0000E+00	0.0000E+00
			0.1389E+01	0.1000E-01
			0.2778E+01	0.2000E-01
			0.5556E+01	0.4000E-01
			0.8333E+01	0.6000E-01
			0.1111E+02	0.8000E-01
			0.1250E+02	0.9000E-01
			0.1389E+02	0.1000E+00
			0.1389E+02	0.5000E+00
			0.1389E+02	0.2000E+01

TIP LOAD KIP	TIP MOVEMENT IN.
0.0000E+00	0.0000E+00
0.4083E+01	0.7639E-02
0.8165E+01	0.1528E-01
0.1633E+02	0.3056E-01
0.3266E+02	0.1986E+00
0.4899E+02	0.6417E+00
0.5879E+02	0.1115E+01
0.6532E+02	0.1528E+01
0.6532E+02	0.2292E+01
0.6532E+02	0.3056E+01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KIP	TOP MOVEMENT IN.	TIP LOAD KIP	TIP MOVEMENT IN.
0.1695E+01	0.1503E-02	0.5344E-01	0.1000E-03
0.1710E+02	0.1510E-01	0.5344E+00	0.1000E-02
0.8646E+02	0.7651E-01	0.2672E+01	0.5000E-02
0.1721E+03	0.1532E+00	0.5344E+01	0.1000E-01
0.4443E+03	0.4978E+00	0.1822E+02	0.5000E-01
0.5115E+03	0.6505E+00	0.2308E+02	0.1000E+00
0.5302E+03	0.1084E+01	0.4377E+02	0.5000E+00
0.5428E+03	0.1606E+01	0.5640E+02	0.1000E+01
0.5517E+03	0.2622E+01	0.6532E+02	0.2000E+01

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\KATA1.DVN
Project Name: SR57/Katella Ave/Abut1 Project Date: 01/14/2010
Project Client: HDR
Computed By: TK
Project Manager: DJC

PILE INFORMATION

Pile Type: Concrete Pile
Top of Pile: 13.00 ft
Length of Square Side: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	60.00 ft
	- Driving/Restrike	60.00 ft
	- Ultimate:	60.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	17.00 ft	0.00%	110.00 pcf	500.00 psf	T-79 Concrete
2	Cohesionless	41.00 ft	0.00%	120.00 pcf	32.0/0.0	Nordlund
3	Cohesive	15.00 ft	0.00%	110.00 pcf	1200.00 psf	T-79 Concrete
4	Cohesionless	24.00 ft	0.00%	110.00 pcf	35.0/0.0	Nordlund

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
13.00 ft	Cohesive	N/A	N/A	500.00 psf	0.00 Kips
16.99 ft	Cohesive	N/A	N/A	500.00 psf	7.98 Kips
17.01 ft	Cohesionless	1870.60 psf	24.54	N/A	8.04 Kips
26.01 ft	Cohesionless	2410.60 psf	24.54	N/A	53.53 Kips
35.01 ft	Cohesionless	2950.60 psf	24.54	N/A	119.41 Kips
44.01 ft	Cohesionless	3490.60 psf	24.54	N/A	205.66 Kips
53.01 ft	Cohesionless	4030.60 psf	24.54	N/A	312.28 Kips
57.99 ft	Cohesionless	4329.40 psf	24.54	N/A	380.04 Kips
58.01 ft	Cohesive	N/A	N/A	1260.00 psf	380.24 Kips
67.01 ft	Cohesive	N/A	N/A	1260.00 psf	425.60 Kips
72.99 ft	Cohesive	N/A	N/A	1260.00 psf	455.73 Kips
73.01 ft	Cohesionless	7629.04 psf	26.85	N/A	456.00 Kips
82.01 ft	Cohesionless	7843.24 psf	26.85	N/A	654.38 Kips
91.01 ft	Cohesionless	8057.44 psf	26.85	N/A	863.59 Kips
96.99 ft	Cohesionless	8199.76 psf	26.85	N/A	1008.59 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
13.00 ft	Cohesive	N/A	N/A	N/A	4.50 Kips
16.99 ft	Cohesive	N/A	N/A	N/A	4.50 Kips
17.01 ft	Cohesionless	1871.20 psf	4.80	13.32 Kips	3.28 Kips
26.01 ft	Cohesionless	2951.20 psf	4.80	13.32 Kips	4.24 Kips
35.01 ft	Cohesionless	4031.20 psf	4.80	13.32 Kips	4.44 Kips
44.01 ft	Cohesionless	5111.20 psf	4.80	13.32 Kips	4.47 Kips
53.01 ft	Cohesionless	6191.20 psf	4.80	13.32 Kips	5.26 Kips
57.99 ft	Cohesionless	6788.80 psf	4.80	13.32 Kips	5.77 Kips
58.01 ft	Cohesive	N/A	N/A	N/A	10.80 Kips
67.01 ft	Cohesive	N/A	N/A	N/A	10.80 Kips
72.99 ft	Cohesive	N/A	N/A	N/A	10.80 Kips
73.01 ft	Cohesionless	7629.28 psf	4.80	13.32 Kips	6.48 Kips
82.01 ft	Cohesionless	8057.68 psf	4.80	13.32 Kips	6.85 Kips
91.01 ft	Cohesionless	8486.08 psf	4.80	13.32 Kips	7.21 Kips
96.99 ft	Cohesionless	8770.72 psf	4.80	13.32 Kips	7.45 Kips

ULTIMATE - SUMMARY OF CAPACITIES

	Depth	Skin Friction	End Bearing	Total Capacity
pile cut off @ elev 175' →	0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	12.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
elev. 162' →	13.00 ft	0.00 Kips	4.50 Kips	4.50 Kips
	16.99 ft	7.98 Kips	4.50 Kips	12.48 Kips
	17.01 ft	8.04 Kips	3.28 Kips	11.32 Kips
	26.01 ft	53.53 Kips	4.24 Kips	57.78 Kips
	35.01 ft	119.41 Kips	4.44 Kips	123.85 Kips
	44.01 ft	205.66 Kips	4.47 Kips	210.13 Kips
	53.01 ft	312.28 Kips	5.26 Kips	317.54 Kips
	57.99 ft	380.04 Kips	5.77 Kips	385.81 Kips
	58.01 ft	380.24 Kips	10.80 Kips	391.04 Kips
	67.01 ft	425.60 Kips	10.80 Kips	436.40 Kips
	72.99 ft	455.73 Kips	10.80 Kips	466.53 Kips
	73.01 ft	456.00 Kips	6.48 Kips	462.48 Kips
	82.01 ft	654.38 Kips	6.85 Kips	661.22 Kips
	91.01 ft	863.59 Kips	7.21 Kips	870.80 Kips
	96.99 ft	1008.59 Kips	7.45 Kips	1016.04 Kips

44.01' 205.66kips
53.01' 312.28kips

pile capacity: $\frac{(312.28-205.66)}{(53.01-44.01)} = 11.8$ Kips/ft

240Kips − 205.66Kips = 34.34Kips

Depth: 44.01' + (34.34/11.8) = 46.9' ≈ 47'

pile tip elev: 175' − 47' = 128' use one from Apile output (124')

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\KATB2.DVN
Project Name: SR57/Katella Ave/Bent 2 Project Date: 01/14/2010
Project Client: HDR
Computed By: TK
Project Manager: DJC

PILE INFORMATION

Pile Type: Concrete Pile
Top of Pile: 7.00 ft
Length of Square Side: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	49.00 ft
	- Driving/Restrike	49.00 ft
	- Ultimate:	49.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	4.00 ft	0.00%	110.00 pcf	500.00 psf	T-79 Concrete
2	Cohesionless	41.00 ft	0.00%	120.00 pcf	32.0/0.0	Nordlund
3	Cohesive	15.00 ft	0.00%	110.00 pcf	1200.00 psf	T-79 Concrete
4	Cohesionless	21.00 ft	0.00%	110.00 pcf	35.0/0.0	Nordlund

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
3.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
4.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
6.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
7.00 ft	Cohesionless	800.00 psf	24.54	N/A	0.00 Kips
13.01 ft	Cohesionless	1160.60 psf	24.54	N/A	14.62 Kips
22.01 ft	Cohesionless	1700.60 psf	24.54	N/A	53.51 Kips
31.01 ft	Cohesionless	2240.60 psf	24.54	N/A	112.78 Kips
40.01 ft	Cohesionless	2780.60 psf	24.54	N/A	192.43 Kips
44.99 ft	Cohesionless	3079.40 psf	24.54	N/A	245.26 Kips
45.01 ft	Cohesive	N/A	N/A	1260.00 psf	245.42 Kips
54.01 ft	Cohesive	N/A	N/A	1260.00 psf	290.78 Kips
59.99 ft	Cohesive	N/A	N/A	1260.00 psf	320.92 Kips
60.01 ft	Cohesionless	6323.84 psf	26.85	N/A	321.15 Kips
69.01 ft	Cohesionless	6538.04 psf	26.85	N/A	486.51 Kips
78.01 ft	Cohesionless	6752.24 psf	26.85	N/A	662.71 Kips
80.99 ft	Cohesionless	6823.16 psf	26.85	N/A	723.44 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
3.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
4.01 ft	Cohesionless	0.00 psf	4.80	13.32 Kips	0.00 Kips
6.99 ft	Cohesionless	0.00 psf	4.80	13.32 Kips	0.00 Kips
7.00 ft	Cohesionless	800.00 psf	4.80	13.32 Kips	1.40 Kips
13.01 ft	Cohesionless	1521.20 psf	4.80	13.32 Kips	2.67 Kips
22.01 ft	Cohesionless	2601.20 psf	4.80	13.32 Kips	4.28 Kips
31.01 ft	Cohesionless	3681.20 psf	4.80	13.32 Kips	4.43 Kips
40.01 ft	Cohesionless	4761.20 psf	4.80	13.32 Kips	4.65 Kips
44.99 ft	Cohesionless	5358.80 psf	4.80	13.32 Kips	4.55 Kips
45.01 ft	Cohesive	N/A	N/A	N/A	10.80 Kips
54.01 ft	Cohesive	N/A	N/A	N/A	10.80 Kips
59.99 ft	Cohesive	N/A	N/A	N/A	10.80 Kips
60.01 ft	Cohesionless	6324.08 psf	4.80	13.32 Kips	5.37 Kips
69.01 ft	Cohesionless	6752.48 psf	4.80	13.32 Kips	5.74 Kips
78.01 ft	Cohesionless	7180.88 psf	4.80	13.32 Kips	6.10 Kips
80.99 ft	Cohesionless	7322.72 psf	4.80	13.32 Kips	6.22 Kips

ULTIMATE - SUMMARY OF CAPACITIES

	Depth	Skin Friction	End Bearing	Total Capacity
FG @ 162' →	0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	3.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
	4.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
pile cutoff	6.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
@ elev 156' →	7.00 ft	0.00 Kips	1.40 Kips	1.40 Kips
	13.01 ft	14.62 Kips	2.67 Kips	17.29 Kips
	22.01 ft	53.51 Kips	4.28 Kips	57.80 Kips
b-II	31.01 ft	112.78 Kips	4.43 Kips	117.21 Kips
	40.01 ft	192.43 Kips	4.65 Kips	197.07 Kips
a-I & a-II	44.99 ft	245.26 Kips	4.55 Kips	249.81 Kips
	45.01 ft	245.42 Kips	10.80 Kips	256.22 Kips
	54.01 ft	290.78 Kips	10.80 Kips	301.58 Kips
	59.99 ft	320.92 Kips	10.80 Kips	331.72 Kips
	60.01 ft	321.15 Kips	5.37 Kips	326.52 Kips
	69.01 ft	486.51 Kips	5.74 Kips	492.25 Kips
	78.01 ft	662.71 Kips	6.10 Kips	668.81 Kips
	80.99 ft	723.44 Kips	6.22 Kips	729.66 Kips

a-I & a-II

40.01' 192.43 kips
44.99' 245.26 kips

pile capacity : $\frac{(245.26 - 192.43)}{(44.99 - 40.01)} = 10.6$ kips/ft

230 kips − 192.43 kips = 37.57 kips

Depth: $40.01' + (37.57/10.6) = 43.5' \simeq 44'$

pile tip elev : 162' − 44' = 118' use one from Apile output (115')

b-II

31.01' 112.78 kips
40.01' 192.43 kips

pile capacity = $\frac{(192.43 - 112.78)}{(40.01 - 31.01)} = 8.9$ kips/ft

140 − 112.78 kips = 27.22 kips.

Depth : $31.01' + (27.22/8.9) = 34'$

pile tip elev : 162' − 34' = 128' Same as one from Apile output

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: C:\PROGRA~1\DRIVEN\KATA3.DVN
Project Name: SR57/Katella Ave/Abut3 Project Date: 01/14/2010
Project Client: HDR
Computed By: TK
Project Manager: DJC

PILE INFORMATION

Pile Type: Concrete Pile
Top of Pile: 11.00 ft
Length of Square Side: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	60.00 ft
	- Driving/Restrike	60.00 ft
	- Ultimate:	60.00 ft
Ultimate Considerations:	- Local Scour:	0.00 ft
	- Long Term Scour:	0.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	15.00 ft	0.00%	110.00 pcf	32.0/0.0	Nordlund
2	Cohesionless	41.00 ft	0.00%	120.00 pcf	32.0/0.0	Nordlund
3	Cohesive	15.00 ft	0.00%	110.00 pcf	1200.00 psf	T-79 Concrete
4	Cohesionless	24.00 ft	0.00%	110.00 pcf	35.0/0.0	Nordlund

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
10.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
11.00 ft	Cohesionless	1210.00 psf	24.54	N/A	0.00 Kips
14.99 ft	Cohesionless	1429.45 psf	24.54	N/A	11.96 Kips
15.01 ft	Cohesionless	1650.60 psf	24.54	N/A	12.03 Kips
24.01 ft	Cohesionless	2190.60 psf	24.54	N/A	53.37 Kips
33.01 ft	Cohesionless	2730.60 psf	24.54	N/A	115.09 Kips
42.01 ft	Cohesionless	3270.60 psf	24.54	N/A	197.19 Kips
51.01 ft	Cohesionless	3810.60 psf	24.54	N/A	299.67 Kips
55.99 ft	Cohesionless	4109.40 psf	24.54	N/A	365.13 Kips
56.01 ft	Cohesive	N/A	N/A	1260.00 psf	365.32 Kips
65.01 ft	Cohesive	N/A	N/A	1260.00 psf	410.68 Kips
70.99 ft	Cohesive	N/A	N/A	1260.00 psf	440.82 Kips
71.01 ft	Cohesionless	7533.84 psf	26.85	N/A	441.08 Kips
80.01 ft	Cohesionless	7748.04 psf	26.85	N/A	637.05 Kips
89.01 ft	Cohesionless	7962.24 psf	26.85	N/A	843.85 Kips
94.99 ft	Cohesionless	8104.56 psf	26.85	N/A	987.25 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	4.80	13.32 Kips	0.00 Kips
9.01 ft	Cohesionless	0.00 psf	4.80	13.32 Kips	0.00 Kips
10.99 ft	Cohesionless	0.00 psf	4.80	13.32 Kips	0.00 Kips
11.00 ft	Cohesionless	1210.00 psf	4.80	13.32 Kips	2.12 Kips
14.99 ft	Cohesionless	1648.90 psf	4.80	13.32 Kips	2.89 Kips
15.01 ft	Cohesionless	1651.20 psf	4.80	13.32 Kips	2.89 Kips
24.01 ft	Cohesionless	2731.20 psf	4.80	13.32 Kips	4.21 Kips
33.01 ft	Cohesionless	3811.20 psf	4.80	13.32 Kips	4.39 Kips
42.01 ft	Cohesionless	4891.20 psf	4.80	13.32 Kips	4.53 Kips
51.01 ft	Cohesionless	5971.20 psf	4.80	13.32 Kips	5.07 Kips
55.99 ft	Cohesionless	6568.80 psf	4.80	13.32 Kips	5.58 Kips
56.01 ft	Cohesive	N/A	N/A	N/A	10.80 Kips
65.01 ft	Cohesive	N/A	N/A	N/A	10.80 Kips
70.99 ft	Cohesive	N/A	N/A	N/A	10.80 Kips
71.01 ft	Cohesionless	7534.08 psf	4.80	13.32 Kips	6.40 Kips
80.01 ft	Cohesionless	7962.48 psf	4.80	13.32 Kips	6.76 Kips
89.01 ft	Cohesionless	8390.88 psf	4.80	13.32 Kips	7.13 Kips
94.99 ft	Cohesionless	8675.52 psf	4.80	13.32 Kips	7.37 Kips

ULTIMATE - SUMMARY OF CAPACITIES

	Depth	Skin Friction	End Bearing	Total Capacity
pile cutoff @ elev 175' →	0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	9.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
	10.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
Elev. 162' →	11.00 ft	0.00 Kips	2.12 Kips	2.12 Kips
	14.99 ft	11.96 Kips	2.89 Kips	14.85 Kips
	15.01 ft	12.03 Kips	2.89 Kips	14.92 Kips
	24.01 ft	53.37 Kips	4.21 Kips	57.58 Kips
	33.01 ft	115.09 Kips	4.39 Kips	119.48 Kips
	42.01 ft	197.19 Kips	4.53 Kips	201.72 Kips
	51.01 ft	299.67 Kips	5.07 Kips	304.74 Kips
	55.99 ft	365.13 Kips	5.58 Kips	370.71 Kips
	56.01 ft	365.32 Kips	10.80 Kips	376.12 Kips
	65.01 ft	410.68 Kips	10.80 Kips	421.48 Kips
	70.99 ft	440.82 Kips	10.80 Kips	451.62 Kips
	71.01 ft	441.08 Kips	6.40 Kips	447.48 Kips
	80.01 ft	637.05 Kips	6.76 Kips	643.81 Kips
	89.01 ft	843.85 Kips	7.13 Kips	850.98 Kips
	94.99 ft	987.25 Kips	7.37 Kips	994.62 Kips

42.01' 197.19 kips
51.01' 299.67 kips

pile capacity: $\frac{(299.67 - 197.19)}{(51.01 - 42.01)} = 11.4$ kips/ft

240 kips − 197.19 kips = 42.81 kips

Depth: 42.01' + (42.81/11.4) = 45.8' ≈ 46'

pile tip elev: 173' − 46' = 127' use one from Apile output (122')

Soil Spring Constants

Project Number: 602231-002

Project name: SR-57 Widening - Katella Avenue / 12-inch Square Pile

Longitudinal Direction: Along the Bridge, Transverse Direction: Along the Street

Pile Type	12 inches Square piles
Pile Diameter/Width (inches)	12
Section Area, A (inches^2)	144
Length of Pile, L (feet)	27
Elastic Modulus of Pile (psi)	3.80E+06

Total Number of Pile	15
Number of Rows along Long Direction	3
Number of Rows along Trans Direction	5
Pile Spacing along Long Direction (feet)	3.5
Pile Spacing along Trans Direction (feet)	3
Pile Cap Width along Long Direction (feet)	10
Pile Cap Width along Trans Direction (feet)	15
Pile Cap Thickness (feet)	4.75

Translational Stiffness

$$k_x = \frac{\text{Shaer force at top of pile (kips)}}{\text{Lateral Displacement at top of pile (feet)}}$$

Axial Spring Stiffness; k_v :

$$k_v = \sum_{n=1}^{N} \frac{AE}{L}$$

where, A : Cross – section area of pile;

E : Modulus of Elasticity of pile;

L : Length of pile; and

N : Number of pile in group

Rotational Spring Stiffness, k_θ :

$$k_\theta = \sum_{n=1}^{N} k_{vn} S_n^2$$

where, k_{vn} : Axial stiffness of nth pile; and

S_n : Distance between nth pile and axis of rotation

Reference : FEMA 356 p4 – 25

	Bent 2					
Pile Cap Condition	Free Head			Fixed Head		
Lateral Displacement at top of Pile (inches)	0.25	0.5	1	0.25	0.5	1
Shear Force at top of Pile (Single Pile) (kips)	30	53	80	63	113	164
	Pile Group					
Translational Stiffness[1)], k_δ (K11, Long Direction, lbs/inches)	1.33E+06	1.17E+06	8.83E+05	2.78E+06	2.50E+06	1.81E+06
Translational Stiffness[1)], k_δ (K22, Trans Direction, lbs/inches)	1.12E+06	9.87E+05	7.45E+05	2.35E+06	2.11E+06	1.53E+06
Axial Stiffness, k_v (K33,lbs/inches)	1.69E+06					
Rotational Stiffness, k_θ (K44, Long Direction, lbs-inches/rad)	8.94E+10			8.94E+10		
Rotational Stiffness, k_θ (K55, Trans Direction, lbs-inches/rad)	3.28E+10			3.28E+10		
Tortional Stiffness, k_θ (K66, Vertical Axis, lbs-inches/rad)	-			-		

[1)] Group reduction was already considered

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================================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.25)

             Analysis of Individual Piles and Drilled Shafts
            Subjected to Lateral Loading Using the p-y Method

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================================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Katella\
Name of input data file:     Katella Abutment 12 inch_05_09.lpd
Name of output file:         Katella Abutment 12 inch_05_09.lpo
Name of plot output file:    Katella Abutment 12 inch_05_09.lpp
Name of runtime file:        Katella Abutment 12 inch_05_09.lpr


--------------------------------------------------------------------------------
                          Time and Date of Analysis
--------------------------------------------------------------------------------

               Date:  May  5, 2009     Time:  18: 2: 0

--------------------------------------------------------------------------------
                              Problem Title
--------------------------------------------------------------------------------

Katella Ave Abutments 1&3 /12-inch Square Concrete Pile


--------------------------------------------------------------------------------
                              Program Options
--------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


--------------------------------------------------------------------------------
                    Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Pile Length                                =     600.00 in
Depth of ground surface below top of pile =        .00 in
Slope angle of ground surface              =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
          in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   12.00000000    1728.0000     144.0000      3800000.
  2     600.0000   12.00000000    1728.0000     144.0000      3800000.


--------------------------------------------------------------------------------
                        Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using  6 layers

Layer  1 is stiff clay without free water
Distance from top of pile to top of layer    =         .000 in
Distance from top of pile to bottom of layer =       72.000 in

Layer  2 is stiff clay without free water
Distance from top of pile to top of layer    =       72.000 in
Distance from top of pile to bottom of layer =      132.000 in

Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      132.000 in
Distance from top of pile to bottom of layer =      672.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      672.000 in
Distance from top of pile to bottom of layer =      720.000 in

Layer  5 is stiff clay without free water
Distance from top of pile to top of layer    =      720.000 in
Distance from top of pile to bottom of layer =      852.000 in

Layer  6 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      852.000 in
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Distance from top of pile to bottom of layer = 1110.000 in
p-y subgrade modulus k for top of soil layer = 110.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 110.000 lbs/in**3

(Depth of lowest layer extends 510.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 12 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	.00	.06367
2	72.00	.06367
3	72.00	.06366
4	132.00	.06366
5	132.00	.06944
6	672.00	.06944
7	672.00	.06366
8	720.00	.06366
9	720.00	.02755
10	852.00	.02755
11	852.00	.03333
12	1110.00	.03333

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 12 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	.000	6.94000	.00	.00700	.0
2	72.000	6.94000	.00	.00700	.0
3	72.000	13.89000	.00	.00500	.0
4	132.000	13.89000	.00	.00500	.0
5	132.000	.00000	32.00	------	------
6	672.000	.00000	32.00	------	------
7	672.000	8.33000	.00	.00600	.0
8	720.000	8.33000	.00	.00600	.0
9	720.000	8.33000	.00	.00600	.0
10	852.000	8.33000	.00	.00600	.0
11	852.000	.00000	35.00	------	------
12	1110.000	.00000	35.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

Loading Type

Static loading criteria was used for computation of p-y curves

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Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in

Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	10186.8227	-.0040992	0.0000	-130.4855
6.000	.225405	58772.1978	9375.1276	-.0040724	204.0701	-140.0796
12.000	.201131	112502.	8508.7531	-.0039941	390.6303	-148.7119
18.000	.177475	160877.	7593.6834	-.0038692	558.6015	-156.3113
24.000	.154701	203626.	6636.3372	-.0037027	707.0338	-162.8041
30.000	.133043	240513.	5643.5854	-.0034998	835.1156	-168.1132
36.000	.112703	271349.	4622.7773	-.0032659	942.1832	-172.1562
42.000	.093851	295987.	3581.7786	-.0030067	1027.7313	-174.8433
48.000	.076622	314330.	2529.0274	-.0027279	1091.4240	-176.0737
54.000	.061117	326335.	1473.6151	-.0024352	1133.1074	-175.7304
60.000	.047400	332013.	425.4065	-.0021344	1152.8246	-173.6724
66.000	.035504	331440.	-604.7719	-.0018313	1150.8327	-169.7204
72.000	.025424	324756.	-1754.8532	-.0015315	1127.6258	-213.6400
78.000	.017126	310382.	-3234.6957	-.0012413	1077.7138	-279.6408
84.000	.010528	285940.	-4852.3487	-.0009689	992.8468	-259.5768
90.000	.005499	252153.	-6323.7899	-.0007230	875.5326	-230.9036
96.000	.001852	210054.	-7568.3853	-.0005119	729.3555	-183.9616
102.000	-.000644	161333.	-7683.4481	-.0003422	560.1832	145.6073
108.000	-.002254	117853.	-6621.3295	-.0002146	409.2118	208.4323
114.000	-.003219	81876.8163	-5285.4624	-.0001234	284.2945	236.8568
120.000	-.003735	54427.4645	-3809.6675	-6.1125E-05	188.9843	255.0748
126.000	-.003953	36160.8063	-2240.2515	-1.9738E-05	125.5584	268.0638
132.000	-.003972	27544.4464	-1348.1173	9.3675E-06	95.6404	29.3142
138.000	-.003840	19983.3987	-1171.0004	3.1082E-05	69.3868	29.7247
144.000	-.003599	13492.4416	-994.3672	4.6376E-05	46.8488	29.1530
150.000	-.003284	8050.9926	-823.5629	5.6218E-05	27.9548	27.7818
156.000	-.002925	3609.6868	-662.8350	6.1546E-05	12.5336	25.7942
162.000	-.002545	96.9728	-515.3536	6.3239E-05	.3367111	23.3663
168.000	-.002166	-2574.5558	-383.2741	6.2107E-05	8.9394	20.6602
174.000	-.001800	-4502.3163	-267.8318	5.8874E-05	15.6330	17.8205
180.000	-.001459	-5788.5371	-169.4574	5.4173E-05	20.0991	14.9709
186.000	-.001150	-6535.8056	-87.9063	4.8542E-05	22.6938	12.2128
192.000	-.000877	-6843.4122	-22.3910	4.2429E-05	23.7618	9.6256
198.000	-.000641	-6804.4971	28.2870	3.6194E-05	23.6267	7.2670
204.000	-.000442	-6503.9687	65.6135	3.0114E-05	22.5832	5.1752
210.000	-.000279	-6017.1350	91.2501	2.4393E-05	20.8928	3.3704
216.000	-.000150	-5408.9677	106.9354	1.9173E-05	18.7811	1.8581
222.000	-4.94E-05	-4733.9104	114.4032	1.4539E-05	16.4372	.6312285
228.000	2.49E-05	-4036.1288	115.3168	1.0532E-05	14.0143	-.3267258
234.000	7.70E-05	-3350.1093	111.2183	7.1576E-06	11.6323	-1.0394
240.000	.000111	-2701.5089	103.4948	4.3928E-06	9.3802	-1.5351
246.000	.000130	-2108.1713	93.3563	2.1954E-06	7.3200	-1.8444
252.000	.000137	-1581.2335	81.8262	5.0979E-07	5.4904	-1.9989
258.000	.000136	-1126.2570	69.7418	-7.2719E-07	3.9106	-2.0292
264.000	.000128	-744.3324	57.7617	-1.5818E-06	2.5845	-1.9641
270.000	.000117	-433.1164	46.3801	-2.1198E-06	1.5039	-1.8298
276.000	.000103	-187.7718	35.9436	-2.4034E-06	.6519853	-1.6491
282.000	8.80E-05	-1.7931	26.6720	-2.4900E-06	.0062259	-1.4415
288.000	7.31E-05	132.2926	18.6787	-2.4304E-06	.4593494	-1.2230
294.000	5.88E-05	222.3513	11.9914	-2.2684E-06	.7720531	-1.0061
300.000	4.58E-05	276.1898	6.5722	-2.0406E-06	.9589925	-.8003032
306.000	3.43E-05	301.2175	2.3349	-1.7768E-06	1.0459	-.6121141
312.000	2.45E-05	304.2090	-.8384462	-1.5002E-06	1.0563	-.4456774
318.000	1.63E-05	291.1561	-3.0847	-1.2282E-06	1.0110	-.3030807
324.000	9.78E-06	267.1923	-4.5483	-9.7310E-07	.9277512	-.1847726
330.000	4.67E-06	236.5767	-5.3724	-7.4295E-07	.8214470	-.0899468
336.000	8.61E-07	202.7231	-5.6930	-5.4224E-07	.7038996	-.0168921
342.000	-1.84E-06	168.2613	-5.6335	-3.7275E-07	.5842406	.0366990
348.000	-3.61E-06	135.1207	-5.3030	-2.3414E-07	.4691690	.0734692
354.000	-4.65E-06	104.6249	-4.7941	-1.2461E-07	.3632810	.0961831
360.000	-5.11E-06	77.5918	-4.1828	-4.1362E-08	.2694160	.1075617
366.000	-5.14E-06	54.4309	-3.5297	1.8955E-08	.1889961	.1101603
372.000	-4.88E-06	35.2357	-2.8803	5.9921E-08	.1223463	.1062849
378.000	-4.42E-06	19.8669	-2.2677	8.5096E-08	.0689821	.0979432
384.000	-3.86E-06	8.0239	-1.7134	9.7839E-08	.0278608	.0868225
390.000	-3.25E-06	-.6934024	-1.2300	1.0119E-07	.0024076	.0742893
396.000	-2.64E-06	-6.7363	-.8229340	9.7793E-08	.0233900	.0614058
402.000	-2.08E-06	-10.5686	-.4918442	8.9887E-08	.0366966	.0489575
408.000	-1.57E-06	-12.6384	-.2325107	7.9285E-08	.0438835	.0374871
414.000	-1.12E-06	-13.3587	-.0380507	6.7407E-08	.0463845	.0273329
420.000	-7.57E-07	-13.0951	.0999501	5.5321E-08	.0454689	.0186673
426.000	-4.61E-07	-12.1593	.1905515	4.3783E-08	.0422199	.0115331
432.000	-2.32E-07	-10.8084	.2427841	3.3290E-08	.0375293	.0058777
438.000	-6.15E-08	-9.2459	.2651645	2.4128E-08	.0321039	.0015824
444.000	5.79E-08	-7.6265	.2653748	1.6419E-08	.0264808	-.0015123
450.000	1.36E-07	-6.0614	.2500777	1.0166E-08	.0210466	-.0035867
456.000	1.80E-07	-4.6255	.2248403	5.2830E-09	.0160609	-.0048257
462.000	1.99E-07	-3.3633	.1941408	1.6331E-09	.0116783	-.0054074
468.000	2.00E-07	-2.2958	.1614336	-9.5241E-10	.0079717	-.0054950
474.000	1.88E-07	-1.4261	.1292532	-2.6529E-09	.0049519	-.0052318
480.000	1.68E-07	-.7447975	.0993407	-3.6447E-09	.0025861	-.0047390
486.000	1.44E-07	-.2340552	.0727785	-4.0919E-09	.0008127	-.0041151
492.000	1.19E-07	.1285444	.0501230	-4.1401E-09	.0004463	-.0034367
498.000	9.41E-08	.3674212	.0315300	-3.9135E-09	.0012758	-.0027609
504.000	7.16E-08	.5069040	.0168651	-3.5141E-09	.0017601	-.0021273
510.000	5.19E-08	.5698025	.0057998	-3.0222E-09	.0019785	-.0015611
516.000	3.54E-08	.5765015	-.0021106	-2.4985E-09	.0020017	-.0010757
522.000	2.20E-08	.5444751	-.0073647	-1.9863E-09	.0018905	-.0006757
528.000	1.15E-08	.4881250	-.0104684	-1.5145E-09	.0016949	-.0003589
534.000	3.78E-09	.4188537	-.0119021	-1.1002E-09	.0014544	-.0001190
540.000	-1.68E-09	.3452996	-.0120988	-7.5105E-10	.0011990	5.3400E-05
546.000	-5.24E-09	.2736679	-.0114325	-4.6826E-10	.0009502	.0001687
552.000	-7.30E-09	.2081094	-.0102134	-2.4815E-10	.0007226	.0002377
558.000	-8.21E-09	.1511072	-.0086887	-8.4037E-11	.0005247	.0002706
564.000	-8.30E-09	.1038452	-.0070475	3.2444E-11	.0003606	.0002765
570.000	-7.82E-09	.0665376	-.0054278	1.1029E-10	.0002310	.0002634
576.000	-6.98E-09	.0387113	-.0039253	1.5837E-10	.0001344	.0002375
582.000	-5.92E-09	.0194337	-.0026019	1.8494E-10	6.7478E-05	.0002037
588.000	-4.76E-09	.0074881	-.0014948	1.9724E-10	2.6000E-05	.0001654
594.000	-3.56E-09	.0014967	-.0006240	2.0134E-10	5.1969E-06	.0001249
600.000	-2.34E-09	0.0000	0.0000	2.0203E-10	0.0000	8.3150E-05

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.25000000	in
Computed slope at pile head	=	-.00409923	
Maximum bending moment	=	332013.48027	lbs-in
Maximum shear force	=	10186.82271	lbs
Depth of maximum bending moment	=	60.00000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	19	
Number of zero deflection points	=	5	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	14423.3258	-.0073823	0.0000	-155.1742
6.000	.455706	83746.8186	13456.7009	-.0073440	290.7876	-167.0341
12.000	.411871	161480.	12421.9113	-.0072320	560.6959	-177.8958
18.000	.368922	232810.	11325.1571	-.0070519	808.3672	-187.6889
24.000	.327249	297382.	10173.0685	-.0068096	1032.5774	-196.3406
30.000	.287206	354887.	8972.7232	-.0065116	1232.2451	-203.7745
36.000	.249109	405055.	7731.6713	-.0061644	1406.4409	-209.9095
42.000	.213233	447667.	6457.9701	-.0057749	1554.3980	-214.6576
48.000	.179811	482551.	5160.2325	-.0053499	1675.5230	-217.9216
54.000	.149035	509589.	3847.6945	-.0048966	1769.4077	-219.5911
60.000	.121052	528723.	2530.3106	-.0044222	1835.8436	-219.5369
66.000	.095968	539953.	1218.8924	-.0039340	1874.8373	-217.6025
72.000	.073845	543350.	-270.5130	-.0034390	1886.6308	-278.8660
78.000	.054700	536707.	-2228.3968	-.0029456	1863.5660	-373.7620
84.000	.038498	516609.	-4426.1247	-.0024644	1793.7809	-358.8140
90.000	.025128	483593.	-6514.5548	-.0020074	1679.1441	-337.3294
96.000	.014409	438434.	-8445.8994	-.0015861	1522.3411	-306.4522
102.000	.006094	382243.	-10138.0297	-.0012112	1327.2316	-257.5913
108.000	-.000125	316778.	-10723.8123	-.0008918	1099.9232	62.3304
114.000	-.004608	253557.	-9758.9418	-.0006313	880.4061	259.2931
120.000	-.007701	199671.	-8063.3900	-.0004242	693.3006	305.8909
126.000	-.009698	156796.	-6138.5067	-.0002613	544.4315	335.7369
132.000	-.010837	126009.	-4891.3718	-.0001321	437.5295	79.9747
138.000	-.011284	98099.8152	-4389.4315	-2.9746E-05	340.6244	87.3387
144.000	-.011194	73335.3232	-3855.4099	4.8577E-05	254.6365	90.6685
150.000	-.010701	51834.8959	-3311.8095	.0001058	179.9823	90.5317
156.000	-.009924	33593.6088	-2777.6132	.0001448	116.6445	87.5338
162.000	-.008964	18503.5380	-2268.1539	.0001686	64.2484	82.2860
168.000	-.007901	6375.7621	-1795.1603	.0001800	22.1381	75.3786
174.000	-.006804	-3038.3859	-1366.9440	.0001815	10.5500	67.3602
180.000	-.005723	-10027.5658	-988.6949	.0001755	34.8179	58.7228
186.000	-.004698	-14902.7252	-662.8531	.0001641	51.7456	49.8912
192.000	-.003754	-17981.8024	-389.5249	.0001491	62.4368	41.2182
198.000	-.002909	-19577.0240	-166.9195	.0001319	67.9758	32.9836
204.000	-.002171	-19984.8366	8.2195	.0001139	69.3918	25.3961
210.000	-.001542	-19478.3902	140.2035	9.5840E-05	67.6333	18.5986
216.000	-.001021	-18302.3946	234.0241	7.8579E-05	63.5500	12.6749
222.000	-.000599	-16670.1008	295.0233	6.2601E-05	57.8823	7.6581
228.000	-.000269	-14762.1155	328.6140	4.8240E-05	51.2573	3.5388
234.000	-2.03E-05	-12726.7328	340.0542	3.5682E-05	44.1900	.2745928
240.000	.000159	-10681.4647	334.2725	2.4987E-05	37.0884	-2.2018
246.000	.000280	-8715.4624	315.7434	1.6125E-05	30.2620	-3.9745
252.000	.000352	-6892.5438	288.4074	8.9942E-06	23.9324	-5.1375
258.000	.000387	-5254.5735	255.6302	3.4446E-06	18.2450	-5.7883
264.000	.000394	-3824.9810	220.1947	-7.0363E-07	13.2812	-6.0236
270.000	.000379	-2612.2374	184.3189	-3.6446E-06	9.0703	-5.9350
276.000	.000350	-1613.1537	149.6947	-5.5751E-06	5.6012	-5.6064
282.000	.000312	-815.9004	117.5394	-6.6848E-06	2.8330	-5.1120
288.000	.000270	-202.6804	88.6568	-7.1502E-06	.7037513	-4.5155
294.000	.000226	247.9808	63.5016	-7.1295E-06	.8610445	-3.8695
300.000	.000184	559.3394	42.2452	-6.7607E-06	1.9422	-3.2160
306.000	.000145	754.9232	24.8371	-6.1602E-06	2.6213	-2.5867
312.000	.000110	857.3842	11.0628	-5.4236E-06	2.9770	-2.0047
318.000	8.01E-05	887.6770	.5949547	-4.6263E-06	3.0822	-1.4846
324.000	5.48E-05	864.5236	-6.9633	-3.8258E-06	3.0018	-1.0348
330.000	3.42E-05	804.1170	-12.0419	-3.0634E-06	2.7921	-.6580563
336.000	1.80E-05	720.0203	-15.0750	-2.3671E-06	2.5001	-.3529759
342.000	5.76E-06	623.2166	-16.4793	-1.7534E-06	2.1639	-.1151191
348.000	-3.05E-06	522.2685	-16.6385	-1.2301E-06	1.8134	.0620456
354.000	-9.00E-06	423.5541	-15.8936	-7.9796E-07	1.4707	.1862844
360.000	-1.26E-05	331.5459	-14.5370	-4.5298E-07	1.1512	.2659025
366.000	-1.44E-05	249.1102	-12.8117	-1.8769E-07	.8649659	.3091970
372.000	-1.49E-05	177.8056	-10.9120	7.3540E-09	.6173805	.3240483
378.000	-1.43E-05	118.1667	-8.9869	1.4258E-07	.4103011	.3176364
384.000	-1.32E-05	69.9628	-7.1452	2.2853E-07	.2429263	.2962653
390.000	-1.16E-05	32.4244	-5.4606	2.7530E-07	.1125846	.2652767
396.000	-9.86E-06	4.4359	-3.9776	2.9214E-07	.0154025	.2290350
402.000	-8.10E-06	-15.3073	-2.7176	2.8718E-07	.0531503	.1909666
408.000	-6.42E-06	-28.1757	-1.6838	2.6731E-07	.0978322	.1536365
414.000	-4.89E-06	-35.5131	-.8663641	2.3821E-07	.1233095	.1188496
420.000	-3.56E-06	-38.5720	-.2465209	2.0437E-07	.1339307	.0877648
426.000	-2.44E-06	-38.4714	.1998098	1.6917E-07	.1335812	.0610120
432.000	-1.53E-06	-36.1743	.4992628	1.3506E-07	.1256053	.0388056
438.000	-8.18E-07	-32.4802	.6788273	1.0370E-07	.1127786	.0210492
444.000	-2.85E-07	-28.0284	.7642599	7.6053E-08	.0973208	.0074284
450.000	9.49E-08	-23.3091	.7790138	5.2598E-08	.0809345	-.0025104
456.000	3.47E-07	-18.6802	.7435976	3.3415E-08	.0648619	-.0092950
462.000	4.96E-07	-14.3860	.6752809	1.8308E-08	.0499512	-.0134772
468.000	5.66E-07	-10.5769	.5880645	6.9029E-09	.0367252	-.0155949
474.000	5.79E-07	-7.3292	.4928439	-1.2779E-09	.0254485	-.0161453
480.000	5.51E-07	-4.6627	.3977002	-6.7566E-09	.0161900	-.0155692
486.000	4.98E-07	-2.5568	.3082680	-1.0055E-08	.0088777	-.0142415
492.000	4.30E-07	-.9635170	.2281360	-1.1663E-08	.0033455	-.0124692
498.000	3.58E-07	.1808538	.1592484	-1.2021E-08	.0006280	-.0104934
504.000	2.86E-07	.9474639	.1022842	-1.1505E-08	.0032898	-.0084947
510.000	2.20E-07	1.4083	.0569982	-1.0429E-08	.0048898	-.0066006
516.000	1.61E-07	1.6314	.0225156	-9.0404E-09	.0056647	-.0048936

522.000	1.11E-07	1.6785	-.0024239	-7.5282E-09	.0058280	-.0034196
528.000	7.05E-08	1.6024	-.0192714	-6.0293E-09	.0055637	-.0021963
534.000	3.87E-08	1.4472	-.0295217	-4.6360E-09	.0050250	-.0012205
540.000	1.49E-08	1.2481	-.0346069	-3.4046E-09	.0043337	-.0004746
546.000	-2.11E-09	1.0319	-.0358268	-2.3630E-09	.0035830	6.7983E-05
552.000	-1.35E-08	.8181749	-.0343073	-1.5177E-09	.0028409	.0004385
558.000	-2.03E-08	.6202238	-.0309836	-8.6055E-10	.0021536	.0006694
564.000	-2.38E-08	.4463719	-.0265991	-3.7325E-10	.0015499	.0007921
570.000	-2.48E-08	.3010342	-.0217185	-3.1781E-11	.0010453	.0008348
576.000	-2.42E-08	.1857499	-.0167476	1.9062E-10	.0006450	.0008222
582.000	-2.25E-08	.1000634	-.0119590	3.2120E-10	.0003474	.0007740
588.000	-2.03E-08	.0422422	-.0075199	3.8621E-10	.0001467	.0007057
594.000	-1.79E-08	.0098248	-.0035202	4.1000E-10	3.4114E-05	.0006276
600.000	-1.54E-08	0.0000	0.0000	4.1449E-10	0.0000	.0005458

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

Pile-head deflection	=	.50000000	in
Computed slope at pile head	=	-.00738230	
Maximum bending moment	=	543349.65938	lbs-in
Maximum shear force	=	14423.32585	lbs
Depth of maximum bending moment	=	72.00000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	14	
Number of zero deflection points	=	5	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	20715.2970	-.0133664	0.0000	-184.5343
6.000	.919802	120970.	19564.4139	-.0133111	420.0353	-199.0934
12.000	.840267	234773.	18329.3120	-.0131486	815.1839	-212.6073
18.000	.762019	340922.	17016.4721	-.0128856	1183.7566	-225.0060
24.000	.685640	438971.	15632.8031	-.0125293	1524.2036	-236.2170
30.000	.611668	528516.	14185.6584	-.0120872	1835.1234	-246.1646
36.000	.540593	609199.	12682.8589	-.0115675	2115.2727	-254.7686
42.000	.472858	680710.	11132.7231	-.0109781	2363.5759	-261.9433
48.000	.408855	742791.	9544.1076	-.0103278	2579.1361	-267.5952
54.000	.348925	795239.	7926.4599	-.0096251	2761.2470	-271.6207
60.000	.293354	837909.	6289.8898	-.0088790	2909.4053	-273.9027
66.000	.242377	870718.	4645.2651	-.0080983	3023.3258	-274.3056
72.000	.196174	893652.	2754.3470	-.0072922	3102.9580	-356.0005
78.000	.154871	903770.	231.9614	-.0064710	3138.0902	-484.7947
84.000	.118522	896435.	-2648.1573	-.0056486	3112.6231	-475.2449
90.000	.087087	871992.	-5454.4905	-.0048406	3027.7503	-460.1995
96.000	.060434	830982.	-8150.4810	-.0040626	2885.3526	-438.4640
102.000	.038336	774186.	-10689.1771	-.0033292	2688.1470	-407.7680
108.000	.020483	702711.	-13000.6451	-.0026545	2439.9703	-362.7213
114.000	.006482	618179.	-14936.9868	-.0020510	2146.4534	-282.7259
120.000	-.004129	523468.	-15000.4114	-.0015294	1817.5958	261.5844
126.000	-.011871	438174.	-13156.3523	-.0010901	1521.4363	353.1019
132.000	-.017210	365591.	-11716.0094	-.0007229	1269.4145	127.0124
138.000	-.020545	297582.	-10857.9080	-.0004199	1033.2692	159.0214
144.000	-.022249	235296.	-9840.1934	-.0001764	817.0016	180.2168
150.000	-.022663	179499.	-8724.3675	1.3079E-05	623.2612	191.7252
156.000	-.022092	130604.	-7564.6367	.0001548	453.4863	194.8517
162.000	-.020805	88723.5720	-6407.0988	.0002550	308.0680	190.9943
168.000	-.019032	53718.8759	-5289.4060	.0003200	186.5239	181.5700
174.000	-.016965	25250.6998	-4240.8354	.0003561	87.6760	167.9535
180.000	-.014759	2828.8511	-3282.6904	.0003689	9.8224	151.4281
186.000	-.012538	-14141.5849	-2428.9568	.0003638	49.1027	133.1497
192.000	-.010394	-26318.6301	-1687.1379	.0003453	91.3841	114.1232
198.000	-.008394	-34387.2393	-1059.2002	.0003176	119.4001	95.1893
204.000	-.006583	-39029.0322	-542.5676	.0002840	135.5175	77.0215
210.000	-.004986	-40898.0507	-131.1124	.0002475	142.0071	60.1302
216.000	-.003613	-40602.3809	183.8999	.0002103	140.9805	44.8739
222.000	-.002463	-38691.2516	412.9432	.0001740	134.3446	31.4739
228.000	-.001525	-35647.0629	567.4637	.0001401	123.7745	20.0330
234.000	-.000782	-31881.6875	659.2274	.0001092	110.7003	10.5549
240.000	-.000214	-27736.3343	699.7864	8.1985E-05	96.3067	2.9647
246.000	.000202	-23484.2509	700.0644	5.8584E-05	81.5425	-2.8721
252.000	.000489	-19335.5616	670.0550	3.9021E-05	67.1374	-7.1311
258.000	.000670	-15443.5910	618.6225	2.3131E-05	53.6236	-10.0131
264.000	.000767	-11912.0917	553.3930	1.0633E-05	41.3614	-11.7301
270.000	.000798	-8802.8753	480.7213	1.1689E-06	30.5655	-12.4938
276.000	.000781	-6143.4355	405.7196	-5.6597E-06	21.3314	-12.5068
282.000	.000730	-3934.2402	332.3319	-1.0264E-05	13.6606	-11.9558
288.000	.000658	-2155.4522	263.4434	-1.3046E-05	7.4842	-11.0071
294.000	.000573	-772.9194	201.0094	-1.4384E-05	2.6837	-9.8042
300.000	.000485	256.6611	146.1964	-1.4620E-05	.8911844	-8.4668
306.000	.000398	981.4375	99.5238	-1.4054E-05	3.4078	-7.0907
312.000	.000316	1450.9473	61.0020	-1.2943E-05	5.0380	-5.7499
318.000	.000243	1713.4618	30.2593	-1.1497E-05	5.9495	-4.4977
324.000	.000178	1814.0592	6.6561	-9.8855E-06	6.2988	-3.3700
330.000	.000124	1793.3355	-10.6168	-8.2374E-06	6.2269	-2.3876
336.000	7.95E-05	1686.6574	-22.4567	-6.6475E-06	5.8564	-1.5590
342.000	4.42E-05	1523.8556	-29.7829	-5.1807E-06	5.2912	-.8830729
348.000	1.73E-05	1329.2631	-33.4872	-3.8772E-06	4.6155	-.3516945
354.000	-2.33E-06	1122.0096	-34.3976	-2.7573E-06	3.8959	.0482031
360.000	-1.58E-05	916.4915	-33.2550	-1.8260E-06	3.1823	.3326787
366.000	-2.42E-05	722.9498	-30.6993	-1.0769E-06	2.5102	.5192238
372.000	-2.87E-05	548.1001	-27.2650	-4.9624E-07	1.9031	.6255222
378.000	-3.02E-05	395.7692	-23.3829	-6.5010E-08	1.3742	.6685169
384.000	-2.95E-05	267.5050	-19.3861	2.3802E-07	.9288367	.6637533
390.000	-2.73E-05	163.1358	-15.5200	4.3477E-07	.5664439	.6249633
396.000	-2.43E-05	81.2654	-11.9535	5.4643E-07	.2821715	.5638494
402.000	-2.08E-05	19.6935	-8.7919	5.9255E-07	.0683802	.4900297
408.000	-1.72E-05	-24.2373	-6.0885	5.9048E-07	.0841573	.4111042
414.000	-1.37E-05	-53.3684	-3.8567	5.5502E-07	.1853068	.3328090
420.000	-1.05E-05	-70.5183	-2.0806	4.9842E-07	.2448552	.2592261
426.000	-7.71E-06	-78.3361	-.7238943	4.3041E-07	.2720003	.1930238

432.000	-5.35E-06	-79.2050	.2622999	3.5844E-07	.2750174	.1357076
438.000	-3.41E-06	-75.1885	.9330145	2.8790E-07	.2610711	.0878639
444.000	-1.89E-06	-68.0088	1.3448	2.2248E-07	.2361418	.0493870
450.000	-7.44E-07	-59.0513	1.5520	1.6443E-07	.2050392	.0196805
456.000	8.09E-08	-49.3852	1.6045	1.1489E-07	.1714764	-.0021700
462.000	6.35E-07	-39.7973	1.5462	7.4141E-08	.1381849	-.0172552
468.000	9.71E-07	-30.8305	1.4143	4.1873E-08	.1070504	-.0267304
474.000	1.14E-06	-22.8260	1.2389	1.7359E-08	.0792571	-.0317315
480.000	1.18E-06	-15.9639	1.0437	-3.6278E-10	.0554302	-.0333161
486.000	1.13E-06	-10.3012	.8465135	-1.2363E-08	.0357679	-.0324258
492.000	1.03E-06	-5.8057	.6596388	-1.9721E-08	.0201589	-.0298658
498.000	8.96E-07	-2.3855	.4911472	-2.3464E-08	.0082830	-.0262981
504.000	7.49E-07	.0880170	.3455170	-2.4513E-08	.0003056	-.0222453
510.000	6.02E-07	1.7607	.2244782	-2.3669E-08	.0061136	-.0181010
516.000	4.65E-07	2.7818	.1277415	-2.1593E-08	.0096589	-.0141446
522.000	3.43E-07	3.2936	.0536314	-1.8818E-08	.0114361	-.0105588
528.000	2.39E-07	3.4253	-.0003876	-1.5748E-08	.0118935	-.0074475
534.000	1.54E-07	3.2890	-.0372892	-1.2680E-08	.0114200	-.0048530
540.000	8.70E-08	2.9779	-.0601635	-9.8174E-09	.0103398	-.0027717
546.000	3.63E-08	2.5670	-.0719832	-7.2841E-09	.0089132	-.0011682
552.000	-4.12E-10	2.1141	-.0754475	-5.1454E-09	.0073405	1.3412E-05
558.000	-2.55E-08	1.6616	-.0728884	-3.4204E-09	.0057695	.0008396
564.000	-4.15E-08	1.2394	-.0662280	-2.0950E-09	.0043035	.0013805
570.000	-5.06E-08	.8668829	-.0569739	-1.1327E-09	.0030100	.0017042
576.000	-5.50E-08	.5557148	-.0462430	-4.8279E-10	.0019296	.0018728
582.000	-5.64E-08	.3119670	-.0348052	-8.6371E-11	.0010832	.0019398
588.000	-5.61E-08	.1380529	-.0231404	1.1923E-10	.0004794	.0019484
594.000	-5.50E-08	.0342823	-.0115044	1.9797E-10	.0001190	.0019302
600.000	-5.37E-08	0.0000	0.0000	2.1363E-10	0.0000	.0019046

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

Pile-head deflection	=	1.00000000 in
Computed slope at pile head	=	-.01336638
Maximum bending moment	=	903769.98381 lbs-in
Maximum shear force	=	20715.29695 lbs
Depth of maximum bending moment	=	78.00000000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	21
Number of zero deflection points	=	5

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth	Deflect.	Moment	Shear	Slope	Total	Soil Res
X in	y in	M lbs-in	V lbs	S Rad.	Stress lbs/in**2	p lbs/in
0.000	.250000	-884697.	21737.4381	0.0000	3071.8653	-130.4855
6.000	.247575	-756854.	20877.0004	-.0007500	2627.9647	-143.4035
12.000	.241000	-634173.	19980.0404	-.0013855	2201.9896	-155.5888
18.000	.230949	-517093.	19012.4293	-.0019115	1795.4630	-166.9483
24.000	.218063	-406024.	17979.4096	-.0023332	1409.8050	-177.3916
30.000	.202950	-301340.	16886.7461	-.0026564	1046.3210	-186.8295
36.000	.186186	-203383.	15740.7417	-.0028870	706.1906	-195.1719
42.000	.168306	-112452.	14548.2455	-.0030313	390.4567	-202.3268
48.000	.149810	-28803.9449	13316.6707	-.0030958	100.0137	-208.1981
54.000	.131156	47348.5132	12054.0240	-.0030874	164.4046	-212.6841
60.000	.112762	115844.	10768.9467	-.0030128	402.2373	-215.6750
66.000	.095003	176576.	9470.7702	-.0028792	613.1107	-217.0505
72.000	.078212	229494.	7970.9271	-.0026937	796.8527	-282.8972
78.000	.062679	272227.	5962.1352	-.0024645	945.2326	-386.7001
84.000	.048638	301039.	3660.8037	-.0022025	1045.2750	-380.4104
90.000	.036248	316157.	1410.5074	-.0019206	1097.7661	-369.6883
96.000	.025592	317965.	-759.8685	-.0016309	1104.0462	-353.7703
102.000	.016678	307038.	-2814.9790	-.0013453	1066.1049	-331.2665
108.000	.009448	284186.	-4706.0134	-.0010752	986.7554	-299.0783
114.000	.003776	250566.	-6345.0804	-.0008309	870.0210	-247.2774
120.000	-.000523	208045.	-6624.1317	-.0006214	722.3770	154.2603
126.000	-.003680	171076.	-5371.9543	-.0004481	594.0156	263.1322
132.000	-.005900	143581.	-4451.9232	-.0003044	498.5456	43.5449
138.000	-.007333	117653.	-4151.0137	-.0001850	408.5188	56.7583
144.000	-.008121	93768.9675	-3783.4032	-8.8442E-05	325.5867	65.7786
150.000	-.008394	72252.5622	-3373.0172	-1.2592E-05	250.8770	71.0168
156.000	-.008272	53292.7612	-2941.0921	4.4766E-05	185.0443	72.9582
162.000	-.007857	36959.4564	-2505.8296	8.6000E-05	128.3314	72.1293
168.000	-.007240	23222.8059	-2082.2357	.0001135	80.6347	69.0687
174.000	-.006495	11972.6284	-1682.1200	.0001296	41.5716	64.3032
180.000	-.005685	3037.3656	-1314.2262	.0001364	10.5464	58.3281
186.000	-.004858	-3798.0863	-984.4638	.0001361	13.1878	51.5927
192.000	-.004052	-8776.1999	-696.2137	.0001303	30.4729	44.4906
198.000	-.003294	-12152.6506	-450.6805	.0001208	42.1967	37.3538
204.000	-.002603	-14184.3657	-247.2671	.0001087	49.2513	30.4507
210.000	-.001989	-15119.8562	-83.9521	9.5358E-05	52.4995	23.9877
216.000	-.001458	-15191.7908	42.3481	8.1509E-05	52.7493	18.1124
222.000	-.001011	-14611.6789	135.4437	6.7893E-05	50.7350	12.9195
228.000	-.000644	-13566.4663	199.5731	5.5019E-05	47.1058	8.4570
234.000	-.000351	-12216.8016	239.1467	4.3240E-05	42.4194	4.7342
240.000	-.000125	-10696.7063	258.5355	3.2771E-05	37.1413	1.7288
246.000	4.26E-05	-9114.3753	261.9056	2.3720E-05	31.6471	-.6054020
252.000	.000160	-7553.8387	253.0950	1.6105E-05	26.2286	-2.3315
258.000	.000236	-6077.2355	235.5305	9.8772E-06	21.1015	-3.5233
264.000	.000278	-4727.4722	212.1804	4.9408E-06	16.4148	-4.2601
270.000	.000295	-3531.0713	185.5353	1.1677E-06	12.2607	-4.6216
276.000	.000292	-2501.0481	157.6155	-1.5882E-06	8.6842	-4.6850
282.000	.000276	-1639.6857	129.9947	-3.4800E-06	5.6934	-4.5219
288.000	.000251	-941.1123	103.8393	-4.6591E-06	3.2678	-4.1965
294.000	.000220	-393.6138	79.9558	-5.2689E-06	1.3667	-3.7646
300.000	.000187	18.3576	58.8426	-5.4403E-06	.0637417	-3.2731
306.000	.000155	312.4978	40.7440	-5.2891E-06	1.0851	-2.7598
312.000	.000124	507.2853	25.7020	-4.9146E-06	1.7614	-2.2542
318.000	9.59E-05	620.9224	13.6058	-4.3992E-06	2.1560	-1.7779
324.000	7.12E-05	670.5551	4.2349	-3.8091E-06	2.3283	-1.3457
330.000	5.02E-05	671.7417	-2.7019	-3.1959E-06	2.3324	-.9665758
336.000	3.29E-05	638.1317	-7.5353	-2.5974E-06	2.2157	-.6445526

342.000	1.90E-05	581.3177	-10.6088	-2.0403E-06	2.0185	-.3799496
348.000	8.37E-06	510.8256	-12.2593	-1.5413E-06	1.7737	-.1702099
354.000	5.21E-07	434.2059	-12.8023	-1.1096E-06	1.5077	-.0107754
360.000	-4.95E-06	357.1983	-12.5221	-7.4800E-07	1.2403	.1041758
366.000	-8.46E-06	283.9410	-11.6662	-4.5508E-07	.9859062	.1811160
372.000	-1.04E-05	217.2039	-10.4428	-2.2612E-07	.7541801	.2266778
378.000	-1.12E-05	158.6272	-9.0209	-5.4417E-08	.5507888	.2472806
384.000	-1.11E-05	108.9526	-7.5325	6.7832E-08	.3783075	.2488640
390.000	-1.04E-05	68.2371	-6.0758	1.4878E-07	.2369343	.2367145
396.000	-9.28E-06	36.0433	-4.7195	1.9643E-07	.1251503	.2153702
402.000	-8.00E-06	11.6028	-3.5076	2.1820E-07	.0402876	.1885889
408.000	-6.66E-06	-6.0484	-2.4638	2.2073E-07	.0210014	.1593650
414.000	-5.35E-06	-17.9625	-1.5957	2.0976E-07	.0623698	.1299814
420.000	-4.14E-06	-25.1973	-.8995421	1.9005E-07	.0874906	.1020847
426.000	-3.07E-06	-28.7570	-.3629674	1.6539E-07	.0998508	.0767736
432.000	-2.15E-06	-29.5529	.0314309	1.3875E-07	.1026142	.0546926
438.000	-1.40E-06	-28.3798	.3038813	1.1229E-07	.0985411	.0361243
444.000	-8.08E-07	-25.9063	.4754815	8.7485E-08	.0899525	.0210758
450.000	-3.54E-07	-22.6741	.5667783	6.5290E-08	.0787294	.0093564
456.000	-2.40E-08	-19.1050	.5967802	4.6203E-08	.0663368	.0006442
462.000	2.01E-07	-15.5127	.5823376	3.0387E-08	.0538636	-.0054584
468.000	3.41E-07	-12.1169	.5378202	1.7764E-08	.0420727	-.0093807
474.000	4.14E-07	-9.0589	.4750274	8.0889E-09	.0314544	-.0115502
480.000	4.38E-07	-6.4166	.4032696	1.0186E-09	.0222799	-.0123691
486.000	4.26E-07	-4.2196	.3295680	-3.8408E-09	.0146515	-.0121981
492.000	3.92E-07	-2.4618	.2589281	-6.8933E-09	.0085479	-.0113485
498.000	3.43E-07	-1.1125	.1946486	-8.5263E-09	.0038628	-.0100780
504.000	2.89E-07	-.1260064	.1386395	-9.0922E-09	.0004375	-.0085917
510.000	2.34E-07	.5511805	.0917277	-8.8979E-09	.0019138	-.0070456
516.000	1.83E-07	.9747265	.0539354	-8.2008E-09	.0033845	-.0055519
522.000	1.36E-07	1.1984	.0247239	-7.2079E-09	.0041611	-.0041853
528.000	9.60E-08	1.2714	.0031985	-6.0795E-09	.0044146	-.0029898
534.000	6.30E-08	1.2368	-.0117264	-4.9336E-09	.0042944	-.0019851
540.000	3.68E-08	1.1307	-.0211999	-3.8520E-09	.0039260	-.0011727
546.000	1.68E-08	.9823878	-.0263417	-2.8866E-09	.0034111	-.0005412
552.000	2.17E-09	.8145965	-.0281773	-2.0656E-09	.0028285	-7.0697E-05
558.000	-7.99E-09	.6442601	-.0275998	-1.3991E-09	.0022370	.0002632
564.000	-1.46E-08	.4833993	-.0253497	-8.8387E-10	.0016785	.0004868
570.000	-1.86E-08	.3400636	-.0220114	-5.0766E-10	.0011808	.0006260
576.000	-2.07E-08	.2192630	-.0180197	-2.5212E-10	.0007613	.0007046
582.000	-2.16E-08	.1238274	-.0136758	-9.5369E-11	.0004300	.0007434
588.000	-2.19E-08	.0551535	-.0091679	-1.3598E-11	.0001915	.0007593
594.000	-2.18E-08	.0138126	-.0045961	1.7910E-11	4.7960E-05	.0007647
600.000	-2.16E-08	0.0000	0.0000	2.4221E-11	0.0000	.0007674

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

Pile-head deflection	=	.25000000 in
Computed slope at pile head	=	-.00005841
Maximum bending moment	=	-884697.20160 lbs-in
Maximum shear force	=	21737.43813 lbs
Depth of maximum bending moment	=	0.00000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	18
Number of zero deflection points	=	5

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .500000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-1451356.	31661.0155	0.0000	5039.4313	-155.1742
6.000	.496022	-1264461.	30637.3283	-.0012408	4390.4901	-170.6114
12.000	.485111	-1083708.	29569.5380	-.0023136	3762.8752	-185.3249
18.000	.468258	-909627.	28415.9162	-.0032243	3158.4260	-199.2157
24.000	.446419	-742717.	27181.7031	-.0039792	2578.8787	-212.1887
30.000	.420508	-583446.	25872.6859	-.0045851	2025.8550	-224.1504
36.000	.391398	-432245.	24495.2116	-.0050491	1500.8501	-235.0077
42.000	.359919	-289504.	23056.1888	-.0053789	1005.2212	-244.6665
48.000	.326852	-155571.	21563.0986	-.0055822	540.1756	-253.0302
54.000	.292932	-30746.5206	20024.0137	-.0056673	106.7588	-259.9981
60.000	.258844	84717.5964	18447.6271	-.0056427	294.1583	-265.4641
66.000	.225220	190625.	16843.2886	-.0055169	661.8924	-269.3154
72.000	.192641	286837.	14972.1893	-.0052987	995.9620	-354.3844
78.000	.161635	370291.	12439.0368	-.0049985	1285.7336	-489.9997
84.000	.132659	436106.	9502.5843	-.0046301	1514.2552	-488.8178
90.000	.106074	484322.	6585.7812	-.0042096	1681.6746	-483.4499
96.000	.082144	515135.	3715.1770	-.0037530	1788.6628	-473.4182
102.000	.061038	528904.	920.8514	-.0032760	1836.4736	-458.0237
108.000	.042832	526185.	-1761.6041	-.0027939	1827.0316	-436.1282
114.000	.027511	507765.	-4286.7622	-.0023215	1763.0735	-405.5912
120.000	.014974	474744.	-6587.7795	-.0018727	1648.4165	-361.4145
126.000	.005039	428712.	-8527.9451	-.0014599	1488.5827	-285.3074
132.000	-.002545	372409.	-9327.5237	-.0010939	1293.0854	18.7812
138.000	-.008087	316782.	-9083.3914	-.0007790	1099.9358	62.5963
144.000	-.011893	263408.	-8606.5997	-.0005139	914.6108	96.3343
150.000	-.014255	213502.	-7955.8111	-.0002961	741.3275	120.5952
156.000	-.015446	167938.	-7185.3278	-.0001218	583.1187	136.2325
162.000	-.015716	127278.	-6343.8043	1.3084E-05	441.9389	144.2753
168.000	-.015289	91812.5226	-5473.4113	.0001132	318.7935	145.8557
174.000	-.014358	61597.4581	-4609.4086	.0001833	213.8801	142.1452
180.000	-.013090	36499.6200	-3780.0741	.0002281	126.7348	134.2996
186.000	-.011621	16236.5683	-3006.9284	.0002522	56.3770	123.4156
192.000	-.010063	416.4795	-2305.1909	.0002598	1.4461	110.4969
198.000	-.008504	-11425.7221	-1684.4080	.0002548	39.6726	96.4307
204.000	-.007006	-19796.4169	-1149.1925	.0002405	68.7376	81.9744
210.000	-.005618	-25216.0325	-700.0223	.0002199	87.5557	67.7490
216.000	-.004367	-28196.6845	-334.0532	.0001955	97.9052	54.2407
222.000	-.003271	-29224.6706	-45.9078	.0001693	101.4746	41.8077
228.000	-.002336	-28747.5780	171.5887	.0001428	99.8180	30.6911
234.000	-.001558	-27165.6067	326.7472	.0001173	94.3250	21.0284
240.000	-.000929	-24826.6113	428.4421	9.3508E-05	86.2035	12.8699
246.000	-.000436	-22024.3009	485.6332	7.2103E-05	76.4733	6.1938

252.000	-6.33E-05	-18999.0129	506.9846	5.3360E-05	65.9688	.9233273
258.000	.000205	-15940.4851	500.5776	3.7397E-05	55.3489	-3.0590
264.000	.000385	-12992.0818	473.7088	2.4179E-05	45.1114	-5.8973
270.000	.000495	-10255.9798	432.7665	1.3558E-05	35.6110	-7.7502
276.000	.000548	-7798.8834	383.1728	5.3089E-06	27.0795	-8.7811
282.000	.000559	-5657.9066	329.3795	-8.3913E-07	19.6455	-9.1500
288.000	.000538	-3846.3299	274.9079	-5.1813E-06	13.3553	-9.0072
294.000	.000496	-2359.0120	222.4193	-8.0164E-06	8.1910	-8.4890
300.000	.000442	-1177.2977	173.8074	-9.6320E-06	4.0878	-7.7150
306.000	.000381	-273.3234	130.3023	-1.0295E-05	.9490395	-6.7867
312.000	.000318	386.3295	92.5804	-1.0243E-05	1.3414	-5.7872
318.000	.000258	837.6418	60.8727	-9.6839E-06	2.9085	-4.7820
324.000	.000202	1116.8014	35.0663	-8.7910E-06	3.8778	-3.8201
330.000	.000152	1258.4369	14.7981	-7.7058E-06	4.3696	-2.9359
336.000	.000110	1294.3782	-.4639132	-6.5395E-06	4.4944	-2.1514
342.000	7.40E-05	1252.8699	-11.3514	-5.3758E-06	4.3502	-1.4778
348.000	4.51E-05	1158.1614	-18.5394	-4.2742E-06	4.0214	-.9182100
354.000	2.27E-05	1030.3972	-22.7020	-3.2743E-06	3.5778	-.4693194
360.000	5.85E-06	885.7376	-24.4796	-2.3989E-06	3.0755	-.1232203
366.000	-6.11E-06	736.6420	-24.4563	-1.6577E-06	2.5578	.1309744
372.000	-1.40E-05	592.2615	-23.1459	-1.0506E-06	2.0565	.3058234
378.000	-1.87E-05	458.8906	-20.9850	-5.7032E-07	1.5934	.4144901
384.000	-2.09E-05	340.4414	-18.3318	-2.0513E-07	1.1821	.4699196
390.000	-2.12E-05	238.9093	-15.4693	5.9561E-08	.8295463	.4842400
396.000	-2.02E-05	154.8099	-12.6115	2.3944E-07	.5375342	.4683609
402.000	-1.83E-05	87.5714	-9.9112	3.5018E-07	.3040673	.4317396
408.000	-1.60E-05	35.8755	-7.4691	4.0658E-07	.1245678	.3822847
414.000	-1.34E-05	-2.0581	-5.3432	4.2203E-07	.0071461	.3263647
420.000	-1.09E-05	-28.2425	-3.5574	4.0818E-07	.0980643	.2688958
426.000	-8.53E-06	-44.7468	-2.1103	3.7484E-07	.1553707	.2134818
432.000	-6.41E-06	-53.5656	-.9820534	3.2992E-07	.1859918	.1625864
438.000	-4.57E-06	-56.5314	-.1411364	2.7962E-07	.1962896	.1177192
444.000	-3.05E-06	-55.2593	.4508863	2.2855E-07	.1918725	.0796217
450.000	-1.83E-06	-51.1208	.8350833	1.7994E-07	.1775026	.0484440
456.000	-8.91E-07	-45.2383	1.0521	1.3592E-07	.1570773	.0239048
462.000	-2.00E-07	-38.4952	1.1401	9.7665E-08	.1336639	.0054303
468.000	2.81E-07	-31.5566	1.1332	6.5661E-08	.1095717	-.0077299
474.000	5.88E-07	-24.8964	1.0608	3.9869E-08	.0864457	-.0164091
480.000	7.59E-07	-18.8268	.9472346	1.9893E-08	.0653709	-.0214523
486.000	8.27E-07	-13.5296	.8118838	5.1103E-09	.0469776	-.0236646
492.000	8.20E-07	-9.0842	.6695618	-5.2213E-09	.0315424	-.0237761
498.000	7.64E-07	-5.4948	.5309687	-1.1882E-08	.0190792	-.0224216
504.000	6.78E-07	-2.7126	.4033078	-1.5632E-08	.0094187	-.0201320
510.000	5.77E-07	-.6551207	.2909123	-1.7170E-08	.0022747	-.0173332
516.000	4.72E-07	.7783557	.1958562	-1.7114E-08	.0027026	-.0143522
522.000	3.71E-07	1.6952	.1185183	-1.5984E-08	.0058859	-.0114271
528.000	2.80E-07	2.2006	.0580801	-1.4204E-08	.0076409	-.0087190
534.000	2.01E-07	2.3921	.0129475	-1.2106E-08	.0083060	-.0063252
540.000	1.35E-07	2.3559	-.0189050	-9.9366E-09	.0081804	-.0042923
546.000	8.16E-08	2.1653	-.0396656	-7.8710E-09	.0075182	-.0026279
552.000	4.03E-08	1.8800	-.0514853	-6.0229E-09	.0065276	-.0013120
558.000	9.29E-09	1.5474	-.0563391	-4.4570E-09	.0053730	-.0003059
564.000	-1.32E-08	1.2039	-.0559369	-3.2000E-09	.0041802	.0004400
570.000	-2.91E-08	.8761873	-.0516771	-2.2497E-09	.0030423	.0009799
576.000	-4.02E-08	.5837638	-.0446335	-1.5827E-09	.0020270	.0013679
582.000	-4.81E-08	.3405852	-.0355682	-1.1603E-09	.0011826	.0016538
588.000	-5.41E-08	.1569450	-.0249649	-9.3304E-10	.0005449	.0018806
594.000	-5.93E-08	.0410059	-.0130787	-8.4260E-10	.0001424	.0020815
600.000	-6.42E-08	0.0000	0.0000	-8.2387E-10	0.0000	.0022781

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection	=	.50000000	in
Computed slope at pile head	=	-.00008539	
Maximum bending moment	=	-1451356.	lbs-in
Maximum shear force	=	31661.01553	lbs
Depth of maximum bending moment	=	0.00000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	18	
Number of zero deflection points	=	5	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = 1.000000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-2339330.	45660.3765	0.0000	8122.6741	-184.5343
6.000	.993587	-2069021.	44442.5380	-.0020140	7184.1019	-202.9712
12.000	.975831	-1806020.	43171.5129	-.0037844	6270.9012	-220.7075
18.000	.948174	-1550963.	41796.4630	-.0053182	5385.2889	-237.6424
24.000	.912014	-1304462.	40322.4954	-.0066227	4529.3819	-253.6801
30.000	.868701	-1067093.	38755.2710	-.0077062	3705.1849	-268.7280
36.000	.819539	-839399.	37101.0005	-.0085772	2914.5789	-282.6955
42.000	.765775	-621881.	35366.4343	-.0092448	2159.3099	-295.4932
48.000	.708601	-415002.	33558.8594	-.0097186	1440.9775	-307.0318
54.000	.649152	-219175.	31686.0995	-.0100083	761.0241	-317.2215
60.000	.588501	-34768.3300	29756.5194	-.0101243	120.7234	-325.9719
66.000	.527660	137903.	27779.0295	-.0100772	478.8309	-333.1914
72.000	.467575	298580.	25452.4706	-.0098778	1036.7362	-442.3282
78.000	.409126	443333.	22271.3547	-.0095388	1539.3505	-618.0437
84.000	.353109	565836.	18544.1635	-.0090778	1964.7093	-624.3533
90.000	.300193	665863.	14790.0194	-.0085150	2312.0240	-627.0280
96.000	.250928	743317.	11031.3820	-.0078712	2580.9601	-625.8511
102.000	.205738	798239.	7292.1135	-.0071669	2771.6649	-620.5717
108.000	.164925	830822.	3597.7524	-.0064227	2884.7982	-610.8821
114.000	.128666	841413.	-24.0291	-.0056587	2921.5712	-596.3784
120.000	.097021	830534.	-3542.6152	-.0048948	2883.7970	-576.4836
126.000	.069929	798901.	-6922.9220	-.0041504	2773.9623	-550.2853
132.000	.047216	747458.	-9619.1499	-.0034439	2595.3419	-348.4573
138.000	.028602	683471.	-11328.6626	-.0027901	2373.1643	-221.3803
144.000	.013735	611515.	-12326.5607	-.0021985	2123.3143	-111.2524
150.000	.002220	535553.	-12716.6679	-.0016744	1859.5577	-18.7833
156.000	-.006358	458914.	-12604.7792	-.0012201	1593.4531	56.0796

162.000	-.012421	384295.	-12094.4739	-.0008348	1334.3585	114.0222
168.000	-.016376	313781.	-11283.7169	-.0005159	1089.5167	156.2301
174.000	-.018612	248891.	-10262.2608	-.0002588	864.2036	184.2552
180.000	-.019482	190634.	-9109.8261	-5.8035E-05	661.9225	199.8897
186.000	-.019308	139573.	-7895.0023	9.2827E-05	484.6276	205.0516
192.000	-.018368	95893.6526	-6674.7890	.0002004	332.9641	201.6861
198.000	-.016903	59475.2693	-5494.6835	.0002714	206.5114	191.6824
204.000	-.015112	29957.4507	-4389.2109	.0003122	104.0189	176.8085
210.000	-.013156	6804.7390	-3382.7927	.0003290	23.6276	158.6642
216.000	-.011163	-10636.0623	-2490.8549	.0003273	36.9308	138.6484
222.000	-.009229	-23085.5195	-1721.0804	.0003119	80.1581	117.9430
228.000	-.007421	-31289.0272	-1074.7279	.0002870	108.6425	97.5078
234.000	-.005784	-35982.2543	-547.9448	.0002563	124.9384	78.0866
240.000	-.004345	-37864.3650	-133.0214	.0002226	131.4735	60.2212
246.000	-.003113	-37578.5108	180.4572	.0001881	130.4809	44.2716
252.000	-.002088	-35698.8788	404.5890	.0001546	123.9544	30.4390
258.000	-.001258	-32723.4424	552.2820	.0001234	113.6231	18.7920
264.000	-.000607	-29071.4942	636.5351	9.5133E-05	100.9427	9.2924
270.000	-.000116	-25085.0215	669.8730	7.0390E-05	87.1008	1.8203
276.000	.000237	-21033.0179	663.9275	4.9320E-05	73.0313	-3.8022
282.000	.000476	-17117.8920	629.1499	3.1890E-05	59.4371	-7.7904
288.000	.000620	-13483.2190	574.6415	1.7909E-05	46.8167	-10.3791
294.000	.000691	-10222.1937	508.0809	7.0789E-06	35.4937	-11.8078
300.000	.000705	-7386.2480	435.7316	-9.6591E-07	25.6467	-12.3087
306.000	.000679	-4993.4150	362.5104	-6.6218E-06	17.3382	-12.0984
312.000	.000626	-3036.1238	292.1003	-1.0290E-05	10.5421	-11.3716
318.000	.000555	-1488.2117	227.0919	-1.2357E-05	5.1674	-10.2978
324.000	.000477	-311.0213	169.1403	-1.3179E-05	1.0799	-9.0194
330.000	.000397	541.4722	119.1271	-1.3074E-05	1.8801	-7.6517
336.000	.000320	1118.5034	77.3175	-1.2316E-05	3.8837	-6.2848
342.000	.000249	1469.2819	43.5082	-1.1133E-05	5.1017	-4.9850
348.000	.000187	1640.6015	17.1593	-9.7126E-06	5.6965	-3.7980
354.000	.000133	1675.1933	-2.4907	-8.1977E-06	5.8166	-2.7520
360.000	8.84E-05	1610.7127	-16.3289	-6.6964E-06	5.5928	-1.8607
366.000	5.26E-05	1479.2462	-25.2905	-5.2847E-06	5.1363	-1.1265
372.000	2.49E-05	1307.2264	-30.2993	-4.0117E-06	4.5390	-.5431211
378.000	4.45E-06	1115.6542	-32.2243	-2.9047E-06	3.8738	-.0985260
384.000	-9.92E-06	920.5352	-31.8503	-1.9744E-06	3.1963	.2231976
390.000	-1.92E-05	733.4512	-29.8610	-1.2188E-06	2.5467	.4398978
396.000	-2.45E-05	562.2036	-26.8315	-6.2683E-07	1.9521	.5699404
402.000	-2.68E-05	411.4738	-23.2283	-1.8199E-07	1.4287	.6311209
408.000	-2.67E-05	283.4643	-19.4152	1.3551E-07	.9842512	.6398938
414.000	-2.51E-05	178.4911	-15.6629	3.4657E-07	.6197607	.6108765
420.000	-2.26E-05	95.5094	-12.1605	4.7175E-07	.3316298	.5565829
426.000	-1.95E-05	32.5647	-9.0288	5.3026E-07	.1130717	.4873386
432.000	-1.62E-05	-12.8359	-6.3327	5.3928E-07	.0445690	.4113367
438.000	-1.30E-05	-43.4283	-4.0944	5.1357E-07	.1507926	.3347912
444.000	-1.00E-05	-61.9682	-2.3035	4.6542E-07	.2151674	.2621555
450.000	-7.42E-06	-71.0705	-.9279246	4.0464E-07	.2467727	.1963765
456.000	-5.19E-06	-73.1033	.0786826	3.3877E-07	.2538309	.1391593
462.000	-3.36E-06	-70.1263	.7698435	2.7333E-07	.2434942	.0912277
468.000	-1.91E-06	-63.8652	1.2012	2.1211E-07	.2217541	.0525650
474.000	-8.11E-07	-55.7117	1.4268	1.5748E-07	.1934433	.0226289
480.000	-1.89E-08	-46.7435	1.4963	1.1067E-07	.1623039	.0005341
486.000	5.17E-07	-37.7562	1.4535	7.2067E-08	.1310978	-.0147966
492.000	8.46E-07	-29.3015	1.3356	4.1431E-08	.1017412	-.0245144
498.000	1.01E-06	-21.7293	1.1728	1.8116E-08	.0754489	-.0297557
504.000	1.06E-06	-15.2283	.9887544	1.2312E-09	.0528761	-.0315800
510.000	1.03E-06	-9.8642	.8012241	-1.0233E-08	.0342509	-.0309300
516.000	9.41E-07	-5.6136	.6226034	-1.7304E-08	.0194918	-.0286102
522.000	8.21E-07	-2.3930	.4609347	-2.0962E-08	.0083090	-.0252794
528.000	6.89E-07	-.0824239	.3207341	-2.2093E-08	.0002862	-.0214542
534.000	5.56E-07	1.4558	.2038133	-2.1466E-08	.0050549	-.0175195
540.000	4.31E-07	2.3633	.1100247	-1.9721E-08	.0082060	-.0137434
546.000	3.20E-07	2.7761	.0379095	-1.7373E-08	.0096392	-.0102950
552.000	2.23E-07	2.8182	-.0147612	-1.4817E-08	.0097856	-.0072619
558.000	1.42E-07	2.5990	-.0505515	-1.2342E-08	.0090242	-.0046682
564.000	7.48E-08	2.2116	-.0720277	-1.0144E-08	.0076793	-.0024905
570.000	2.00E-08	1.7346	-.0815176	-8.3412E-09	.0060230	-.0006728
576.000	-2.53E-08	1.2334	-.0809534	-6.9852E-09	.0042827	.0008609
582.000	-6.38E-08	.7631941	-.0717870	-6.0730E-09	.0026500	.0021946
588.000	-9.82E-08	.3719756	-.0549707	-5.5544E-09	.0012916	.0034108
594.000	-1.30E-07	.1035459	-.0309980	-5.3371E-09	.0003595	.0045801
600.000	-1.62E-07	0.0000	0.0000	-5.2898E-09	0.0000	.0057525

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

Pile-head deflection	=	1.00000000	in
Computed slope at pile head	=	-.00012350	
Maximum bending moment	=	-2339330.	lbs-in
Maximum shear force	=	45660.37653	lbs
Depth of maximum bending moment	=	0.00000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	14	
Number of zero deflection points	=	5	

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	332013.	10186.8227
4	y= .500000	M= 0.000	0.0000	.5000000	543350.	14423.3258
4	y= 1.000000	M= 0.000	0.0000	1.0000000	903770.	20715.2970
5	y= .250000	S= 0.000	0.0000	.2500000	-884697.	21737.4381
5	y= .500000	S= 0.000	0.0000	.5000000	-1451356.	31661.0155
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-2339330.	45660.3765

The analysis ended normally.

```
==============================================================================

                 LPILE Plus for Windows, Version 5.0 (5.0.25)

               Analysis of Individual Piles and Drilled Shafts
             Subjected to Lateral Loading Using the p-y Method

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==============================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Katella\
Name of input data file:     Katella Bent 12 inch_3DR1_1.lpd
Name of output file:         Katella Bent 12 inch_3DR1_1.lpo
Name of plot output file:    Katella Bent 12 inch_3DR1_1.lpp
Name of runtime file:        Katella Bent 12 inch_3DR1_1.lpr

------------------------------------------------------------------------------
                           Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  May  8, 2009     Time:  13: 4:50

------------------------------------------------------------------------------
                               Problem Title
------------------------------------------------------------------------------

Katella Ave Bent 2/12-inch Square Concrete Pile/ 3D(0.75) Row 1


------------------------------------------------------------------------------
                               Program Options
------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1


------------------------------------------------------------------------------
                     Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Pile Length                                =     720.00 in
Depth of ground surface below top of pile =    -108.00 in
Slope angle of ground surface              =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
           in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------   -----------   ----------   ----------   -----------
  1       0.0000   12.00000000    1728.0000     144.0000      3800000.
  2     720.0000   12.00000000    1728.0000     144.0000      3800000.


------------------------------------------------------------------------------
                        Soil and Rock Layering Information
------------------------------------------------------------------------------

The soil profile is modelled using  4 layers

Layer  1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =     -108.000 in
Distance from top of pile to bottom of layer =      432.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  2 is stiff clay without free water
Distance from top of pile to top of layer    =      432.000 in
Distance from top of pile to bottom of layer =      480.000 in

Layer  3 is stiff clay without free water
Distance from top of pile to top of layer    =      480.000 in
Distance from top of pile to bottom of layer =      612.000 in

Layer  4 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      612.000 in
Distance from top of pile to bottom of layer =      870.000 in
p-y subgrade modulus k for top of soil layer =      110.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      110.000 lbs/in**3


(Depth of lowest layer extends  150.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-108.00	.06944
2	432.00	.06944
3	432.00	.06366
4	480.00	.06366
5	480.00	.02755
6	612.00	.02755
7	612.00	.03333
8	870.00	.03333

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-108.000	.00000	32.00	------	------
2	432.000	.00000	32.00	------	------
3	432.000	8.33000	.00	.00600	.0
4	480.000	8.33000	.00	.00600	.0
5	480.000	8.33000	.00	.00600	.0
6	612.000	8.33000	.00	.00600	.0
7	612.000	.00000	35.00	------	------
8	870.000	.00000	35.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.7500	1.0000
2	720.000	.7500	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	30080.5228	-.0053852	0.0000	-912.8208
7.200	.211227	192919.	23464.3466	-.0052794	669.8592	-925.0059
14.400	.173976	337887.	16817.8166	-.0049884	1173.2173	-921.2524
21.600	.139394	435096.	10574.7130	-.0045646	1510.7500	-812.9430
28.800	.108246	490162.	5249.2203	-.0040574	1701.9530	-666.3605
36.000	.080968	510685.	961.5109	-.0035086	1773.2110	-524.6699
43.200	.057721	504008.	-2341.1464	-.0029523	1750.0285	-392.7349
50.400	.038454	476972.	-4741.7470	-.0024145	1656.1537	-274.0986
57.600	.022952	435727.	-6344.2393	-.0019141	1512.9412	-171.0381
64.800	.010890	385615.	-7264.8298	-.0014638	1338.9418	-84.6815
72.000	.001873	331114.	-7624.2874	-.0010709	1149.6997	-15.1679
79.200	-.004531	275825.	-7541.4856	-.0007382	957.7274	38.1684
86.400	-.008757	222516.	-7128.3028	-.0004649	772.6254	76.6046
93.600	-.011226	173178.	-6485.8932	-.0002480	601.3122	101.8425
100.800	-.012328	129119.	-5702.2571	-8.2268E-05	448.3307	115.8342
108.000	-.012411	91065.4255	-4850.9794	3.8447E-05	316.1994	120.6318
115.200	-.011774	59265.1509	-3990.9616	.0001209	205.7818	118.2620
122.400	-.010670	33595.5785	-3166.9545	.0001718	116.6513	110.6288
129.600	-.009301	13661.0057	-2410.6909	.0001977	47.4340	99.4444
136.800	-.007824	-1118.3709	-1742.4272	.0002046	3.8832	86.1844
144.000	-.006355	-11429.9455	-1172.7205	.0001977	39.6873	72.0674
151.200	-.004977	-18005.5466	-704.2932	.0001815	62.5193	58.0513
158.400	-.003741	-21571.7676	-333.8620	.0001598	74.9020	44.8463
165.600	-.002675	-22813.1587	-53.8422	.0001355	79.2124	32.9370
172.800	-.001790	-22347.0946	146.1379	.0001108	77.5941	22.6130
180.000	-.001080	-20708.7733	277.9501	8.7147E-05	71.9055	14.0015
187.200	-.000535	-18344.6129	353.9239	6.5736E-05	63.6966	7.1023
194.400	-.000134	-15612.2690	386.0451	4.7119E-05	54.2093	1.8203
201.600	.000144	-12785.5634	385.3822	3.1550E-05	44.3943	-2.0044
208.800	.000321	-10062.7653	361.7146	1.9024E-05	34.9402	-4.5700
216.000	.000418	-7576.8738	323.3324	9.3531E-06	26.3086	-6.0917
223.200	.000455	-5406.7784	276.9760	2.2349E-06	18.7735	-6.7850
230.400	.000450	-3588.4190	227.8807	-2.6967E-06	12.4598	-6.8526
237.600	.000416	-2125.2968	179.8974	-5.8292E-06	7.3795	-6.4761
244.800	.000366	-997.8966	135.6618	-7.5415E-06	3.4649	-5.8115
252.000	.000308	-171.7662	96.7883	-8.1827E-06	.5964104	-4.9867
259.200	.000248	395.8544	64.0701	-8.0599E-06	1.3745	-4.1017
266.400	.000192	750.8431	37.6733	-7.4312E-06	2.6071	-3.2307
273.600	.000141	938.3503	17.3127	-6.5051E-06	3.2582	-2.4250
280.800	9.81E-05	1000.1464	2.4049	-5.4423E-06	3.4727	-1.7161
288.000	6.28E-05	972.9805	-7.8049	-4.3606E-06	3.3784	-1.1199
295.200	3.53E-05	887.7566	-14.1419	-3.3404E-06	3.0825	-.6403443
302.400	1.47E-05	769.3371	-17.4275	-2.4319E-06	2.6713	-.2723208
309.600	2.72E-07	636.8006	-18.4263	-1.6610E-06	2.2111	-.0051202
316.800	-9.17E-06	503.9987	-17.8134	-1.0356E-06	1.7500	.1753557
324.000	-1.46E-05	380.2872	-16.1576	-5.5078E-07	1.3204	.2846018
331.200	-1.71E-05	271.3294	-13.9160	-1.9354E-07	.9421161	.3380537
338.400	-1.74E-05	179.8964	-11.4388	5.3845E-08	.6246402	.3500725
345.600	-1.63E-05	106.6111	-8.9786	2.1092E-07	.3701774	.3333104
352.800	-1.44E-05	50.6046	-6.7045	2.9711E-07	.1757104	.2983842
360.000	-1.21E-05	10.0664	-4.7167	3.3038E-07	.0349526	.2537875
367.200	-9.63E-06	-17.3155	-3.0615	3.2640E-07	.0601234	.2059757
374.400	-7.35E-06	-34.0196	-1.7456	2.9826E-07	.1181238	.1595643
381.600	-5.34E-06	-42.4519	-.7478227	2.5633E-07	.1474026	.1175916
388.800	-3.66E-06	-44.7883	-.0299878	2.0850E-07	.1555149	.0818069
396.000	-2.33E-06	-42.8838	.4551529	1.6044E-07	.1489020	.0529543
403.200	-1.35E-06	-38.2341	.7575025	1.1597E-07	.1327573	.0310317
410.400	-6.65E-07	-31.9757	.9250584	7.7474E-08	.1110269	.0155116
417.600	-2.33E-07	-24.9133	1.0008	4.6285E-08	.0865044	.0055191
424.800	1.56E-09	-17.5647	1.0205	2.2996E-08	.0609884	-3.7479E-05
432.000	9.78E-08	-10.2180	.8942674	7.7646E-09	.0354792	-.0350279
439.200	1.13E-07	-4.6872	.6219906	-4.0709E-10	.0162750	-.0406046
446.400	9.19E-08	-1.2614	.3572719	-3.6684E-09	.0043797	-.0329283
453.600	6.05E-08	.4575034	.1606615	-4.1091E-09	.0015886	-.0216856
460.800	3.28E-08	1.0522	.0403418	-3.2814E-09	.0036534	-.0117365
468.000	1.33E-08	1.0384	-.0190543	-2.1352E-09	.0036056	-.0047624
475.200	2.02E-09	.7777932	-.0388067	-1.1395E-09	.0027007	-.0007244
482.400	-3.11E-09	.4796084	-.0374027	-4.5014E-10	.0016653	.0011144
489.600	-4.46E-09	.2391939	-.0276413	-5.6058E-11	.0008305	.0015971
496.800	-3.92E-09	.0815735	-.0168391	1.1980E-10	.0002832	.0014035
504.000	-2.73E-09	-.0032893	-.0082612	1.6272E-10	1.1421E-05	.0009793
511.200	-1.58E-09	-.0373877	-.0027044	1.4042E-10	.0001298	.0005643
518.400	-7.12E-10	-.0422327	.0002453	9.6768E-11	.0001466	.0002551
525.600	-1.82E-10	-.0338554	.0013984	5.5053E-11	.0001176	6.5235E-05
532.800	8.06E-11	-.0220963	.0015293	2.4378E-11	7.6723E-05	-2.8866E-05
540.000	1.69E-10	-.0118336	.0012076	5.7760E-12	4.1089E-05	-6.0490E-05
547.200	1.64E-10	-.0047068	.0007787	-3.2922E-12	1.6343E-05	-5.8655E-05
554.400	1.21E-10	-.0006206	.0004109	-6.2129E-12	2.1548E-06	-4.3511E-05
561.600	7.43E-11	.0012100	.0001584	-5.8897E-12	4.2013E-06	-2.6613E-05
568.800	3.67E-11	.0016609	1.5337E-05	-4.3158E-12	5.7670E-06	-1.3136E-05
576.000	1.22E-11	.0014308	-4.7634E-05	-2.6208E-12	4.9681E-06	-4.3554E-06
583.200	-1.06E-12	.0009750	-6.1945E-05	-1.3018E-12	3.3853E-06	3.7987E-07
590.400	-6.59E-12	.0005388	-5.2088E-05	-4.7189E-13	1.8708E-06	2.3584E-06
597.600	-7.86E-12	.0002249	-3.3468E-05	-5.3189E-14	7.8092E-07	2.8135E-06
604.800	-7.35E-12	5.6859E-05	-1.3862E-05	1.0129E-13	1.9743E-07	2.6327E-06
612.000	-6.40E-12	2.5295E-05	-3.7290E-06	1.4633E-13	8.7830E-08	1.8191E-07
619.200	-5.24E-12	3.1614E-06	-2.5261E-06	1.6193E-13	1.0977E-08	1.5222E-07
626.400	-4.07E-12	-1.1081E-05	-1.5446E-06	1.5759E-13	3.8476E-08	1.2043E-07
633.600	-2.97E-12	-1.9080E-05	-7.8743E-07	1.4105E-13	6.6251E-08	8.9884E-08
640.800	-2.03E-12	-2.2420E-05	-2.3819E-07	1.1830E-13	7.7847E-08	6.2681E-08
648.000	-1.27E-12	-2.2510E-05	1.3117E-07	9.3666E-14	7.8161E-08	3.9920E-08
655.200	-6.86E-13	-2.0531E-05	3.5387E-07	7.0069E-14	7.1288E-08	2.1939E-08
662.400	-2.62E-13	-1.7415E-05	4.6361E-07	4.9265E-14	6.0467E-08	8.5448E-09
669.600	2.38E-14	-1.3855E-05	4.9153E-07	3.2122E-14	4.8108E-08	-7.8979E-10
676.800	2.00E-13	-1.0337E-05	4.6431E-07	1.8859E-14	3.5891E-08	-6.7691E-09
684.000	2.95E-13	-7.1690E-06	4.0339E-07	9.2613E-15	2.4892E-08	-1.0153E-08
691.200	3.34E-13	-4.5277E-06	3.2483E-07	2.8487E-15	1.5721E-08	-1.1671E-08
698.400	3.36E-13	-2.4914E-06	2.3975E-07	-9.9954E-16	8.6508E-09	-1.1963E-08
705.600	3.19E-13	-1.0753E-06	1.5512E-07	-2.9550E-15	3.7337E-09	-1.1547E-08
712.800	2.94E-13	-2.5775E-07	7.4673E-08	-3.6858E-15	8.9496E-10	-1.0799E-08
720.000	2.66E-13	0.0000	0.0000	-3.8271E-15	0.0000	-9.9440E-09

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.25000000	in
Computed slope at pile head	=	-.00538519	
Maximum bending moment	=	510684.78067	lbs-in
Maximum shear force	=	30080.52281	lbs
Depth of maximum bending moment	=	36.00000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	5	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	53327.9188	-.0105277	0.0000	-1394.5873
7.200	.424200	347813.	42892.5442	-.0103370	1207.6851	-1504.1278
14.400	.351147	617653.	32209.1496	-.0098077	2144.6272	-1463.4818
21.600	.282969	811625.	21904.4555	-.0090241	2818.1426	-1398.9333
28.800	.221199	933077.	12125.2847	-.0080676	3239.8500	-1317.5031
36.000	.166796	986229.	3491.2637	-.0070154	3424.4068	-1080.8361
43.200	.120178	983351.	-3343.4384	-.0059355	3414.4132	-817.6923
50.400	.081324	938084.	-8373.9679	-.0048821	3257.2349	-579.6771
57.600	.049876	862766.	-11798.8290	-.0038948	2995.7148	-371.6733
64.800	.025239	768181.	-13843.3732	-.0030007	2667.2935	-196.2557
72.000	.006666	663421.	-14744.2810	-.0022158	2303.5461	-53.9965
79.200	-.006669	555863.	-14736.4324	-.0015473	1930.0794	56.1766
86.400	-.015615	451217.	-14042.4325	-.0009952	1566.7245	136.6011
93.600	-.020999	353652.	-12864.8457	-.0005539	1227.9578	190.5063
100.800	-.023592	265963.	-11381.0219	-.0002142	923.4822	221.6670
108.000	-.024084	189765.	-9740.2671	3.5628E-05	658.9067	234.0983
115.200	-.023079	125703.	-8063.0285	.0002086	436.4688	231.8014
122.400	-.021081	73657.5142	-6441.7143	.0003179	255.7553	218.5637
129.600	-.018501	32942.3419	-4942.7551	.0003763	114.3831	197.8139
136.800	-.015662	2481.8406	-3609.5259	.0003957	8.6175	172.5276
144.000	-.012802	-19034.8305	-2465.7818	.0003867	66.0932	145.1791
151.200	-.010094	-33025.4177	-1519.3068	.0003581	114.6716	117.7307
158.400	-.007645	-40912.8479	-765.5276	.0003176	142.0585	91.6525
165.600	-.005520	-44049.0147	-190.9062	.0002710	152.9480	67.9646
172.800	-.003743	-43661.8970	224.0242	.0002229	151.6038	47.2939
180.000	-.002310	-40823.0660	502.0613	.0001766	141.7468	29.9387
187.200	-.001200	-36432.2148	667.2113	.0001343	126.5007	15.9363
194.400	-.000377	-31215.2236	743.0445	9.7163E-05	108.3862	5.1284
201.600	.000199	-25732.3739	751.5015	6.5942E-05	89.3485	-2.7793
208.800	.000573	-20393.6022	712.1043	4.0654E-05	70.8111	-8.1644
216.000	.000785	-15478.0718	641.5145	2.0987E-05	53.7433	-11.4439
223.200	.000875	-11155.7931	553.3735	6.3854E-06	38.7354	-13.0397
230.400	.000877	-7509.4941	458.3606	-3.8477E-06	26.0746	-13.3527
237.600	.000820	-4555.4006	364.4088	-1.0462E-05	15.8174	-12.7450
244.800	.000726	-2262.0070	277.0221	-1.4200E-05	7.8542	-11.5291
252.000	.000615	-566.2822	199.6488	-1.5750E-05	1.9663	-9.9635
259.200	.000499	612.9362	134.0734	-1.5725E-05	2.1283	-8.2519
266.400	.000389	1364.3748	80.7974	-1.4641E-05	4.7374	-6.5470
273.600	.000289	1776.4183	39.3896	-1.2919E-05	6.1681	-4.9552
280.800	.000203	1931.5849	8.7927	-1.0886E-05	6.7069	-3.5440
288.000	.000132	1903.0330	-12.4210	-8.7837E-06	6.6078	-2.3487
295.200	7.61E-05	1752.7226	-25.8454	-6.7795E-06	6.0858	-1.3803
302.400	3.42E-05	1530.8596	-33.0867	-4.9793E-06	5.3155	-.6312174
309.600	4.37E-06	1276.2743	-35.6548	-3.4403E-06	4.4315	-.0821439
316.800	-1.54E-05	1017.4307	-34.8934	-2.1827E-06	3.5327	.2936351
324.000	-2.71E-05	773.8091	-31.9425	-1.2007E-06	2.6868	.5260515
331.200	-3.27E-05	557.4580	-27.7256	-4.7084E-07	1.9356	.6453106
338.400	-3.38E-05	374.5598	-22.9553	4.0134E-08	1.3006	.6797853
345.600	-3.21E-05	226.9017	-18.1513	3.6988E-07	.7878533	.6546716
352.800	-2.85E-05	113.1818	-13.6659	5.5633E-07	.3929924	.5912675
360.000	-2.41E-05	30.1132	-9.7130	6.3489E-07	.1045597	.5067394
367.200	-1.94E-05	-26.6861	-6.3975	6.3677E-07	.0926599	.4142424
374.400	-1.49E-05	-62.0110	-3.7424	5.8814E-07	.2153159	.3232796
381.600	-1.09E-05	-80.5771	-1.7139	5.0997E-07	.2797816	.2402002
388.800	-7.55E-06	-86.6912	-.2416612	4.1827E-07	.3010112	.1687567
396.000	-4.88E-06	-84.0570	.7642475	3.2465E-07	.2918646	.1106624
403.200	-2.87E-06	-75.6861	1.4006	2.3708E-07	.2627988	.0661039
410.400	-1.47E-06	-63.8883	1.7616	1.6056E-07	.2218343	.0341848
417.600	-5.62E-07	-50.3184	1.9325	9.7942E-08	.1747166	.0132828
424.800	-5.50E-08	-36.0599	1.9851	5.0585E-08	.1252079	.0013195
432.000	1.67E-07	-21.7330	1.7747	1.8901E-08	.0754617	-.0597521
439.200	2.17E-07	-10.5036	1.2797	1.2270E-09	.0364709	-.0777656
446.400	1.85E-07	-3.3056	.7618306	-6.3438E-09	.0114779	-.0660803
453.600	1.26E-07	.4667429	.3617670	-7.9002E-09	.0016206	-.0450484
460.800	7.07E-08	1.9038	.1083822	-6.6006E-09	.0066105	-.0253362
468.000	3.07E-08	2.0274	-.0224535	-4.4453E-09	.0070397	-.0110070
475.200	6.73E-09	1.5805	-.0707562	-2.4673E-09	.0054878	-.0024104
482.400	-4.80E-09	1.0086	-.0732507	-1.0478E-09	.0035019	.0017175
489.600	-8.36E-09	.5256694	-.0562907	-2.0670E-10	.0018252	.0029937
496.800	-7.77E-09	.1979719	-.0354929	1.9003E-10	.0006874	.0027835
504.000	-5.62E-09	.0145717	-.0182233	3.0656E-10	5.0596E-05	.0020136
511.200	-3.36E-09	-.0644430	-.0066452	2.7921E-10	.0002238	.0012025
518.400	-1.60E-09	-.0811198	-.0002512	1.9941E-10	.0002817	.0005736
525.600	-4.86E-10	-.0680604	.0024405	1.1762E-10	.0002363	.0001741
532.800	9.21E-11	-.0459762	.0029485	5.5102E-11	.0001596	-3.2999E-05
540.000	3.07E-10	-.0256027	.0024333	1.5859E-11	8.8898E-05	-.0001101
547.200	3.21E-10	-.0109361	.0016238	-4.1733E-12	3.7973E-05	-.0001148
554.400	2.47E-10	-.0022202	.0008917	-1.1386E-11	7.7090E-06	-8.8565E-05
561.600	1.57E-10	.0019045	.0003710	-1.1559E-11	6.6129E-06	-5.6065E-05
568.800	8.08E-11	.0031228	6.4982E-05	-8.8031E-12	1.0843E-05	-2.8950E-05
576.000	2.98E-11	.0028403	-7.7633E-05	-5.5339E-12	9.8620E-06	-1.0665E-05
583.200	1.15E-12	.0020049	-.0001175	-2.8776E-12	6.9613E-06	-4.1032E-07
590.400	-1.17E-11	.0011482	-.0001039	-1.1489E-12	3.9868E-06	4.1756E-06
597.600	-1.54E-11	.0005080	-6.9063E-05	-2.4093E-13	1.7639E-06	5.5151E-06
604.800	-1.51E-11	.0001537	-2.9703E-05	1.2183E-13	5.3365E-07	5.4182E-06
612.000	-1.36E-11	8.0271E-05	-8.8005E-06	2.5010E-13	2.7872E-07	3.8798E-07
619.200	-1.15E-11	2.6964E-05	-6.1992E-06	3.0889E-13	9.3624E-08	3.3461E-07
626.400	-9.20E-12	-8.9976E-06	-4.0139E-06	3.1874E-13	3.1242E-08	2.7242E-07
633.600	-6.94E-12	-3.0836E-05	-2.2786E-06	2.9690E-13	1.0707E-07	2.0961E-07

640.800	-4.92E-12	-4.1809E-05	-9.7811E-07	2.5708E-13	1.4517E-07	1.5162E-07
648.000	-3.24E-12	-4.4921E-05	-6.6510E-08	2.0953E-13	1.5598E-07	1.0160E-07
655.200	-1.90E-12	-4.2767E-05	5.1857E-07	1.6145E-13	1.4850E-07	6.0922E-08
662.400	-9.10E-13	-3.7454E-05	8.4469E-07	1.1747E-13	1.3005E-07	2.9668E-08
669.600	-2.12E-13	-3.0603E-05	9.7686E-07	8.0160E-14	1.0626E-07	7.0458E-09
676.800	2.44E-13	-2.3387E-05	9.7255E-07	5.0560E-14	8.1205E-08	-8.2439E-09
684.000	5.16E-13	-1.6598E-05	8.7904E-07	2.8638E-14	5.7633E-08	-1.7729E-08
691.200	6.56E-13	-1.0729E-05	7.3258E-07	1.3656E-14	3.7253E-08	-2.2955E-08
698.400	7.12E-13	-6.0492E-06	5.5874E-07	4.4578E-15	2.1004E-08	-2.5335E-08
705.600	7.21E-13	-2.6829E-06	3.7374E-07	-3.2955E-16	9.3156E-09	-2.6055E-08
712.800	7.08E-13	-6.6735E-07	1.8631E-07	-2.1663E-15	2.3172E-09	-2.6007E-08
720.000	6.89E-13	0.0000	0.0000	-2.5322E-15	0.0000	-2.5746E-08

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

Pile-head deflection	=	.50000000	in
Computed slope at pile head	=	-.01052772	
Maximum bending moment	=	986229.16545	lbs-in
Maximum shear force	=	53327.91880	lbs
Depth of maximum bending moment	=	36.00000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	5	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	80097.8671	-.0199326	0.0000	-1394.5873
7.200	.856485	540557.	69409.9352	-.0196363	1876.9338	-1574.2826
14.400	.717238	999503.	57389.1710	-.0187919	3470.4968	-1764.8186
21.600	.585881	1366961.	43957.5206	-.0174945	4746.3924	-1966.1954
28.800	.465317	1632491.	29036.9293	-.0158501	5668.3728	-2178.4133
36.000	.357640	1785093.	13928.5545	-.0139764	6198.2388	-2018.3575
43.200	.264056	1833063.	222.2500	-.0119928	6364.8005	-1788.9493
50.400	.184944	1788293.	-10963.7840	-.0100074	6209.3513	-1318.2823
57.600	.119950	1675184.	-18927.5261	-.0081085	5816.6113	-893.8682
64.800	.068181	1515737.	-24054.0878	-.0063591	5262.9750	-530.1767
72.000	.028379	1328805.	-26790.2421	-.0047996	4613.9069	-229.8662
79.200	-.000934	1129957.	-27589.4506	-.0034516	3923.4629	7.8638
86.400	-.021325	931517.	-26889.5620	-.0023214	3234.4344	186.5497
93.600	-.034362	742748.	-25095.7450	-.0014035	2578.9848	311.7328
100.800	-.041536	570138.	-22568.5424	-.0006837	1979.6471	390.2679
108.000	-.044208	417761.	-19616.6554	-.0001421	1450.5577	429.7007
115.200	-.043582	287659.	-16493.8721	.0002446	998.8144	437.7391
122.400	-.040685	180249.	-13399.4370	.0005011	625.8641	421.8263
129.600	-.036366	94706.6486	-10481.1050	.0006519	328.8425	388.8215
136.800	-.031298	29320.9461	-7840.1358	.0007199	101.8088	344.7810
144.000	-.025999	-18191.3072	-5537.5293	.0007260	63.1643	294.8319
151.200	-.020844	-50419.4753	-3600.8875	.0006884	175.0676	243.1242
158.400	-.016087	-70044.0869	-2031.3891	.0006223	243.2086	192.8476
165.600	-.011882	-79671.4789	-810.4699	.0005402	276.6371	146.2966
172.800	-.008307	-81714.8537	94.0868	.0004518	283.7321	104.9691
180.000	-.005377	-78316.6286	722.8438	.0003640	271.9327	69.6856
187.200	-.003065	-71305.9033	1120.2917	.0002820	247.5899	40.7166
194.400	-.001316	-62184.4287	1331.3477	.0002088	215.9182	17.9101
201.600	-5.81E-05	-52134.4969	1398.7392	.0001461	181.0226	.8098145
208.800	.000788	-42042.5843	1361.1977	9.4510E-05	145.9812	-11.2380
216.000	.001303	-32533.2506	1252.3587	5.3624E-05	112.9627	-18.9950
223.200	.001560	-24008.6187	1100.2498	2.2625E-05	83.3633	-23.2575
230.400	.001629	-16689.6532	927.2411	3.1233E-07	57.9502	-24.8005
237.600	.001565	-10656.3466	750.3403	-1.4680E-05	37.0012	-24.3386
244.800	.001417	-5884.7527	581.7221	-2.3749E-05	20.4332	-22.4998
252.000	.001223	-2279.5486	429.3973	-2.8225E-05	7.9151	-19.8126
259.200	.001011	298.5684	297.9438	-2.9311E-05	1.0367	-16.7022
266.400	.000801	2010.8415	189.2372	-2.8045E-05	6.9821	-13.4940
273.600	.000607	3023.5835	103.1378	-2.5284E-05	10.4986	-10.4225
280.800	.000437	3496.0252	38.1028	-2.1710E-05	12.1390	-7.6428
288.000	.000294	3572.2634	-8.2925	-1.7835E-05	12.4037	-5.2448
295.200	.000180	3376.6126	-38.9316	-1.4025E-05	11.7243	-3.2661
302.400	9.24E-05	3011.6482	-56.8297	-1.0523E-05	10.4571	-1.7056
309.600	2.85E-05	2558.2642	-64.8966	-7.4692E-06	8.8829	-.5351714
316.800	-1.52E-05	2077.1370	-65.7771	-4.9279E-06	7.2123	.2905914
324.000	-4.25E-05	1611.0740	-61.7578	-2.9059E-06	5.5940	.8258730
331.200	-5.70E-05	1187.8243	-54.7258	-1.3714E-06	4.1244	1.1275
338.400	-6.22E-05	823.0218	-46.1667	-2.6894E-07	2.8577	1.2501
345.600	-6.09E-05	523.0243	-37.1898	4.6902E-07	1.8161	1.2435
352.800	-5.55E-05	287.4884	-28.5720	9.1338E-07	.9982236	1.1504
360.000	-4.78E-05	111.5878	-20.8092	1.1322E-06	.3874576	1.0059
367.200	-3.92E-05	-12.1644	-14.1721	1.1867E-06	.0422374	.8376915
374.400	-3.07E-05	-92.4906	-8.7590	1.1293E-06	.3211480	.6659503
381.600	-2.29E-05	-138.2940	-4.5443	1.0028E-06	.4801875	.5047912
388.800	-1.62E-05	-157.9290	-1.4203	8.4038E-07	.5483646	.3630079
396.000	-1.08E-05	-158.7457	.7692116	6.6676E-07	.5512003	.2451774
403.200	-6.64E-06	-146.8524	2.2014	4.9922E-07	.5099040	.1526599
410.400	-3.62E-06	-127.0452	3.0551	3.4906E-07	.4411290	.0844831
417.600	-1.61E-06	-102.8583	3.4964	2.2301E-07	.3571470	.0380755
424.800	-4.10E-07	-76.6977	3.6688	1.2457E-07	.2663114	.0098338
432.000	1.84E-07	-50.0273	3.4670	5.5095E-08	.1737058	-.0659039
439.200	3.83E-07	-26.7733	2.7356	1.2990E-08	.0929628	-.1372509
446.400	3.71E-07	-10.6344	1.7631	-7.5187E-09	.0369250	-.1328969
453.600	2.75E-07	-1.3849	.9301465	-1.4108E-08	.0048087	-.0984743
460.800	1.68E-07	2.7597	.3591498	-1.3355E-08	.0095823	-.0601359
468.000	8.26E-08	3.7869	.0360986	-9.7654E-09	.0131488	-.0296005
475.200	2.73E-08	3.2795	-.1056440	-5.8913E-09	.0113872	-.0097724
482.400	-2.19E-09	2.2656	-.1380063	-2.8512E-09	.0078666	.0007829
489.600	-1.38E-08	1.2922	-.1174314	-9.0068E-10	.0044869	.0049323
496.800	-1.52E-08	.5745707	-.0801341	1.2279E-10	.0019950	.0054280
504.000	-1.20E-08	.1382989	-.0451166	5.1361E-10	.0004802	.0042991
511.200	-7.76E-09	-.0751079	-.0196349	5.4826E-10	.0002608	.0027791
518.400	-4.11E-09	-.1444441	-.0043324	4.2789E-10	.0005015	.0014716
525.600	-1.60E-09	-.1374950	.0030257	2.7332E-10	.0004774	.0005724

532.800	-1.73E-10	-.1008738	.0053094	1.4263E-10	.0003503	6.1970E-05
540.000	4.56E-10	-.0610400	.0049449	5.3863E-11	.0002119	-.0001632
547.200	6.03E-10	-.0296676	.0035803	4.1333E-12	.0001030	-.0002158
554.400	5.15E-10	-.0094833	.0021390	-1.7331E-11	3.2928E-05	-.0001845
561.600	3.53E-10	.0011346	.0010195	-2.1908E-11	3.9395E-06	-.0001264
568.800	2.00E-10	.0051979	.0003068	-1.8436E-11	1.8048E-05	-7.1549E-05
576.000	8.76E-11	.0055521	-6.3690E-05	-1.2543E-11	1.9278E-05	-3.1356E-05
583.200	1.92E-11	.0042807	-.0002013	-7.1520E-12	1.4864E-05	-6.8617E-06
590.400	-1.54E-11	.0026537	-.0002061	-3.3503E-12	9.2143E-06	5.5291E-06
597.600	-2.91E-11	.0013133	-.0001487	-1.1754E-12	4.5601E-06	1.0417E-05
604.800	-3.24E-11	.0005129	-6.9441E-05	-1.7416E-13	1.7809E-06	1.1591E-05
612.000	-3.16E-11	.0003133	-2.4480E-05	2.7881E-13	1.0880E-06	8.9833E-07
619.200	-2.83E-11	.0001604	-1.8284E-05	5.3853E-13	5.5685E-07	8.2291E-07
626.400	-2.38E-11	5.0060E-05	-1.2779E-05	6.5390E-13	1.7382E-07	7.0614E-07
633.600	-1.89E-11	-2.3646E-05	-8.1775E-06	6.6838E-13	8.2103E-08	5.7207E-07
640.800	-1.42E-11	-6.7696E-05	-4.5416E-06	6.1830E-13	2.3506E-07	4.3792E-07
648.000	-1.00E-11	-8.9045E-05	-1.8313E-06	5.3237E-13	3.0918E-07	3.1495E-07
655.200	-6.55E-12	-9.4066E-05	5.6737E-08	4.3198E-13	3.2662E-07	2.0950E-07
662.400	-3.81E-12	-8.8228E-05	1.2578E-06	3.3204E-13	3.0635E-07	1.2412E-07
669.600	-1.77E-12	-7.5955E-05	1.9155E-06	2.4203E-13	2.6373E-07	5.8600E-08
676.800	-3.23E-13	-6.0644E-05	2.1658E-06	1.6714E-13	2.1057E-07	1.0911E-08
684.000	6.41E-13	-4.4767E-05	2.1257E-06	1.0934E-13	1.5544E-07	-2.2034E-08
691.200	1.25E-12	-3.0033E-05	1.8889E-06	6.8336E-14	1.0428E-07	-4.3766E-08
698.400	1.63E-12	-1.7568E-05	1.5233E-06	4.2239E-14	6.0999E-08	-5.7791E-08
705.600	1.86E-12	-8.0983E-06	1.0731E-06	2.8167E-14	2.8119E-08	-6.7245E-08
712.800	2.03E-12	-2.1148E-06	5.6238E-07	2.2568E-14	7.3431E-09	-7.4628E-08
720.000	2.18E-12	0.0000	0.0000	2.1409E-14	0.0000	-8.1590E-08

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

Pile-head deflection	=	1.00000000	in
Computed slope at pile head	=	-.01993262	
Maximum bending moment	=	1833063.	lbs-in
Maximum shear force	=	80097.86708	lbs
Depth of maximum bending moment	=	43.20000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	7	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	-1566446.	62981.8195	0.0000	5439.0481	-912.8208
7.200	.243817	-1139250.	55683.6589	-.0014834	3955.7289	-1013.6252
14.400	.228639	-764600.	48110.5303	-.0025272	2654.8622	-1090.0382
21.600	.207426	-446458.	40073.8526	-.0031911	1550.2024	-1142.3723
28.800	.182687	-187537.	31912.6738	-.0035387	651.1696	-1124.6218
36.000	.156468	13084.2202	24213.9465	-.0036343	45.4313	-1013.9136
43.200	.130352	161144.	17370.9519	-.0035388	559.5278	-886.9183
50.400	.105509	263226.	11470.6007	-.0033062	913.9789	-752.0682
57.600	.082744	326321.	6543.3753	-.0029830	1133.0578	-616.6055
64.800	.062554	357451.	2572.4706	-.0026081	1241.1477	-486.4236
72.000	.045187	363364.	-496.3156	-.0022129	1261.6813	-366.0170
79.200	.030689	350304.	-2744.6570	-.0018216	1216.3319	-258.5222
86.400	.018956	323841.	-4272.3085	-.0014520	1124.4485	-165.8254
93.600	.009779	288782.	-5188.6705	-.0011162	1002.7165	-88.7195
100.800	.002883	249124.	-5605.5810	-.0008213	865.0150	-27.0890
108.000	-.002047	208062.	-5631.4846	-.0005706	722.4374	19.8935
115.200	-.005334	168031.	-5367.0078	-.0003644	583.4407	53.5722
122.400	-.007294	130777.	-4901.8900	-.0002006	454.0870	75.6272
129.600	-.008222	97443.7143	-4313.1431	-7.5478E-05	338.3462	87.9136
136.800	-.008381	68667.8052	-3664.2771	1.5592E-05	238.4299	92.3269
144.000	-.007998	44678.1234	-3005.3963	7.7734E-05	155.1324	90.6955
151.200	-.007262	25390.0983	-2373.9665	.0001161	88.1601	84.7016
158.400	-.006325	10493.0052	-1796.0607	.0001358	36.4340	75.8278
165.600	-.005306	-473.1764	-1287.9030	.0001413	1.6430	65.3272
172.800	-.004290	-8052.7984	-857.5577	.0001366	27.9611	54.2132
180.000	-.003338	-12822.0075	-506.6358	.0001252	44.5209	43.2651
187.200	-.002488	-15348.3543	-231.9204	.0001098	53.2929	33.0448
194.400	-.001758	-16161.6609	-26.8401	9.2476E-05	56.1169	23.9220
201.600	-.001156	-15734.8511	117.2538	7.4989E-05	54.6349	16.1041
208.800	-.000678	-14473.2068	210.0293	5.8428E-05	50.2542	9.6669
216.000	-.000315	-12710.4294	261.3402	4.3524E-05	44.1334	4.5861
223.200	-5.13E-05	-10709.9083	280.6051	3.0684E-05	37.1872	.7652552
230.400	.000127	-8669.7164	276.3811	2.0059E-05	30.1032	-1.9386
237.600	.000238	-6730.0211	256.1047	1.1617E-05	23.3681	-3.6937
244.800	.000295	-4981.8094	225.9707	5.1956E-06	17.2979	-4.6768
252.000	.000312	-3476.0424	190.9195	5.5858E-07	12.0696	-5.0597
259.200	.000303	-2232.5688	154.7026	-2.5711E-06	7.7520	-5.0006
266.400	.000275	-1248.3257	120.0027	-4.4795E-06	4.3345	-4.6383
273.600	.000238	-504.5306	88.5844	-5.4405E-06	1.7518	-4.0890
280.800	.000197	27.2903	61.4585	-5.7022E-06	.0947579	-3.4460
288.000	.000156	380.4721	39.0447	-5.4786E-06	1.3211	-2.7801
295.200	.000118	589.5340	21.3245	-4.9468E-06	2.0470	-2.1422
302.400	8.48E-05	687.5452	7.9764	-4.2467E-06	2.3873	-1.5656
309.600	5.69E-05	704.3939	-1.5102	-3.4835E-06	2.4458	-1.0695
316.800	3.46E-05	665.7985	-7.7424	-2.7323E-06	2.3118	-.6616582
324.000	1.76E-05	592.9027	-11.3539	-2.0423E-06	2.0587	-.3415256
331.200	5.20E-06	502.3023	-12.9537	-1.4418E-06	1.7441	-.1028596
338.400	-3.19E-06	406.3696	-13.0930	-9.4363E-07	1.4110	.0641582
345.600	-8.38E-06	313.7629	-12.2460	-5.4882E-07	1.0895	.1711328
352.800	-1.11E-05	230.0277	-10.8015	-2.5069E-07	.7987074	.2301058
360.000	-1.20E-05	158.2212	-9.0638	-3.7837E-08	.5493792	.2525917
367.200	-1.16E-05	99.5091	-7.2583	1.0346E-07	.3455176	.2489479
374.400	-1.05E-05	53.7024	-5.5412	1.8746E-07	.1864666	.2280220
381.600	-8.94E-06	19.7163	-4.0110	2.2771E-07	.0684595	.1970181
388.800	-7.23E-06	-4.0563	-2.7203	2.3630E-07	.0140842	.1615224
396.000	-5.54E-06	-19.4556	-1.6865	2.2341E-07	.0675540	.1256401
403.200	-4.01E-06	-28.3417	-.9022644	1.9720E-07	.0984085	.0921991
410.400	-2.70E-06	-32.4482	-.3436010	1.6387E-07	.1126672	.0629852
417.600	-1.65E-06	-33.2895	.0234828	1.2783E-07	.1155886	.0389826

424.800	-8.59E-07	-32.1100	.2379785	9.1979E-08	.1114931	.0205996
432.000	-3.24E-07	-29.8626	.7294655	5.8003E-08	.1036897	.1159246
439.200	-2.39E-08	-21.6057	1.1777	2.9785E-08	.0750198	.0085735
446.400	1.05E-07	-12.9043	1.0728	1.0865E-08	.0448067	-.0376877
453.600	1.33E-07	-6.1567	.7663077	4.1515E-10	.0213774	-.0474622
460.800	1.11E-07	-1.8695	.4520600	-3.9852E-09	.0064913	-.0398288
468.000	7.51E-08	.3529642	.2118027	-4.8166E-09	.0012256	-.0269093
475.200	4.18E-08	1.1805	.0609726	-3.9759E-09	.0040988	-.0149879
482.400	1.79E-08	1.2310	-.0160388	-2.6539E-09	.0042742	-.0064042
489.600	3.63E-09	.9494942	-.0437773	-1.4584E-09	.0032969	-.0013010
496.800	-3.12E-09	.6005762	-.0444377	-6.0863E-10	.0020853	.0011175
504.000	-5.13E-09	.3095915	-.0337980	-1.0963E-10	.0010750	.0018379
511.200	-4.70E-09	.1138852	-.0211228	1.2253E-10	.0003954	.0016830
518.400	-3.37E-09	.0054236	-.0107226	1.8794E-10	1.8832E-05	.0012060
525.600	-1.99E-09	-.0405198	-.0038118	1.6870E-10	.0001407	.0007137
532.800	-9.38E-10	-.0494665	-3.3269E-05	1.1937E-10	.0001718	.0003359
540.000	-2.74E-10	-.0409988	.0015290	6.9772E-11	.0001424	9.8046E-05
547.200	6.68E-11	-.0274485	.0017959	3.2246E-11	9.5307E-05	-2.3910E-05
554.400	1.91E-10	-.0151377	.0014641	8.8980E-12	5.2561E-05	-6.8256E-05
561.600	1.95E-10	-.0063652	.0009671	-2.8908E-12	2.2101E-05	-6.9800E-05
568.800	1.49E-10	-.0012112	.0005238	-7.0445E-12	4.2054E-06	-5.3347E-05
576.000	9.35E-11	.0011774	.0002113	-7.0631E-12	4.0881E-06	-3.3469E-05
583.200	4.72E-11	.0018309	2.9850E-05	-5.4138E-12	6.3571E-06	-1.6920E-05
590.400	1.55E-11	.0016072	-5.1037E-05	-3.5289E-12	5.5805E-06	-5.5482E-06
597.600	-3.57E-12	.0010959	-6.6404E-05	-2.0470E-12	3.8053E-06	1.2796E-06
604.800	-1.40E-11	.0006510	-4.3766E-05	-1.0892E-12	2.2603E-06	5.0087E-06
612.000	-1.93E-11	.0004657	-2.3763E-05	-4.7703E-13	1.6170E-06	5.4759E-07
619.200	-2.09E-11	.0003088	-1.9613E-05	-5.2424E-14	1.0722E-06	6.0537E-07
626.400	-2.00E-11	.0001833	-1.5299E-05	2.1734E-13	6.3634E-07	5.9283E-07
633.600	-1.77E-11	8.8478E-05	-1.1237E-05	3.6632E-13	3.0721E-07	5.3557E-07
640.800	-1.47E-11	2.1454E-05	-7.6742E-06	4.2659E-13	7.4492E-08	4.5408E-07
648.000	-1.16E-11	-2.2031E-05	-4.7302E-06	4.2628E-13	7.6498E-08	3.6371E-07
655.200	-8.60E-12	-4.6661E-05	-2.4302E-06	3.8862E-13	1.6202E-07	2.7516E-07
662.400	-5.99E-12	-5.7027E-05	-7.3737E-07	3.3177E-13	1.9801E-07	1.9508E-07
669.600	-3.82E-12	-5.7279E-05	4.2151E-07	2.6910E-13	1.9889E-07	1.2683E-07
676.800	-2.11E-12	-5.0957E-05	1.1347E-06	2.0976E-13	1.7693E-07	7.1288E-08
684.000	-8.01E-13	-4.0939E-05	1.4905E-06	1.5938E-13	1.4215E-07	2.7541E-08
691.200	1.85E-13	-2.9493E-05	1.5664E-06	1.2077E-13	1.0241E-07	-6.4604E-09
698.400	9.38E-13	-1.8383E-05	1.4231E-06	9.4518E-14	6.3829E-08	-3.3352E-08
705.600	1.55E-12	-9.0009E-06	1.1018E-06	7.9505E-14	3.1253E-08	-5.5891E-08
712.800	2.08E-12	-2.5165E-06	6.2506E-07	7.3191E-14	8.7378E-09	-7.6541E-08
720.000	2.60E-12	0.0000	0.0000	7.1811E-14	0.0000	-9.7087E-08

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

Pile-head deflection	=	.25000000 in
Computed slope at pile head	=	-.00023421
Maximum bending moment	=	-1566446. lbs-in
Maximum shear force	=	62981.81946 lbs
Depth of maximum bending moment	=	0.00000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	5
Number of zero deflection points	=	8

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .500000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-2980724.	112632.	0.0000	10349.7360	-1394.5873
7.200	.488234	-2210581.	101297.	-.0028461	7675.6281	-1574.2824
14.400	.459016	-1522049.	89276.1361	-.0048925	5284.8910	-1764.8189
21.600	.417782	-925005.	76238.3978	-.0062341	3211.8213	-1856.7750
28.800	.369245	-424216.	62805.6205	-.0069738	1472.9711	-1874.5520
36.000	.317359	-20603.5885	49392.6466	-.0072177	71.5402	-1851.2741
43.200	.265311	287038.	36267.2824	-.0070716	996.6613	-1794.6604
50.400	.215528	501645.	24275.8794	-.0066392	1741.8239	-1536.2849
57.600	.169706	636611.	14192.5142	-.0060152	2210.4552	-1264.6498
64.800	.128910	706017.	6031.1230	-.0052791	2451.4496	-1002.4033
72.000	.093687	723459.	-309.4560	-.0044954	2512.0114	-758.8687
79.200	.064177	701561.	-4987.6292	-.0037141	2435.9768	-540.6239
86.400	.040204	651637.	-8200.0240	-.0029722	2262.6299	-351.7080
93.600	.021377	583481.	-10164.3178	-.0022951	2025.9756	-193.9291
100.800	.007155	505271.	-11104.4976	-.0016982	1754.4140	-67.2319
108.000	-.003077	423576.	-11238.8643	-.0011889	1470.7507	29.9078
115.200	-.009965	343432.	-10770.8696	-.0007684	1192.4708	100.0907
122.400	-.014142	268476.	-9882.6878	-.0004329	932.2072	146.6264
129.600	-.016200	201121.	-8731.2886	-.0001755	698.3364	173.2067
136.800	-.016669	142745.	-7446.6802	1.3031E-05	495.6428	183.6290
144.000	-.016012	93888.6912	-6131.9417	.0001428	326.0024	181.5762
151.200	-.014613	54445.1647	-4864.6413	.0002241	189.0457	170.4517
158.400	-.012785	23837.8568	-3699.2491	.0002670	82.7703	153.2683
165.600	-.010769	1175.9776	-2670.1843	.0002807	4.0833	132.5830
172.800	-.008743	-14612.7972	-1795.1799	.0002734	50.7389	110.4737
180.000	-.006832	-24674.6131	-1078.7058	.0002518	85.6757	88.5468
187.200	-.005117	-30146.1610	-515.2464	.0002218	104.6742	67.9697
194.400	-.003639	-32094.1613	-92.2858	.0001876	111.4381	49.5194
201.600	-.002415	-31475.0758	207.0940	.0001528	109.2885	33.6416
208.800	-.001439	-29112.0083	402.0504	.0001196	101.0834	20.5130
216.000	-.000693	-25685.5494	512.2675	8.9525E-05	89.1859	10.1029
223.200	-.000150	-21735.3561	556.6721	6.3527E-05	75.4700	2.2317
230.400	.000222	-17669.4712	552.5439	4.1923E-05	61.3523	-3.3784
237.600	.000454	-13778.7243	514.9658	2.4682E-05	47.8428	-7.0599
244.800	.000577	-10253.9639	456.5567	1.1506E-05	35.6040	-9.1648
252.000	.000620	-7204.3085	387.4256	1.9347E-06	25.0150	-10.0382
259.200	.000605	-4675.0349	315.2907	-4.5781E-06	16.2328	-9.9993
266.400	.000554	-2664.1226	245.7088	-8.6018E-06	9.2504	-9.3291
273.600	.000481	-1136.8283	182.3725	-1.0686E-05	3.9473	-8.2644
280.800	.000400	-37.9585	127.4363	-1.1330E-05	.1318003	-6.9957
288.000	.000318	698.2546	81.8437	-1.0968E-05	2.4245	-5.6689
295.200	.000242	1140.5907	45.6344	-9.9596E-06	3.9604	-4.3892
302.400	.000175	1355.3896	18.2180	-8.5912E-06	4.7062	-3.2264
309.600	.000118	1402.9305	-1.3933	-7.0789E-06	4.8713	-2.2212

316.800	7.28E-05	1335.3262	-14.3971	-5.5777E-06	4.6365	-1.3910
324.000	3.79E-05	1195.6117	-22.0557	-4.1901E-06	4.1514	-.7363622
331.200	1.24E-05	1017.7241	-25.5910	-2.9767E-06	3.5338	-.2456548
338.400	-4.99E-06	827.1018	-26.1148	-1.9652E-06	2.8719	.1001435
345.600	-1.59E-05	641.6709	-24.5881	-1.1600E-06	2.2280	.3239411
352.800	-2.17E-05	473.0332	-21.8028	-5.4887E-07	1.6425	.4497473
360.000	-2.38E-05	327.7103	-18.3813	-1.0986E-07	1.1379	.5006762
367.200	-2.33E-05	208.3425	-14.7874	1.8403E-07	.7234115	.4976315
374.400	-2.11E-05	114.7719	-11.3451	3.6117E-07	.3985137	.4585557
381.600	-1.81E-05	44.9729	-8.2611	4.4875E-07	.1561558	.3981252
388.800	-1.47E-05	-4.1874	-5.6478	4.7111E-07	.0145395	.3277787
396.000	-1.13E-05	-36.3556	-3.5463	4.4889E-07	.1262346	.2559731
403.200	-8.20E-06	-55.2541	-1.9459	3.9866E-07	.1918546	.1885828
410.400	-5.55E-06	-64.3766	-.8012817	3.3307E-07	.2235297	.1293672
417.600	-3.40E-06	-66.7926	-.0459264	2.6116E-07	.2319187	.0804537
424.800	-1.78E-06	-65.0379	.3977646	1.8889E-07	.2258260	.0427938
432.000	-6.82E-07	-61.0648	1.4306	1.1975E-07	.2120305	.2441176
439.200	-6.05E-08	-44.4366	2.3874	6.1910E-08	.1542937	.0216518
446.400	2.10E-07	-26.6860	2.1947	2.2917E-08	.0926597	-.0751702
453.600	2.70E-07	-12.8322	1.5766	1.2512E-09	.0445563	-.0965381
460.800	2.28E-07	-3.9830	.9352179	-7.9676E-09	.0138298	-.0816232
468.000	1.55E-07	.6349209	.4417675	-9.8032E-09	.0022046	-.0554464
475.200	8.67E-08	2.3785	.1303269	-8.1511E-09	.0082586	-.0310649
482.400	3.74E-08	2.5116	-.0297769	-5.4701E-09	.0087209	-.0134084
489.600	7.97E-09	1.9497	-.0883201	-3.0242E-09	.0067698	-.0028536
496.800	-6.11E-09	1.2398	-.0907141	-1.2756E-09	.0043049	.0021886
504.000	-1.04E-08	.6434061	-.0694246	-2.4314E-10	.0022340	.0037252
511.200	-9.61E-09	.2401045	-.0436211	2.4124E-10	.0008337	.0034425
518.400	-6.93E-09	.0152627	-.0222965	3.8125E-10	5.2996E-05	.0024810
525.600	-4.12E-09	-.0809653	-.0080504	3.4523E-10	.0002811	.0014763
532.800	-1.96E-09	-.1006625	-.0002138	2.4565E-10	.0003495	.0007005
540.000	-5.85E-10	-.0840444	.0030619	1.4439E-10	.0002918	.0002094
547.200	1.23E-10	-.0565716	.0036569	6.7293E-11	.0001964	-4.4116E-05
554.400	3.84E-10	-.0313858	.0030024	1.9071E-11	.0001090	-.0001377
561.600	3.98E-10	-.0133365	.0019939	-5.4476E-12	4.6307E-05	-.0001425
568.800	3.06E-10	-.0026731	.0010866	-1.4225E-11	9.2814E-06	-.0001096
576.000	1.93E-10	.0023103	.0004433	-1.4424E-11	8.0217E-06	-6.9111E-05
583.200	9.82E-11	.0037108	6.7867E-05	-1.1123E-11	1.2885E-05	-3.5183E-05
590.400	3.28E-11	.0032875	-.0001011	-7.2858E-12	1.1415E-05	-1.1748E-05
597.600	-6.68E-12	.0022552	-.0001348	-4.2470E-12	7.8306E-06	2.3918E-06
604.800	-2.84E-11	.0013469	-8.9601E-05	-2.2722E-12	4.6766E-06	1.0155E-05
612.000	-3.94E-11	.0009650	-4.9009E-05	-1.0047E-12	3.3505E-06	1.1203E-06
619.200	-4.28E-11	.0006411	-4.0501E-05	-1.2422E-13	2.2261E-06	1.2431E-06
626.400	-4.12E-11	.0003817	-3.1634E-05	4.3656E-13	1.3255E-06	1.2201E-06
633.600	-3.65E-11	.0001856	-2.3267E-05	7.4759E-13	6.4443E-07	1.1040E-06
640.800	-3.04E-11	4.6686E-05	-1.5919E-05	8.7494E-13	1.6210E-07	9.3729E-07
648.000	-2.39E-11	-4.3634E-05	-9.8382E-06	8.7661E-13	1.5151E-07	7.5174E-07
655.200	-1.78E-11	-9.4984E-05	-5.0817E-06	8.0062E-13	3.2980E-07	5.6951E-07
662.400	-1.24E-11	-.0001168	-1.5756E-06	6.8450E-13	4.0559E-07	4.0442E-07
669.600	-7.94E-12	-.0001177	8.2907E-07	5.5595E-13	4.0858E-07	2.6353E-07
676.800	-4.40E-12	-.0001049	2.3132E-06	4.3394E-13	3.6414E-07	1.4872E-07
684.000	-1.69E-12	-8.4362E-05	3.0580E-06	3.3019E-13	2.9292E-07	5.8169E-08
691.200	3.52E-13	-6.0836E-05	3.2231E-06	2.5059E-13	2.1124E-07	-1.2315E-08
698.400	1.92E-12	-3.7949E-05	2.9334E-06	1.9643E-13	1.3177E-07	-6.8148E-08
705.600	3.18E-12	-1.8595E-05	2.2741E-06	1.6543E-13	6.4567E-08	-1.1501E-07
712.800	4.30E-12	-5.2030E-06	1.2913E-06	1.5238E-13	1.8066E-08	-1.5797E-07
720.000	5.38E-12	0.0000	0.0000	1.4953E-13	0.0000	-2.0073E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection	=	.50000000 in
Computed slope at pile head	=	-.00042223
Maximum bending moment	=	-2980724. lbs-in
Maximum shear force	=	112631.73447 lbs
Depth of maximum bending moment	=	0.00000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	5
Number of zero deflection points	=	8

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = 1.000000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-5113642.	163771.	0.0000	17755.7026	-1394.5873
7.200	.979815	-3975297.	152436.	-.0049830	13803.1160	-1574.2822
14.400	.928245	-2918563.	140415.	-.0087625	10133.9001	-1764.8182
21.600	.853635	-1953317.	126984.	-.0114335	6782.3516	-1966.1955
28.800	.763603	-1089999.	112063.	-.0131020	3784.7182	-2178.4143
36.000	.664966	-339609.	95575.4423	-.0138857	1179.1994	-2401.4749
43.200	.563648	286288.	77442.7742	-.0139150	994.0539	-2635.3774
50.400	.464590	775567.	57586.9766	-.0133328	2692.9393	-2880.1219
57.600	.371656	1115540.	37457.6692	-.0122960	3873.4028	-2711.3523
64.800	.287528	1314957.	19647.8699	-.0109635	4565.8228	-2235.8141
72.000	.213781	1398469.	5365.0917	-.0094759	4855.7963	-1731.6243
79.200	.151075	1392214.	-5450.3032	-.0079459	4834.0774	-1272.6521
86.400	.099360	1319985.	-13160.9601	-.0064590	4583.2811	-869.1970
93.600	.058065	1202696.	-18186.4388	-.0050759	4176.0294	-526.7693
100.800	.026266	1058100.	-20971.2802	-.0038364	3673.9592	-246.7978
108.000	.002821	900710.	-21958.4484	-.0027625	3127.4653	-27.4156
115.200	-.013514	741899.	-21568.4888	-.0018620	2576.0367	135.7378
122.400	-.023992	590124.	-20184.3337	-.0011317	2049.0409	248.7498
129.600	-.029811	451244.	-18141.3752	-.0005608	1566.8200	318.7387
136.800	-.032067	328888.	-15722.2004	-.0001331	1141.9721	353.2543
144.000	-.031727	224844.	-13155.2484	.0001705	780.7100	359.7879
151.200	-.029612	139452.	-10616.5843	.0003702	484.2097	345.3966
158.400	-.026396	71965.6737	-8233.9852	.0004861	249.8808	316.4365
165.600	-.022612	20883.0151	-6092.5830	.0005370	72.5105	278.3974
172.800	-.018663	-15767.5221	-4241.3901	.0005398	54.7483	235.8229
180.000	-.014838	-40193.0028	-2700.1387	.0005092	139.5590	192.3026
187.200	-.011331	-54649.5191	-1465.9808	.0004572	189.7553	150.5191
194.400	-.008255	-61303.1258	-519.7097	.0003936	212.8581	112.3340
201.600	-.005663	-62133.3391	168.7269	.0003259	215.7408	78.8984

208.800	-.003562	-58873.4590	635.5556	.0002596	204.4217	50.7762
216.000	-.001925	-52981.3389	919.3985	.0001983	183.9630	28.0690
223.200	-.000707	-45634.1203	1058.3740	.0001442	158.4518	10.5353
230.400	.000151	-37740.7531	1088.0147	9.8479E-05	131.0443	-2.3018
237.600	.000711	-29966.7090	1039.9087	6.1359E-05	104.0511	-11.0610
244.800	.001035	-22766.0682	940.9508	3.2449E-05	79.0488	-16.4273
252.000	.001178	-16417.0174	813.0832	1.0967E-05	57.0035	-19.0915
259.200	.001193	-11057.6701	673.4077	-4.0962E-06	38.3947	-19.7072
266.400	.001120	-6719.9461	534.5607	-1.3843E-05	23.3331	-18.8614
273.600	.000993	-3359.9954	405.2543	-1.9369E-05	11.6667	-17.0571
280.800	.000841	-884.2839	290.9039	-2.1696E-05	3.0704	-14.7069
288.000	.000681	829.0207	194.2787	-2.1726E-05	2.8785	-12.1334
295.200	.000528	1913.3299	116.1280	-2.0223E-05	6.6435	-9.5751
302.400	.000390	2501.2642	55.7498	-1.7802E-05	8.6849	-7.1966
309.600	.000271	2716.1274	11.4833	-1.4942E-05	9.4310	-5.0997
316.800	.000175	2666.6238	-18.8851	-1.1991E-05	9.2591	-3.3360
324.000	9.87E-05	2444.1822	-37.8024	-9.1890E-06	8.4867	-1.9188
331.200	4.22E-05	2122.2695	-47.7120	-6.6855E-06	7.3690	-.8338711
338.400	2.43E-06	1757.1290	-50.8899	-4.5586E-06	6.1011	-.0488817
345.600	-2.35E-05	1389.4544	-49.3425	-2.8335E-06	4.8245	.4787142
352.800	-3.84E-05	1046.5964	-44.7549	-1.4980E-06	3.6340	.7956233
360.000	-4.50E-05	744.9834	-38.4772	-5.1573E-07	2.5867	.9481879
367.200	-4.58E-05	492.5246	-31.5383	1.6273E-07	1.7102	.9792954
374.400	-4.27E-05	290.8324	-24.6774	5.9220E-07	1.0098	.9264951
381.600	-3.73E-05	137.1697	-18.3861	8.2685E-07	.4762836	.8210893
388.800	-3.08E-05	26.0723	-12.9535	9.1635E-07	.0905287	.6879670
396.000	-2.41E-05	-49.3610	-8.5114	9.0358E-07	.1713922	.5459677
403.200	-1.78E-05	-96.4912	-5.0749	8.2362E-07	.3350389	.4085909
410.400	-1.22E-05	-122.4401	-2.5784	7.0359E-07	.4251392	.2848952
417.600	-7.63E-06	-133.6200	-.9030886	5.6320E-07	.4639584	.1804665
424.800	-4.10E-06	-135.4446	.1006884	4.1569E-07	.4702937	.0983604
432.000	-1.64E-06	-132.1701	2.5746	2.6897E-07	.4589240	.5888435
439.200	-2.29E-07	-98.3700	4.9901	1.4258E-07	.3415625	.0821108
446.400	4.09E-07	-60.3133	4.7583	5.5581E-08	.2094211	-.1464824
453.600	5.71E-07	-29.8502	3.4946	6.1497E-09	.1036465	-.2045410
460.800	4.98E-07	-9.9905	2.1168	-1.5693E-08	.0346893	-.1781986
468.000	3.45E-07	.6313379	1.0303	-2.0824E-08	.0021921	-.1236082
475.200	1.98E-07	4.8454	.3303893	-1.7821E-08	.0168241	-.0708029
482.400	8.85E-08	5.3889	-.0386127	-1.2210E-08	.0187116	-.0316977
489.600	2.19E-08	4.2893	-.1809113	-6.9044E-09	.0148935	-.0078297
496.800	-1.09E-08	2.7838	-.1950210	-3.0265E-09	.0096660	.0039103
504.000	-2.17E-08	1.4810	-.1529387	-6.8835E-10	.0051425	.0077792
511.200	-2.08E-08	.5815031	-.0980763	4.4242E-10	.0020191	.0074604
518.400	-1.53E-08	.0687276	-.0514279	7.9890E-10	.0002386	.0054975
525.600	-9.33E-09	-.1590594	-.0196124	7.4938E-10	.0005523	.0033402
532.800	-4.56E-09	-.2136906	-.0017101	5.4502E-10	.0007420	.0016327
540.000	-1.48E-09	-.1836847	.0060731	3.2716E-10	.0006378	.0005293
547.200	1.53E-10	-.1262380	.0077821	1.5725E-10	.0004383	-5.4624E-05
554.400	7.86E-10	-.0716230	.0065715	4.8773E-11	.0002487	-.0002816
561.600	8.55E-10	-.0316086	.0044554	-7.8235E-12	.0001098	-.0003062
568.800	6.74E-10	-.0074657	.0024845	-2.9246E-11	2.5923E-05	-.0002413
576.000	4.34E-10	.0041682	.0010566	-3.1054E-11	1.4473E-05	-.0001553
583.200	2.27E-10	.0077497	.0002053	-2.4520E-11	2.6909E-05	-8.1146E-05
590.400	8.06E-11	.0071246	-.0001908	-1.6365E-11	2.4738E-05	-2.8874E-05
597.600	-9.08E-12	.0050027	-.0002830	-9.7163E-12	1.7371E-05	3.2535E-06
604.800	-5.93E-11	.0030495	-.0001948	-5.3017E-12	1.0588E-05	2.1236E-05
612.000	-8.54E-11	.0021971	-.0001096	-2.4253E-12	7.6288E-06	2.4291E-06
619.200	-9.42E-11	.0014706	-9.1050E-05	-4.1448E-13	5.1064E-06	2.7350E-06
626.400	-9.14E-11	.0008860	-7.1457E-05	8.7753E-13	3.0763E-06	2.7074E-06
633.600	-8.16E-11	.0004417	-5.2836E-05	1.6054E-12	1.5335E-06	2.4651E-06
640.800	-6.83E-11	.0001251	-3.6388E-05	1.9161E-12	4.3452E-07	2.1037E-06
648.000	-5.40E-11	-8.2322E-05	-2.2710E-05	1.9396E-12	2.8584E-07	1.6955E-06
655.200	-4.03E-11	-.0002019	-1.1959E-05	1.7838E-12	7.0101E-07	1.2911E-06
662.400	-2.83E-11	-.0002545	-3.9898E-06	1.5336E-12	8.8377E-07	9.2246E-07
669.600	-1.83E-11	-.0002593	1.5133E-06	1.2518E-12	9.0049E-07	6.0617E-07
676.800	-1.03E-11	-.0002327	4.9452E-06	9.8207E-13	8.0810E-07	3.4713E-07
684.000	-4.12E-12	-.0001881	6.7051E-06	7.5133E-13	6.5323E-07	1.4175E-07
691.200	5.43E-13	-.0001362	7.1471E-06	5.7353E-13	4.7285E-07	-1.8997E-08
698.400	4.14E-12	-8.5214E-05	6.5493E-06	4.5215E-13	2.9588E-07	-1.4706E-07
705.600	7.05E-12	-4.1871E-05	5.1017E-06	3.8248E-13	1.4538E-07	-2.5506E-07
712.800	9.64E-12	-1.1750E-05	2.9077E-06	3.5308E-13	4.0798E-08	-3.5438E-07
720.000	1.21E-11	0.0000	0.0000	3.4664E-13	0.0000	-4.5331E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

Pile-head deflection	=	1.00000000	in
Computed slope at pile head	=	-.00062409	
Maximum bending moment	=	-5113642.	lbs-in
Maximum shear force	=	163770.88175	lbs
Depth of maximum bending moment	=	0.00000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	7	
Number of zero deflection points	=	8	

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	510685.	30080.5228
4	y= .500000	M= 0.000	0.0000	.5000000	986229.	53327.9188
4	y= 1.000000	M= 0.000	0.0000	1.0000000	1833063.	80097.8671
5	y= .250000	S= 0.000	0.0000	.2500000	-1566446.	62981.8195
5	y= .500000	S= 0.000	0.0000	.5000000	-2980724.	112632.
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-5113642.	163771.

The analysis ended normally.

```
==============================================================================
                 LPILE Plus for Windows, Version 5.0 (5.0.25)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

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==============================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Katella\
Name of input data file:     Katella Bent 12 inch_3DR2_1.lpd
Name of output file:         Katella Bent 12 inch_3DR2_1.lpo
Name of plot output file:    Katella Bent 12 inch_3DR2_1.lpp
Name of runtime file:        Katella Bent 12 inch_3DR2_1.lpr

------------------------------------------------------------------------------
                           Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  May  8, 2009     Time:  13: 6: 3

------------------------------------------------------------------------------
                               Problem Title
------------------------------------------------------------------------------

Katella Ave Bent 2/12-inch Square Concrete Pile/ 3D(0.55) Row 2

------------------------------------------------------------------------------
                               Program Options
------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments              =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1

------------------------------------------------------------------------------
                     Pile Structural Properties and Geometry
------------------------------------------------------------------------------

Pile Length                                  =     720.00 in
Depth of ground surface below top of pile =    -108.00 in
Slope angle of ground surface                =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth         Pile      Moment of       Pile      Modulus of
           X         Diameter     Inertia        Area      Elasticity
          in           in         in**4        Sq.in      lbs/Sq.in
-----  ---------  -----------  ----------   ----------   -----------
  1       0.0000   12.00000000    1728.0000     144.0000      3800000.
  2     720.0000   12.00000000    1728.0000     144.0000      3800000.

------------------------------------------------------------------------------
                        Soil and Rock Layering Information
------------------------------------------------------------------------------

The soil profile is modelled using  4 layers

Layer  1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =     -108.000 in
Distance from top of pile to bottom of layer =      432.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  2 is stiff clay without free water
Distance from top of pile to top of layer    =      432.000 in
Distance from top of pile to bottom of layer =      480.000 in

Layer  3 is stiff clay without free water
Distance from top of pile to top of layer    =      480.000 in
Distance from top of pile to bottom of layer =      612.000 in

Layer  4 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      612.000 in
Distance from top of pile to bottom of layer =      870.000 in
p-y subgrade modulus k for top of soil layer =      110.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      110.000 lbs/in**3


(Depth of lowest layer extends  150.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-108.00	.06944
2	432.00	.06944
3	432.00	.06366
4	480.00	.06366
5	480.00	.02755
6	612.00	.02755
7	612.00	.03333
8	870.00	.03333

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-108.000	.00000	32.00	------	------
2	432.000	.00000	32.00	------	------
3	432.000	8.33000	.00	.00600	.0
4	480.000	8.33000	.00	.00600	.0
5	480.000	8.33000	.00	.00600	.0
6	612.000	8.33000	.00	.00600	.0
7	612.000	.00000	35.00	------	------
8	870.000	.00000	35.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.5500	1.0000
2	720.000	.5500	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	24045.9382	-.0050060	0.0000	-669.4019
7.200	.213957	155780.	19174.4744	-.0049206	540.9023	-683.7825
14.400	.179144	276112.	14237.0797	-.0046838	958.7237	-687.7160
21.600	.146511	360794.	9505.5506	-.0043346	1252.7563	-626.5976
28.800	.116726	412992.	5352.7866	-.0039104	1434.0012	-526.9479
36.000	.090202	437874.	1912.6765	-.0034439	1520.3956	-428.6382
43.200	.067134	440535.	-836.3225	-.0029623	1529.6351	-334.9726
50.400	.047545	425831.	-2936.9146	-.0024873	1478.5795	-248.5251
57.600	.031317	398243.	-4447.7104	-.0020355	1382.7893	-171.1404
64.800	.018233	361784.	-5438.1173	-.0016188	1256.1940	-103.9727
72.000	.008006	319934.	-5983.6109	-.0012451	1110.8835	-47.5533
79.200	.000304	275620.	-6161.5609	-.0009186	957.0134	-1.8772
86.400	-.005222	231208.	-6047.7206	-.0006407	802.8054	33.4996
93.600	-.008922	188533.	-5713.4309	-.0004106	654.6274	59.3587
100.800	-.011134	148935.	-5223.5457	-.0002256	517.1339	76.7205
108.000	-.012171	113314.	-4635.0433	-8.1799E-05	393.4501	86.7524
115.200	-.012312	82189.9370	-3996.2594	2.5385E-05	285.3817	90.6876
122.400	-.011805	55767.4909	-3346.6605	.0001010	193.6371	89.7566
129.600	-.010858	33998.0263	-2717.0597	.0001502	118.0487	85.1325
136.800	-.009642	16641.8312	-2130.1789	.0001780	57.7841	77.8899
144.000	-.008294	3323.4494	-1601.4582	.0001889	11.5398	68.9770
151.200	-.006921	-6419.1671	-1140.0235	.0001872	22.2888	59.1993
158.400	-.005598	-13092.8897	-749.7335	.0001765	45.4614	49.2146
165.600	-.004379	-17215.3295	-430.2371	.0001599	59.7754	39.5344
172.800	-.003295	-19288.3041	-177.9899	.0001399	66.9733	30.5342
180.000	-.002364	-19778.3847	12.8121	.0001185	68.6749	22.4663
187.200	-.001589	-19103.8102	149.4082	9.7183E-05	66.3327	15.4770
194.400	-.000964	-17626.9070	239.7734	7.7046E-05	61.2045	9.6244
201.600	-.000479	-15651.0738	292.0502	5.8801E-05	54.3440	4.8969
208.800	-.000118	-13421.3846	314.1093	4.2862E-05	46.6020	1.2306
216.000	.000138	-11127.8997	313.2311	2.9403E-05	38.6385	-1.4746
223.200	.000306	-8910.8572	295.8947	1.8417E-05	30.9405	-3.3411
230.400	.000403	-6867.0165	267.6606	9.7668E-06	23.8438	-4.5017
237.600	.000446	-5056.5442	233.1293	3.2298E-06	17.5574	-5.0903
244.800	.000450	-3509.9551	195.9590	-1.4668E-06	12.1873	-5.2347
252.000	.000425	-2234.7350	158.9285	-4.6163E-06	7.7595	-5.0515
259.200	.000383	-1221.3851	124.0286	-6.5111E-06	4.2409	-4.6429
266.400	.000331	-448.7228	92.5717	-7.4267E-06	1.5581	-4.0952
273.600	.000276	111.6469	65.3075	-7.6115E-06	.3876628	-3.4782
280.800	.000222	491.7050	42.5389	-7.2807E-06	1.7073	-2.8464
288.000	.000171	724.2073	24.2301	-6.6141E-06	2.5146	-2.2394
295.200	.000127	840.6190	10.1040	-5.7562E-06	2.9188	-1.6845
302.400	8.85E-05	869.7050	-.2739728	-4.8185E-06	3.0198	-1.1982
309.600	5.72E-05	836.6738	-7.4262	-3.8830E-06	2.9051	-.7884780
316.800	3.26E-05	762.7678	-11.9079	-3.0061E-06	2.6485	-.4564482
324.000	1.39E-05	665.1997	-14.2659	-2.2233E-06	2.3097	-.1985498
331.200	5.46E-07	557.3386	-15.0092	-1.5530E-06	1.9352	-.0079112
338.400	-8.44E-06	449.0675	-14.5903	-1.0012E-06	1.5593	.1242684
345.600	-1.39E-05	347.2385	-13.3954	-5.6467E-07	1.2057	.2076477
352.800	-1.66E-05	256.1739	-11.7409	-2.3385E-07	.8894926	.2519241
360.000	-1.72E-05	178.1690	-9.8755	4.2747E-09	.6186425	.2662469
367.200	-1.65E-05	113.9664	-7.9852	1.6444E-07	.3957167	.2588315
374.400	-1.49E-05	63.1816	-6.2012	2.6156E-07	.2193807	.2367442
381.600	-1.27E-05	24.6697	-4.6079	3.0972E-07	.0856585	.2058215
388.800	-1.04E-05	-3.1725	-3.2525	3.2151E-07	.0110157	.1706923
396.000	-8.11E-06	-22.1660	-2.1524	3.0762E-07	.0769653	.1348738
403.200	-5.98E-06	-34.1677	-1.3036	2.7673E-07	.1186377	.1009133
410.400	-4.12E-06	-40.9379	-.6863142	2.3555E-07	.1421456	.0705565
417.600	-2.59E-06	-44.0506	-.2705890	1.8896E-07	.1529534	.0449227
424.800	-1.40E-06	-44.8344	-.0200396	1.4023E-07	.1556751	.0246743
432.000	-5.71E-07	-44.3391	.8045896	9.1340E-08	.1539554	.2043893
439.200	-8.81E-08	-33.2483	1.6539	4.8803E-08	.1154456	.0315384
446.400	1.32E-07	-20.5226	1.5972	1.9323E-08	.0712589	-.0473034
453.600	1.90E-07	-10.2490	1.1817	2.4529E-09	.0355868	-.0681180
460.800	1.67E-07	-3.5067	.7206001	-5.0886E-09	.0121760	-.0599538
468.000	1.17E-07	.1276411	.3540182	-6.9411E-09	.0004432	-.0418745
475.200	6.74E-08	1.5912	.1163079	-5.9988E-09	.0055249	-.0241561
482.400	3.05E-08	1.8025	-.0100267	-4.1382E-09	.0062586	-.0109368
489.600	7.86E-09	1.4468	-.0595292	-2.3568E-09	.0050236	-.0028139
496.800	-3.40E-09	.9452538	-.0652739	-1.0454E-09	.0032821	.0012182
504.000	-7.20E-09	.5068565	-.0516093	-2.4929E-10	.0017599	.0025775
511.200	-6.99E-09	.2020793	-.0333165	1.3939E-10	.0007017	.0025038
518.400	-5.19E-09	.0270995	-.0176115	2.6503E-10	9.4095E-05	.0018587
525.600	-3.17E-09	-.0515259	-.0068272	2.5164E-10	.0001789	.0011369
532.800	-1.57E-09	-.0712118	-.0007149	1.8435E-10	.0002473	.0005609
540.000	-5.20E-10	-.0618208	.0019746	1.1142E-10	.0002147	.0001862
547.200	3.83E-11	-.0427773	.0025956	5.4070E-11	.0001485	-1.3708E-05
554.400	2.59E-10	-.0244445	.0022127	1.7216E-11	8.4877E-05	-9.2660E-05
561.600	2.86E-10	-.0109151	.0015101	-2.1699E-12	3.7900E-05	-.0001025
568.800	2.27E-10	-.0026991	.0008478	-9.6338E-12	9.3718E-06	-8.1469E-05
576.000	1.47E-10	.0012936	.0003644	-1.0404E-11	4.4917E-06	-5.2810E-05
583.200	7.76E-11	.0025486	7.4189E-05	-8.2979E-12	8.8493E-06	-2.7810E-05
590.400	2.80E-11	.0023619	-6.1983E-05	-5.6057E-12	8.2011E-06	-1.0015E-05
597.600	-3.07E-12	.0016560	-9.4076E-05	-3.4029E-12	5.7501E-06	1.1007E-06
604.800	-2.10E-11	.0010072	-6.2989E-05	-1.9428E-12	3.4973E-06	7.5345E-06
612.000	-3.10E-11	.0007490	-3.3534E-05	-9.7994E-13	2.6007E-06	6.4745E-07
619.200	-3.51E-11	.0005243	-2.8509E-05	-2.8183E-13	1.8206E-06	7.4823E-07
626.400	-3.51E-11	.0003385	-2.3070E-05	1.9120E-13	1.1752E-06	7.6266E-07
633.600	-3.24E-11	.0001921	-1.7740E-05	4.8210E-13	6.6713E-07	7.1784E-07
640.800	-2.82E-11	8.3009E-05	-1.2865E-05	6.3295E-13	2.8823E-07	6.3639E-07
648.000	-2.33E-11	6.8757E-06	-8.6439E-06	6.8223E-13	2.3874E-08	5.3616E-07
655.200	-1.83E-11	-4.1463E-05	-5.1643E-06	6.6326E-13	1.4397E-07	4.3040E-07
662.400	-1.37E-11	-6.7490E-05	-2.4335E-06	6.0353E-13	2.3434E-07	3.2816E-07
669.600	-9.65E-12	-7.6506E-05	-4.0659E-07	5.2459E-13	2.6564E-07	2.3487E-07
676.800	-6.18E-12	-7.3345E-05	9.8971E-07	4.4243E-13	2.5467E-07	1.5299E-07
684.000	-3.28E-12	-6.2254E-05	1.8381E-06	3.6809E-13	2.1616E-07	8.2678E-08
691.200	-8.75E-13	-4.6876E-05	2.2166E-06	3.0826E-13	1.6277E-07	2.2446E-08
698.400	1.16E-12	-3.0335E-05	2.1885E-06	2.6593E-13	1.0533E-07	-3.0229E-08
705.600	2.95E-12	-1.5362E-05	1.7977E-06	2.4087E-13	5.3339E-08	-7.8326E-08
712.800	4.63E-12	-4.4481E-06	1.0668E-06	2.3001E-13	1.5445E-08	-1.2472E-07
720.000	6.27E-12	0.0000	0.0000	2.2757E-13	0.0000	-1.7161E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.25000000	in
Computed slope at pile head	=	-.00500596	
Maximum bending moment	=	440534.90104	lbs-in
Maximum shear force	=	24045.93824	lbs
Depth of maximum bending moment	=	43.20000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	5	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	42767.5689	-.0097951	0.0000	-1022.6974
7.200	.429475	281418.	35077.0943	-.0096408	977.1465	-1113.5456
14.400	.361172	505110.	27124.0580	-.0092096	1753.8547	-1095.6312
21.600	.296857	672005.	19362.0886	-.0085642	2333.3494	-1060.4714
28.800	.237847	783924.	11900.8167	-.0077660	2721.9591	-1012.1041
36.000	.185026	843376.	5091.9636	-.0068739	2928.3902	-879.2440
43.200	.138863	857249.	-567.6544	-.0059415	2976.5573	-692.8721
50.400	.099468	835202.	-4933.7781	-.0050136	2900.0075	-519.9400
57.600	.066667	786202.	-8117.1166	-.0041247	2729.8684	-364.3207
64.800	.040072	718316.	-10251.3000	-.0032999	2494.1516	-228.5081
72.000	.019149	638583.	-11483.4038	-.0025560	2217.3034	-113.7430
79.200	.003266	552955.	-11965.5230	-.0019027	1919.9815	-20.1790
86.400	-.008250	466280.	-11847.6304	-.0013439	1619.0273	52.9270
93.600	-.016086	382349.	-11271.8364	-.0008787	1327.5999	107.0158
100.800	-.020903	303965.	-10368.0750	-.0005024	1055.4354	144.0291
108.000	-.023320	233049.	-9251.1562	-.0002080	809.1962	166.2261
115.200	-.023898	170749.	-8019.0691	1.3411E-05	592.8776	176.0203
122.400	-.023127	117574.	-6752.3737	.0001715	408.2427	175.8396
129.600	-.021428	73514.5775	-5514.4980	.0002762	255.2589	168.0148
136.800	-.019149	38165.1344	-4352.7459	.0003375	132.5178	154.6942
144.000	-.016569	10835.0361	-3299.8215	.0003643	37.6217	137.7848
151.200	-.013903	-9352.2956	-2375.6926	.0003652	32.4732	118.9176
158.400	-.011310	-23374.9372	-1589.6317	.0003472	81.1630	99.4326
165.600	-.008903	-32242.9917	-942.2991	.0003167	111.9548	80.3820
172.800	-.006750	-36944.0445	-427.7584	.0002788	128.2779	62.5460
180.000	-.004888	-38402.7133	-35.3411	.0002375	133.3428	46.4588
187.200	-.003330	-37452.9565	248.6967	.0001959	130.0450	32.4406
194.400	-.002068	-34821.4805	439.7598	.0001563	120.9079	20.6325
201.600	-.001080	-31120.4157	553.7561	.0001201	108.0570	11.0331
208.800	-.000338	-26847.3933	606.1939	8.8331E-05	93.2201	3.5329
216.000	.000192	-22391.2232	611.5195	6.1337E-05	77.7473	-2.0536
223.200	.000545	-18041.5129	582.6705	3.9169E-05	62.6441	-5.9600
230.400	.000756	-14000.7685	530.8174	2.1602E-05	48.6138	-8.4436
237.600	.000856	-10397.7424	465.2596	8.2260E-06	36.1033	-9.7669
244.800	.000875	-7301.0306	393.4435	-1.4773E-06	25.3508	-10.1820
252.000	.000835	-4732.1559	321.0722	-8.0744E-06	16.4311	-9.9211
259.200	.000758	-2677.5910	252.2769	-1.2137E-05	9.2972	-9.1887
266.400	.000660	-1099.3688	189.8265	-1.4207E-05	3.8173	-8.1586
273.600	.000554	55.9099	135.3536	-1.4780E-05	.1941315	-6.9727
280.800	.000448	849.7226	89.5813	-1.4283E-05	2.9504	-5.7418
288.000	.000348	1345.8807	52.5378	-1.3079E-05	4.6732	-4.5481
295.200	.000259	1606.2665	23.7503	-1.1461E-05	5.5773	-3.4485
302.400	.000183	1687.8843	2.4137	-9.6548E-06	5.8607	-2.4784
309.600	.000120	1641.0243	-12.4688	-7.8297E-06	5.6980	-1.6557
316.800	7.02E-05	1508.3335	-21.9744	-6.1031E-06	5.2373	-.9847662
324.000	3.23E-05	1324.5925	-27.1752	-4.5500E-06	4.5993	-.4598947
331.200	4.73E-06	1117.0105	-29.0776	-3.2114E-06	3.8785	-.0685352
338.400	-1.40E-05	905.8756	-28.5827	-2.1023E-06	3.1454	.2060000
345.600	-2.55E-05	705.4198	-26.4645	-1.2189E-06	2.4494	.3823757
352.800	-3.15E-05	524.7864	-23.3616	-5.4449E-07	1.8222	.4795592
360.000	-3.34E-05	369.0133	-19.7790	-5.4464E-08	1.2813	.5156047
367.200	-3.23E-05	239.9691	-16.0982	2.7941E-07	.8332261	.5068442
374.400	-2.94E-05	137.1997	-12.5908	4.8619E-07	.4763880	.4674190
381.600	-2.53E-05	58.6614	-9.4354	5.9357E-07	.2036854	.4090873
388.800	-2.08E-05	1.3301	-6.7342	6.2646E-07	.0046185	.3412423
396.000	-1.63E-05	-38.3112	-4.5298	6.0618E-07	.1330248	.2710818
403.200	-1.21E-05	-63.8995	-2.8200	5.5015E-07	.2218734	.2038777
410.400	-8.38E-06	-78.9189	-1.5701	4.7185E-07	.2740240	.1433014
417.600	-5.29E-06	-86.5095	-.7238840	3.8115E-07	.3003804	.0917694
424.800	-2.89E-06	-89.3428	-.2107091	2.8474E-07	.3102182	.0507792
432.000	-1.19E-06	-89.5438	1.5072	1.8667E-07	.3109158	.4264077
439.200	-2.00E-07	-67.6397	3.3001	1.0049E-07	.2348600	.0716428
446.400	2.57E-07	-42.0217	3.2273	4.0372E-08	.1459086	-.0918720
453.600	3.81E-07	-21.1663	2.4049	5.7300E-09	.0734940	-.1365713
460.800	3.39E-07	-7.3907	1.4761	-9.9263E-09	.0256623	-.1214233
468.000	2.38E-07	.0902044	.7316597	-1.3929E-08	.0003132	-.0853781
475.200	1.38E-07	3.1452	.2457820	-1.2155E-08	.0109207	-.0495880
482.400	6.34E-08	3.6295	-.0144212	-8.4409E-09	.0126023	-.0226907
489.600	1.69E-08	2.9375	-.1179081	-4.8406E-09	.0101996	-.0060557
496.800	-6.35E-09	1.9316	-.1315235	-2.1711E-09	.0067069	.0022736
504.000	-1.44E-08	1.0436	-.1048293	-5.4000E-10	.0036234	.0051414
511.200	-1.41E-08	.4220460	-.0681092	2.6351E-10	.0014654	.0050586
518.400	-1.06E-08	.0627787	-.0362815	5.2931E-10	.0002180	.0037824
525.600	-6.50E-09	-.1004071	-.0142811	5.0868E-10	.0003486	.0023288
532.800	-3.24E-09	-.1428695	-.0017251	3.7531E-10	.0004961	.0011590
540.000	-1.10E-09	-.1252491	.0038628	2.2831E-10	.0004349	.0003932
547.200	5.16E-11	-.0872452	.0052118	1.1181E-10	.0003029	-1.8466E-05
554.400	5.12E-10	-.0501986	.0044849	3.6458E-11	.0001743	-.0001834
561.600	5.77E-10	-.0226619	.0030812	-3.4872E-12	7.8687E-05	-.0002065
568.800	4.62E-10	-.0058299	.0017421	-1.9108E-11	2.0243E-05	-.0001655
576.000	3.01E-10	.0024246	.0007578	-2.0975E-11	8.4187E-06	-.0001079
583.200	1.60E-10	.0050830	.0001630	-1.6859E-11	1.7649E-05	-5.7290E-05
590.400	5.86E-11	.0047715	-.0001189	-1.1456E-11	1.6568E-05	-2.1003E-05
597.600	-5.00E-12	.0033711	-.0001880	-6.9918E-12	1.1705E-05	1.7923E-06
604.800	-4.20E-11	.0020637	-.0001274	-4.0122E-12	7.1657E-06	1.5056E-05
612.000	-6.28E-11	.0015368	-6.8470E-05	-2.0383E-12	5.3361E-06	1.3091E-06
619.200	-7.14E-11	.0010777	-5.8286E-05	-6.0485E-13	3.7422E-06	1.5197E-06
626.400	-7.15E-11	.0006975	-4.7224E-05	3.6841E-13	2.4218E-06	1.5530E-06
633.600	-6.61E-11	.0003977	-3.6362E-05	9.6884E-13	1.3810E-06	1.4644E-06

640.800	-5.75E-11	.0001739	-2.6410E-05	1.2822E-12	6.0370E-07	1.3001E-06
648.000	-4.76E-11	1.7411E-05	-1.7782E-05	1.3871E-12	6.0455E-08	1.0967E-06
655.200	-3.76E-11	-8.2190E-05	-1.0660E-05	1.3516E-12	2.8538E-07	8.8149E-07
662.400	-2.82E-11	-.0001361	-5.0639E-06	1.2319E-12	4.7255E-07	6.7302E-07
669.600	-1.98E-11	-.0001551	-9.0402E-07	1.0722E-12	5.3858E-07	4.8250E-07
676.800	-1.27E-11	-.0001491	1.9672E-06	9.0544E-13	5.1775E-07	3.1506E-07
684.000	-6.79E-12	-.0001268	3.7173E-06	7.5419E-13	4.4022E-07	1.7110E-07
691.200	-1.86E-12	-9.5583E-05	4.5048E-06	6.3228E-13	3.3188E-07	4.7640E-08
698.400	2.32E-12	-6.1913E-05	4.4587E-06	5.4593E-13	2.1498E-07	-6.0434E-08
705.600	6.00E-12	-3.1377E-05	3.6681E-06	4.9478E-13	1.0895E-07	-1.5919E-07
712.800	9.44E-12	-9.0924E-06	2.1789E-06	4.7260E-13	3.1571E-08	-2.5447E-07
720.000	1.28E-11	0.0000	0.0000	4.6761E-13	0.0000	-3.5079E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

Pile-head deflection	=	.50000000	in
Computed slope at pile head	=	-.00979509	
Maximum bending moment	=	857248.50936	lbs-in
Maximum shear force	=	42767.56886	lbs
Depth of maximum bending moment	=	43.20000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	5	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	64358.1841	-.0185534	0.0000	-1022.6974
7.200	.866415	436871.	56520.3685	-.0183139	1516.9118	-1154.4736
14.400	.736280	813893.	47705.1452	-.0176282	2826.0184	-1294.1995
21.600	.612569	1123825.	37855.2764	-.0165658	3902.1691	-1441.8751
28.800	.497731	1359009.	26913.5239	-.0152046	4718.7822	-1597.5006
36.000	.393623	1511379.	15440.0301	-.0136310	5247.8453	-1589.5811
43.200	.301446	1581346.	4545.4024	-.0119354	5490.7837	-1436.7044
50.400	.221753	1576833.	-4799.6625	-.0102039	5475.1154	-1159.1470
57.600	.154509	1512231.	-12012.2898	-.0085104	5250.8006	-844.3606
64.800	.099204	1403856.	-17088.5043	-.0069116	4874.5009	-565.6990
72.000	.054981	1266156.	-20300.7434	-.0054478	4396.3754	-326.5897
79.200	.020755	1111526.	-21938.0478	-.0041443	3859.4638	-128.2171
86.400	-.004696	950248.	-22291.1789	-.0030139	3299.4730	30.1251
93.600	-.022645	790533.	-21640.3789	-.0020595	2744.9048	150.6527
100.800	-.034353	638627.	-20245.8866	-.0012760	2217.4541	236.7063
108.000	-.041019	498992.	-18341.1553	-.0006523	1732.6105	292.3857
115.200	-.043746	374514.	-16128.5861	-.0001734	1300.3963	322.2168
122.400	-.043516	266740.	-13777.4970	.0001782	926.1812	330.8635
129.600	-.041181	176118.	-11423.9868	.0004210	611.5215	322.8894
136.800	-.037455	102235.	-9172.3220	.0005736	354.9818	302.5731
144.000	-.032921	44036.7449	-7097.4717	.0006538	152.9054	273.7742
151.200	-.028041	31.1757	-5248.4340	.0006779	.1082488	239.8474
158.400	-.023159	-31540.7045	-3652.0268	.0006606	109.5163	203.5990
165.600	-.018527	-52558.0102	-2316.8643	.0006145	182.4931	167.2794
172.800	-.014310	-64903.5507	-1237.2857	.0005501	225.3596	132.6035
180.000	-.010605	-70374.9240	-397.0564	.0004760	244.3574	100.7935
187.200	-.007456	-70621.1634	227.2870	.0003987	245.2124	72.6353
194.400	-.004865	-67101.9914	663.5334	.0003232	232.9930	48.5443
201.600	-.002803	-61066.2827	941.3759	.0002529	212.0357	28.6342
208.800	-.001223	-53546.1785	1090.4825	.0001901	185.9242	12.7843
216.000	-6.58E-05	-45363.3347	1139.0391	.0001358	157.5116	.7036228
223.200	.000733	-37144.0152	1112.7265	9.0598E-05	128.9723	-8.0127
230.400	.001239	-29340.0730	1034.0787	5.4148E-05	101.8753	-13.8339
237.600	.001513	-22253.2820	922.1629	2.5862E-05	77.2683	-17.2538
244.800	.001611	-16060.9267	792.5189	4.8568E-06	55.7671	-18.7585
252.000	.001583	-10841.0102	657.2956	-9.8920E-06	37.6424	-18.8035
259.200	.001469	-6595.8697	525.5300	-1.9452E-05	22.9023	-17.7980
266.400	.001303	-3273.3784	403.5154	-2.4863E-05	11.3659	-16.0949
273.600	.001111	-785.2486	295.2186	-2.7088E-05	2.7266	-13.9875
280.800	.000913	977.7691	202.7100	-2.6982E-05	3.3950	-11.7093
288.000	.000722	2133.7756	126.5801	-2.5276E-05	7.4089	-9.4379
295.200	.000549	2800.5232	66.3236	-2.2571E-05	9.7240	-7.3001
302.400	.000397	3088.8355	20.6782	-1.9342E-05	10.7251	-5.3792
309.600	.000270	3098.2892	-12.0878	-1.5950E-05	10.7579	-3.7225
316.800	.000168	2914.7709	-33.9421	-1.2653E-05	10.1207	-2.3482
324.000	8.79E-05	2609.5224	-46.9072	-9.6248E-06	9.0608	-1.2532
331.200	2.89E-05	2239.3067	-52.9273	-6.9665E-06	7.7754	-.4190200
338.400	-1.24E-05	1847.3690	-53.7777	-4.7260E-06	6.4145	.1827913
345.600	-3.91E-05	1464.9071	-51.0104	-2.9100E-06	5.0865	.5859251
352.800	-5.43E-05	1112.8197	-45.9278	-1.4968E-06	3.8640	.8259004
360.000	-6.07E-05	803.5469	-39.5799	-4.4615E-07	2.7901	.9374022
367.200	-6.07E-05	542.8691	-32.7764	2.9202E-07	1.8850	.9524570
374.400	-5.65E-05	331.5666	-26.1101	7.7142E-07	1.1513	.8993044
381.600	-4.96E-05	166.8840	-19.9859	1.0447E-06	.5794585	.8018418
388.800	-4.14E-05	43.7690	-14.6530	1.1602E-06	.1519756	.6795181
396.000	-3.29E-05	-44.1199	-10.2356	1.1600E-06	.1531940	.5475599
403.200	-2.47E-05	-103.6232	-6.7616	1.0790E-06	.3598028	.4174261
410.400	-1.74E-05	-141.4872	-4.1882	9.4461E-07	.4912749	.2974012
417.600	-1.11E-05	-163.9339	-2.4219	7.7717E-07	.5692148	.1932532
424.800	-6.19E-06	-176.3623	-1.3342	5.9060E-07	.6123691	.1088940
432.000	-2.64E-06	-183.1457	2.4581	3.9350E-07	.6359225	.9445034
439.200	-5.27E-07	-140.9660	6.5377	2.1581E-07	.4894652	.1887124
446.400	4.70E-07	-89.0035	6.6104	8.9730E-08	.3090398	-.1684997
453.600	7.65E-07	-45.7759	5.0172	1.5838E-08	.1589443	-.2740562
460.800	6.99E-07	-16.7555	3.1300	-1.8444E-08	.0581789	-.2501821
468.000	5.00E-07	-.7045263	1.5851	-2.8017E-08	.0024463	-.1789320
475.200	2.95E-07	6.0706	.5605108	-2.5075E-08	.0210786	-.1056898
482.400	1.39E-07	7.3668	.0014231	-1.7708E-08	.0255793	-.0496123
489.600	4.01E-08	6.0911	-.2288928	-1.0330E-08	.0211497	-.0143643
496.800	-1.02E-08	4.0708	-.2674247	-4.7584E-09	.0141346	.0036611
504.000	-2.84E-08	2.2402	-.2176097	-1.2985E-09	.0077785	.0101764
511.200	-2.89E-08	.9371926	-.1436871	4.4354E-10	.0032541	.0103576
518.400	-2.20E-08	.1711156	-.0779993	1.0512E-09	.0005942	.0078890
525.600	-1.38E-08	-.1859975	-.0318278	1.0430E-09	.0006458	.0049365

532.800	-7.01E-09	-.2872046	-.0050211	7.8357E-10	.0009972	.0025099
540.000	-2.50E-09	-.2583007	.0072376	4.8450E-10	.0008969	.0008953
547.200	-3.11E-11	-.1829832	.0105008	2.4257E-10	.0006354	1.1129E-05
554.400	9.93E-10	-.1070889	.0092604	8.3538E-11	.0003718	-.0003557
561.600	1.17E-09	-.0496331	.0064690	-2.3842E-12	.0001723	-.0004197
568.800	9.59E-10	-.0139348	.0037219	-3.7235E-11	4.8385E-05	-.0003434
576.000	6.36E-10	.0039623	.0016661	-4.2702E-11	1.3758E-05	-.0002277
583.200	3.44E-10	.0100570	.0004031	-3.5016E-11	3.4920E-05	-.0001232
590.400	1.31E-10	.0097672	-.0002097	-2.4148E-11	3.3914E-05	-4.7080E-05
597.600	-3.86E-12	.0070368	-.0003743	-1.4935E-11	2.4433E-05	1.3808E-06
604.800	-8.36E-11	.0043779	-.0002615	-8.6770E-12	1.5201E-05	2.9945E-05
612.000	-1.29E-10	.0032715	-.0001440	-4.4833E-12	1.1359E-05	2.6858E-06
619.200	-1.48E-10	.0023042	-.0001230	-1.4264E-12	8.0007E-06	3.1542E-06
626.400	-1.49E-10	.0015005	-9.9951E-05	6.5946E-13	5.2099E-06	3.2443E-06
633.600	-1.39E-10	.0008649	-7.7210E-05	1.9563E-12	3.0031E-06	3.0729E-06
640.800	-1.21E-10	.0003886	-5.6291E-05	2.6435E-12	1.3495E-06	2.7379E-06
648.000	-1.01E-10	5.4314E-05	-3.8093E-05	2.8864E-12	1.8859E-07	2.3170E-06
655.200	-7.96E-11	-.0001599	-2.3027E-05	2.8285E-12	5.5522E-07	1.8681E-06
662.400	-5.99E-11	-.0002773	-1.1150E-05	2.5888E-12	9.6277E-07	1.4311E-06
669.600	-4.23E-11	-.0003205	-2.2889E-06	2.2611E-12	1.1127E-06	1.0302E-06
676.800	-2.73E-11	-.0003102	3.8561E-06	1.9153E-12	1.0772E-06	6.7672E-07
684.000	-1.48E-11	-.0002649	7.6310E-06	1.6000E-12	9.1990E-07	3.7186E-07
691.200	-4.28E-12	-.0002003	9.3646E-06	1.3449E-12	6.9566E-07	1.0969E-07
698.400	4.61E-12	-.0001301	9.3262E-06	1.1637E-12	4.5167E-07	-1.2035E-07
705.600	1.25E-11	-6.6052E-05	7.7016E-06	1.0562E-12	2.2935E-07	-3.3091E-07
712.800	1.98E-11	-1.9178E-05	4.5870E-06	1.0095E-12	6.6590E-08	-5.3427E-07
720.000	2.70E-11	0.0000	0.0000	9.9896E-13	0.0000	-7.3988E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

Pile-head deflection	=	1.00000000 in
Computed slope at pile head	=	-.01855343
Maximum bending moment	=	1581346. lbs-in
Maximum shear force	=	64358.18407 lbs
Depth of maximum bending moment	=	43.20000000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	7
Number of zero deflection points	=	8

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	-1357536.	50602.0370	0.0000	4713.6662	-669.4019
7.200	.244641	-1012511.	45238.1955	-.0012994	3515.6626	-744.9695
14.400	.231289	-706105.	39657.3404	-.0022416	2451.7534	-805.2849
21.600	.212362	-441445.	33698.1885	-.0028707	1532.7956	-850.0350
28.800	.189951	-220851.	27551.0159	-.0032338	766.8440	-857.5129
36.000	.165795	-44710.4916	21627.6774	-.0033794	155.2448	-787.8589
43.200	.141287	90587.4840	16253.5116	-.0033543	314.5399	-704.9650
50.400	.117494	189340.	11504.6508	-.0032008	657.4308	-614.1630
57.600	.095195	256254.	7420.8602	-.0029565	889.7724	-520.2233
64.800	.074920	296200.	4010.0514	-.0026536	1028.4738	-427.2236
72.000	.056983	313999.	1253.5204	-.0023191	1090.2750	-338.4794
79.200	.041525	314251.	-888.4971	-.0019747	1091.1498	-256.5255
86.400	.028548	301205.	-2471.2983	-.0016372	1045.8501	-183.1416
93.600	.017949	278664.	-3560.4871	-.0013193	967.5849	-119.4109
100.800	.009550	249934.	-4227.2545	-.0010295	867.8258	-65.8023
108.000	.003124	217792.	-4544.3042	-.0007731	756.2222	-22.2671
115.200	-.001583	184496.	-4582.4999	-.0005525	640.6106	11.6572
122.400	-.004833	151804.	-4408.2569	-.0003682	527.0972	36.7436
129.600	-.006884	121017.	-4081.6603	-.0002186	420.1977	53.9776
136.800	-.007980	93028.0895	-3655.2543	-.0001012	323.0142	64.4685
144.000	-.008342	68381.2816	-3173.4262	-1.2749E-05	237.4350	69.3726
151.200	-.008164	47330.7517	-2672.2930	5.0690E-05	164.3429	69.8310
158.400	-.007612	29900.2628	-2179.9899	9.3031E-05	103.8204	66.9198
165.600	-.006824	15938.8973	-1717.2642	.0001182	55.3434	61.6151
172.800	-.005911	5171.6584	-1298.2780	.0001297	17.9571	54.7700
180.000	-.004956	-2756.3055	-931.5367	.0001311	9.5705	47.1026
187.200	-.004023	-8242.4700	-620.8701	.0001250	28.6197	39.1937
194.400	-.003156	-11696.8355	-366.4060	.0001141	40.6140	31.4908
201.600	-.002380	-13518.7170	-165.4903	.0001003	46.9400	24.3191
208.800	-.001712	-14079.8957	-13.5205	8.5144E-05	48.8885	17.8947
216.000	-.001154	-13713.4115	95.3286	6.9906E-05	47.6160	12.3411
223.200	-.000705	-12707.1638	167.4978	5.5421E-05	44.1221	7.7059
230.400	-.000356	-11301.4434	209.5579	4.2258E-05	39.2411	3.9775
237.600	-9.65E-05	-9689.5306	227.8398	3.0750E-05	33.6442	1.1008
244.800	8.66E-05	-8020.5501	228.1720	2.1041E-05	27.8491	-1.0086
252.000	.000206	-6403.8537	215.7112	1.3133E-05	22.2356	-2.4528
259.200	.000276	-4914.3092	194.8525	6.9275E-06	17.0636	-3.3413
266.400	.000306	-3597.9777	169.2036	2.2607E-06	12.4930	-3.7834
273.600	.000308	-2477.7774	141.6072	-1.0703E-06	8.6034	-3.8823
280.800	.000291	-1558.8346	114.1987	-3.2833E-06	5.4126	-3.7312
288.000	.000261	-833.3156	88.4872	-4.5948E-06	2.8935	-3.4109
295.200	.000225	-284.6188	65.4475	-5.2077E-06	.9882596	-2.9890
302.400	.000186	109.1290	45.6176	-5.3039E-06	.3789202	-2.5193
309.600	.000148	372.2746	29.1925	-5.0400E-06	1.2926	-2.0432
316.800	.000113	529.5006	16.1118	-4.5456E-06	1.8385	-1.5903
324.000	8.28E-05	604.2841	6.1368	-3.9240E-06	2.0982	-1.1805
331.200	5.69E-05	617.8704	-1.0839	-3.2540E-06	2.1454	-.8252594
338.400	3.59E-05	588.6752	-5.9614	-2.5925E-06	2.0440	-.5295834
345.600	1.96E-05	532.0265	-8.9245	-1.9781E-06	1.8473	-.2934996
352.800	7.47E-06	460.1627	-10.3898	-1.4341E-06	1.5978	-.1135199
360.000	-1.04E-06	382.4141	-10.7404	-9.7219E-07	1.3278	.0161237
367.200	-6.53E-06	305.5013	-10.3134	-5.9504E-07	1.0608	.1024673
374.400	-9.61E-06	233.9004	-9.3937	-2.9932E-07	.8121543	.1530251
381.600	-1.08E-05	170.2324	-8.2120	-7.7753E-08	.5910846	.1752109
388.800	-1.07E-05	115.6473	-6.9479	7.8979E-08	.4015530	.1759490
396.000	-9.71E-06	70.1833	-5.7332	1.8086E-07	.2436921	.1614486
403.200	-8.13E-06	33.0889	-4.6584	2.3748E-07	.1148920	.1371140
410.400	-6.29E-06	3.1025	-3.7776	2.5732E-07	.0107724	.1075601
417.600	-4.42E-06	-21.3081	-3.1142	2.4734E-07	.0739863	.0767068

424.800	-2.73E-06	-41.7421	-2.6655	2.1277E-07	.1449379	.0479249
432.000	-1.36E-06	-59.6917	-.7413849	1.5716E-07	.2072629	.4865603
439.200	-4.63E-07	-52.4180	1.6067	9.5698E-08	.1820071	.1656823
446.400	1.95E-08	-36.5554	2.1780	4.6918E-08	.1269285	-.0069846
453.600	2.13E-07	-21.0548	1.8782	1.5334E-08	.0731071	-.0762917
460.800	2.40E-07	-9.5092	1.2937	-1.4227E-09	.0330182	-.0860667
468.000	1.93E-07	-2.4253	.7356394	-7.9658E-09	.0084213	-.0689544
475.200	1.26E-07	1.0840	.3254590	-8.7012E-09	.0037638	-.0449846
482.400	6.72E-08	2.2613	.0768281	-6.8672E-09	.0078516	-.0240796
489.600	2.67E-08	2.1903	-.0443044	-4.4266E-09	.0076052	-.0095683
496.800	3.49E-09	1.6233	-.0832506	-2.3358E-09	.0056364	-.0012501
504.000	-6.92E-09	.9914800	-.0788286	-9.0231E-10	.0034426	.0024784
511.200	-9.50E-09	.4881542	-.0576539	-9.1109E-11	.0016950	.0034035
518.400	-8.23E-09	.1612638	-.0347876	2.6493E-10	.0005599	.0029483
525.600	-5.69E-09	-.0127879	-.0168402	3.4633E-10	4.4402E-05	.0020371
532.800	-3.24E-09	-.0812352	-.0053229	2.9479E-10	.0002821	.0011621
540.000	-1.44E-09	-.0894380	.0007213	2.0121E-10	.0003105	.0005168
547.200	-3.47E-10	-.0708490	.0030296	1.1334E-10	.0002460	.0001244
554.400	1.89E-10	-.0458113	.0032337	4.9379E-11	.0001591	-6.7701E-05
561.600	3.64E-10	-.0242831	.0025211	1.0950E-11	8.4316E-05	-.0001303
568.800	3.47E-10	-.0095081	.0016051	-7.5757E-12	3.3014E-05	-.0001242
576.000	2.55E-10	-.0011703	.0008297	-1.3430E-11	4.0636E-06	-9.1198E-05
583.200	1.53E-10	.0024398	.0003037	-1.2734E-11	8.4715E-06	-5.4912E-05
590.400	7.13E-11	.0032033	1.4151E-05	-9.6403E-12	1.1122E-05	-2.5524E-05
597.600	1.45E-11	.0026436	-9.6432E-05	-6.4348E-12	9.1790E-06	-5.1935E-06
604.800	-2.14E-11	.0018146	-8.7544E-05	-3.9907E-12	6.3008E-06	7.6625E-06
612.000	-4.30E-11	.0013829	-5.6734E-05	-2.2376E-12	4.8018E-06	8.9590E-07
619.200	-5.36E-11	.0009977	-4.9400E-05	-9.3248E-13	3.4641E-06	1.1414E-06
626.400	-5.64E-11	.0006716	-4.0881E-05	-1.7340E-14	2.3318E-06	1.2250E-06
633.600	-5.39E-11	.0004090	-3.2174E-05	5.7505E-13	1.4200E-06	1.1936E-06
640.800	-4.81E-11	.0002083	-2.3963E-05	9.1344E-13	7.2311E-07	1.0871E-06
648.000	-4.07E-11	6.3895E-05	-1.6675E-05	1.0626E-12	2.2186E-07	9.3761E-07
655.200	-3.28E-11	-3.1860E-05	-1.0528E-05	1.0802E-12	1.1062E-07	7.6989E-07
662.400	-2.52E-11	-8.7703E-05	-5.5914E-06	1.0147E-12	3.0453E-07	6.0129E-07
669.600	-1.82E-11	-.0001124	-1.8324E-06	9.0497E-13	3.9019E-07	4.4288E-07
676.800	-1.21E-11	-.0001141	8.4342E-07	7.8081E-13	3.9614E-07	3.0039E-07
684.000	-6.95E-12	-.0001002	2.5559E-06	6.6331E-13	3.4802E-07	1.7531E-07
691.200	-2.57E-12	-7.7284E-05	3.4247E-06	5.6599E-13	2.6835E-07	6.6011E-08
698.400	1.20E-12	-5.0915E-05	3.5500E-06	4.9570E-13	1.7679E-07	-3.1188E-08
705.600	4.56E-12	-2.6164E-05	3.0021E-06	4.5345E-13	9.0846E-08	-1.2101E-07
712.800	7.73E-12	-7.6851E-06	1.8169E-06	4.3489E-13	2.6684E-08	-2.0821E-07
720.000	1.08E-11	0.0000	0.0000	4.3068E-13	0.0000	-2.9649E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

Pile-head deflection	=	.25000000	in
Computed slope at pile head	=	-.00018916	
Maximum bending moment	=	-1357536.	lbs-in
Maximum shear force	=	50602.03697	lbs
Depth of maximum bending moment	=	0.00000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	5	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .500000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-2587851.	90714.6704	0.0000	8985.5924	-1022.6974
7.200	.489785	-1964629.	82402.4176	-.0024959	6821.6283	-1154.4736
14.400	.464059	-1401255.	73587.2368	-.0043412	4865.4694	-1294.1997
21.600	.427271	-904973.	63941.1515	-.0056056	3142.2665	-1385.2684
28.800	.383339	-480503.	53865.3690	-.0063652	1668.4118	-1413.5601
36.000	.335613	-129311.	43689.3022	-.0066995	448.9980	-1413.1252
43.200	.286866	148623.	33605.1170	-.0066889	516.0533	-1388.0374
50.400	.239293	354602.	24105.1915	-.0064130	1231.2578	-1250.8308
57.600	.194519	495738.	15775.3795	-.0059468	1721.3129	-1063.0059
64.800	.153658	581768.	8794.1591	-.0053561	2020.0268	-876.2220
72.000	.117391	622374.	3129.4684	-.0046959	2161.0208	-697.3032
79.200	.086037	626832.	-1294.2361	-.0040110	2176.5002	-531.5036
86.400	.059632	603737.	-4584.8342	-.0033364	2096.3090	-382.5514
93.600	.037993	560810.	-6871.9589	-.0026979	1947.2585	-252.7610
100.800	.020782	504781.	-8297.3996	-.0021137	1752.7111	-143.1947
108.000	.007555	441328.	-9006.7802	-.0015950	1532.3885	-53.8555
115.200	-.002187	375083.	-9142.6784	-.0011474	1302.3721	16.1060
122.400	-.008968	309673.	-8839.2403	-.0007720	1075.2546	68.1824
129.600	-.013304	247798.	-8218.2606	-.0004664	860.4100	104.3120
136.800	-.015684	191330.	-7386.6234	-.0002256	664.3416	126.6984
144.000	-.016553	141431.	-6434.9538	-4.3204E-05	491.0789	137.6543
151.200	-.016306	98667.0451	-5437.2965	8.8428E-05	342.5939	139.4728
158.400	-.015280	63133.6442	-4451.6216	.0001771	219.2140	134.3258
165.600	-.013755	34563.6940	-3520.9607	.0002307	120.0128	124.1911
172.800	-.011958	12431.8106	-2674.9806	.0002565	43.1660	110.8034
180.000	-.010062	-3956.0264	-1931.8252	.0002611	13.7362	95.6287
187.200	-.008198	-15386.4717	-1300.0749	.0002505	53.4252	79.8575
194.400	-.006455	-22677.1046	-780.7028	.0002296	78.7399	64.4125
201.600	-.004891	-26628.5920	-368.9312	.0002026	92.4604	49.9685
208.800	-.003537	-27989.7145	-55.9203	.0001727	97.1865	36.9790
216.000	-.002405	-27433.8447	169.7564	.0001423	95.2564	25.7090
223.200	-.001488	-25545.2226	320.8728	.0001132	88.6987	16.2678
230.400	-.000774	-22813.2768	410.5534	8.6717E-05	79.2128	8.6435
237.600	-.000240	-19633.2534	451.5112	6.3446E-05	68.1710	2.7337
244.800	.000140	-16311.5150	455.5011	4.3739E-05	56.6372	-1.6254
252.000	.000390	-13074.0379	432.9639	2.7629E-05	45.3960	-4.6349
259.200	.000537	-10076.8352	392.8322	1.4936E-05	34.9890	-6.5128
266.400	.000605	-7417.2538	342.4666	5.3451E-06	25.7544	-7.4777
273.600	.000614	-5145.3158	287.6922	-1.5422E-06	17.8657	-7.7374
280.800	.000583	-3274.4859	232.9082	-6.1584E-06	11.3697	-7.4804
288.000	.000526	-1791.4373	181.2451	-8.9357E-06	6.2203	-6.8705
295.200	.000454	-664.5568	134.7481	-1.0282E-05	2.3075	-6.0453
302.400	.000378	148.9349	94.5706	-1.0565E-05	.5171349	-5.1151
309.600	.000302	697.2596	61.1634	-1.0101E-05	2.4210	-4.1647

316.800	.000232	1029.6877	34.4506	-9.1542E-06	3.5753	-3.2555
324.000	.000170	1193.3483	13.9861	-7.9354E-06	4.1436	-2.4291
331.200	.000118	1231.0869	-.9135077	-6.6062E-06	4.2746	-1.7097
338.400	7.53E-05	1180.1938	-11.0596	-5.2843E-06	4.0979	-1.1086
345.600	4.19E-05	1071.8286	-17.3070	-4.0496E-06	3.7216	-.6267448
352.800	1.69E-05	930.9731	-20.4908	-2.9516E-06	3.2325	-.2576545
360.000	-6.33E-07	776.7607	-21.3832	-2.0153E-06	2.6971	.0097707
367.200	-1.21E-05	623.0548	-20.6663	-1.2479E-06	2.1634	.1893836
374.400	-1.86E-05	479.1665	-18.9184	-6.4359E-07	1.6638	.2961305
381.600	-2.13E-05	350.6297	-16.6108	-1.8866E-07	1.2175	.3448589
388.800	-2.13E-05	239.9703	-14.1111	1.3514E-07	.8332303	.3495086
396.000	-1.94E-05	147.4295	-11.6914	3.4753E-07	.5119080	.3226367
403.200	-1.63E-05	71.6142	-9.5391	4.6762E-07	.2486602	.2752175
410.400	-1.27E-05	10.0661	-7.7684	5.1240E-07	.0349517	.2166607
417.600	-8.94E-06	-40.2503	-6.4304	4.9585E-07	.1397580	.1549913
424.800	-5.52E-06	-82.5319	-5.5228	4.2853E-07	.2865692	.0971370
432.000	-2.77E-06	-119.7780	-1.6080	3.1762E-07	.4158958	.9902835
439.200	-9.51E-07	-105.6878	3.1831	1.9401E-07	.3669714	.3405892
446.400	2.87E-08	-73.9414	4.3722	9.5526E-08	.2567409	-.0102748
453.600	4.25E-07	-42.7276	3.7878	3.1563E-08	.1483598	-.1520709
460.800	4.83E-07	-19.3972	2.6173	-2.4967E-09	.0673515	-.1730555
468.000	3.89E-07	-5.0381	1.4932	-1.5893E-08	.0174932	-.1391946
475.200	2.54E-07	2.1053	.6642109	-1.7501E-08	.0073100	-.0910888
482.400	1.37E-07	4.5266	.1601231	-1.3865E-08	.0157173	-.0489356
489.600	5.47E-08	4.4111	-.0865375	-8.9652E-09	.0153162	-.0195812
496.800	7.54E-09	3.2804	-.1667464	-4.7484E-09	.0113904	-.0026990
504.000	-1.37E-08	2.0099	-.1587951	-1.8480E-09	.0069788	.0049078
511.200	-1.91E-08	.9937923	-.1165335	-2.0121E-10	.0034507	.0068316
518.400	-1.66E-08	.3318258	-.0705361	5.2555E-10	.0011522	.0059455
525.600	-1.15E-08	-.0219276	-.0342964	6.9545E-10	7.6138E-05	.0041211
532.800	-6.59E-09	-.1620420	-.0109687	5.9459E-10	.0005626	.0023588
540.000	-2.94E-09	-.1798771	.0013195	4.0714E-10	.0006246	.0010546
547.200	-7.23E-10	-.1430411	.0060486	2.3010E-10	.0004967	.0002590
554.400	3.69E-10	-.0927766	.0065057	1.0081E-10	.0003221	-.0001321
561.600	7.28E-10	-.0493594	.0050910	2.2888E-11	.0001714	-.0002609
568.800	6.98E-10	-.0194666	.0032513	-1.4846E-11	6.7592E-05	-.0002501
576.000	5.15E-10	-.0025405	.0016873	-2.6911E-11	8.8210E-06	-.0001843
583.200	3.11E-10	.0048303	.0006229	-2.5655E-11	1.6772E-05	-.0001113
590.400	1.45E-10	.0064292	3.4834E-05	-1.9482E-11	2.2324E-05	-5.2011E-05
597.600	3.03E-11	.0053319	-.0001915	-1.3034E-11	1.8514E-05	-1.0862E-05
604.800	-4.25E-11	.0036715	-.0001758	-8.0984E-12	1.2748E-05	1.5212E-05
612.000	-8.63E-11	.0027997	-.0001146	-4.5506E-12	9.7211E-06	1.7993E-06
619.200	-1.08E-10	.0020211	-9.9853E-05	-1.9076E-12	7.0179E-06	2.2991E-06
626.400	-1.14E-10	.0013618	-8.2680E-05	-5.2921E-14	4.7285E-06	2.4712E-06
633.600	-1.09E-10	.0008306	-6.5107E-05	1.1490E-12	2.8839E-06	2.4101E-06
640.800	-9.72E-11	.0004243	-4.8524E-05	1.8370E-12	1.4731E-06	2.1965E-06
648.000	-8.23E-11	.0001318	-3.3792E-05	2.1418E-12	4.5770E-07	1.8957E-06
655.200	-6.64E-11	-6.2350E-05	-2.1361E-05	2.1799E-12	2.1649E-07	1.5574E-06
662.400	-5.09E-11	-.0001758	-1.1372E-05	2.0494E-12	6.1034E-07	1.2171E-06
669.600	-3.69E-11	-.0002261	-3.7616E-06	1.8290E-12	7.8512E-07	8.9705E-07
676.800	-2.46E-11	-.0002299	1.6602E-06	1.5790E-12	7.9842E-07	6.0899E-07
684.000	-1.41E-11	-.0002022	5.1341E-06	1.3421E-12	7.0211E-07	3.5599E-07
691.200	-5.26E-12	-.0001560	6.9010E-06	1.1457E-12	5.4172E-07	1.3482E-07
698.400	2.38E-12	-.0001028	7.1634E-06	1.0038E-12	3.5706E-07	-6.1954E-08
705.600	9.20E-12	-5.2862E-05	6.0624E-06	9.1841E-13	1.8355E-07	-2.4385E-07
712.800	1.56E-11	-1.5533E-05	3.6710E-06	8.8092E-13	5.3934E-08	-4.2045E-07
720.000	2.19E-11	0.0000	0.0000	8.7240E-13	0.0000	-5.9926E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection	=	.50000000	in
Computed slope at pile head	=	-.00034168	
Maximum bending moment	=	-2587851.	lbs-in
Maximum shear force	=	90714.67038	lbs
Depth of maximum bending moment	=	0.00000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	5	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)

Specified deflection at pile head	=	1.000000	in
Specified slope at pile head	=	0.000E+00	in/in
Specified axial load at pile head	=	.000	lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-4450770.	132443.	0.0000	15454.0613	-1022.6974
7.200	.982431	-3527100.	124131.	-.0043738	12246.8767	-1154.4734
14.400	.937017	-2663279.	115316.	-.0077677	9247.4972	-1294.1992
21.600	.870577	-1866549.	105466.	-.0102511	6481.0737	-1441.8749
28.800	.789400	-1144566.	94524.4413	-.0119020	3974.1876	-1597.5004
36.000	.699188	-505397.	82433.5670	-.0128066	1754.8516	-1761.0758
43.200	.604986	42477.3248	69136.3299	-.0130603	147.4907	-1932.6012
50.400	.511119	490166.	54575.4902	-.0127683	1701.9649	-2112.0765
57.600	.421122	828364.	39106.7542	-.0120455	2876.2652	-2184.7946
64.800	.337665	1053303.	24309.6971	-.0110138	3657.3026	-1925.4990
72.000	.262523	1178424.	11764.1124	-.0097903	4091.7501	-1559.3856
79.200	.196684	1222706.	1776.1903	-.0084739	4245.5082	-1215.0372
86.400	.140499	1204001.	-5842.7239	-.0071435	4180.5596	-901.3279
93.600	.093819	1138571.	-11334.4652	-.0058592	3953.3720	-624.1558
100.800	.056127	1040785.	-14973.6803	-.0046643	3613.8363	-386.7372
108.000	.026652	922950.	-17049.8493	-.0035877	3204.6880	-189.9764
115.200	.004464	795267.	-17852.1258	-.0026457	2761.3439	-32.8782
122.400	-.011446	665880.	-17657.1870	-.0018447	2312.0817	87.0278
129.600	-.022099	541004.	-16720.0944	-.0011830	1878.4845	173.2756
136.800	-.028481	425110.	-15268.0060	-.0006533	1476.0770	230.0822
144.000	-.031507	321144.	-13496.4669	-.0002442	1115.0842	262.0119
151.200	-.031997	230761.	-11567.9286	5.8395E-05	801.2536	273.6931
158.400	-.030666	154566.	-9612.1034	.0002696	536.6878	269.5916
165.600	-.028114	92346.7531	-7727.7496	.0004050	320.6484	253.8400
172.800	-.024834	43286.4881	-5985.4933	.0004794	150.3003	230.1201
180.000	-.021211	6155.6494	-4431.3246	.0005065	21.3738	201.5934
187.200	-.017540	-20524.5867	-3090.4493	.0004986	71.2659	170.8719
194.400	-.014031	-38346.8210	-1971.2274	.0004663	133.1487	140.0230
201.600	-.010825	-48910.2619	-1068.9858	.0004185	169.8273	110.5997

208.800	-.008005	-53740.2169	-369.5449	.0003622	186.5980	83.6895
216.000	-.005609	-54231.7089	147.6489	.0003030	188.3045	59.9755
223.200	-.003642	-51614.0733	506.8491	.0002450	179.2155	39.8024
230.400	-.002082	-46933.0816	733.8186	.0001910	162.9621	23.2447
237.600	-.000892	-41047.0850	854.1164	.0001427	142.5246	10.1714
244.800	-2.62E-05	-34633.8056	891.8329	.0001012	120.2563	.3054651
252.000	.000566	-28204.6909	868.7281	6.6785E-05	97.9330	-6.7235
259.200	.000935	-22124.1209	803.7154	3.9192E-05	76.8199	-11.3356
266.400	.001130	-16631.1888	712.6321	1.7945E-05	57.7472	-13.9653
273.600	.001194	-11862.2192	608.2337	2.3236E-06	41.1883	-15.0342
280.800	.001164	-7872.6236	500.3562	-8.4959E-06	27.3355	-14.9318
288.000	.001072	-4657.0903	396.1918	-1.5365E-05	16.1705	-14.0028
295.200	.000943	-2167.4616	300.6349	-1.9107E-05	7.5259	-12.5408
302.400	.000796	-327.9473	216.6595	-2.0475E-05	1.1387	-10.7857
309.600	.000648	952.4347	145.6988	-2.0133E-05	3.3071	-8.9256
316.800	.000506	1770.1159	88.0064	-1.8640E-05	6.1462	-7.1001
324.000	.000379	2219.7269	42.9814	-1.6453E-05	7.7074	-5.4068
331.200	.000270	2389.0487	9.4516	-1.3926E-05	8.2953	-3.9070
338.400	.000179	2355.8299	-14.0924	-1.1324E-05	8.1800	-2.6330
345.600	.000106	2186.1176	-29.3101	-8.8343E-06	7.5907	-1.5942
352.800	5.15E-05	1933.7645	-37.8694	-6.5756E-06	6.7145	-.7834430
360.000	1.18E-05	1640.7978	-41.3464	-4.6159E-06	5.6972	-.1823871
367.200	-1.49E-05	1338.3761	-41.1592	-2.9825E-06	4.6471	.2344052
374.400	-3.11E-05	1048.1060	-38.5307	-1.6742E-06	3.6393	.4957083
381.600	-3.91E-05	783.5334	-34.4745	-6.6997E-07	2.7206	.6310157
388.800	-4.08E-05	551.6727	-29.7957	6.2046E-08	1.9155	.6686727
396.000	-3.82E-05	354.4760	-25.1035	5.5884E-07	1.2308	.6347148
403.200	-3.27E-05	190.1828	-20.8302	8.5745E-07	.6603571	.5523003
410.400	-2.58E-05	54.5210	-17.2521	9.9160E-07	.1893089	.4416234
417.600	-1.85E-05	-58.2472	-14.5096	9.8956E-07	.2022471	.3201903
424.800	-1.16E-05	-154.4166	-12.6248	8.7297E-07	.5361688	.2033474
432.000	-5.89E-06	-240.0445	-4.2992	6.5671E-07	.8334880	2.1093
439.200	-2.11E-06	-216.3245	6.0134	4.0650E-07	.7511269	.7552711
446.400	-3.59E-08	-153.4513	8.7787	2.0378E-07	.5328169	.0128609
453.600	8.26E-07	-89.9113	7.7606	7.0354E-08	.3121920	-.2956686
460.800	9.77E-07	-41.6988	5.4363	-1.8011E-09	.1447875	-.3499755
468.000	8.00E-07	-11.6290	3.1454	-3.1038E-08	.0403786	-.2863798
475.200	5.30E-07	3.5948	1.4308	-3.5443E-08	.0124820	-.1899032
482.400	2.89E-07	8.9741	.3741930	-2.8552E-08	.0311600	-.1035909
489.600	1.19E-07	8.9832	-.1522837	-1.8707E-08	.0311917	-.0426526
496.800	1.99E-08	6.7812	-.3314444	-1.0064E-08	.0235458	-.0071142
504.000	-2.58E-08	4.2104	-.3237540	-4.0379E-09	.0146194	.0092505
511.200	-3.83E-08	2.1191	-.2410953	-5.6771E-10	.0073581	.0137103
518.400	-3.40E-08	.7386275	-.1478961	9.9905E-10	.0025647	.0121783
525.600	-2.39E-08	-.0105623	-.0732457	1.3982E-09	3.6675E-05	.0085579
532.800	-1.39E-08	-.3161107	-.0245549	1.2191E-09	.0010976	.0049673
540.000	-6.34E-09	-.3641527	.0015015	8.4616E-10	.0012644	.0022706
547.200	-1.68E-09	-.2944891	.0118478	4.8506E-10	.0010225	.0006034
554.400	6.45E-10	-.1935443	.0131883	2.1750E-10	.0006720	-.0002311
561.600	1.45E-09	-.1045775	.0104907	5.4054E-11	.0003631	-.0005183
568.800	1.42E-09	-.0424786	.0067895	-2.6569E-11	.0001475	-.0005098
576.000	1.06E-09	-.0068093	.0035815	-5.3591E-11	2.3643E-05	-.0003813
583.200	6.52E-10	.0090954	.0013686	-5.2338E-11	3.1581E-05	-.0002334
590.400	3.11E-10	.0128985	.0001274	-4.0280E-11	4.4787E-05	-.0001113
597.600	7.18E-11	.0109299	-.0003660	-2.7216E-11	3.7951E-05	-2.5706E-05
604.800	-8.10E-11	.0076286	-.0003540	-1.7041E-11	2.6488E-05	2.9022E-05
612.000	-1.74E-10	.0058318	-.0002365	-9.6616E-12	2.0249E-05	3.6203E-06
619.200	-2.20E-10	.0042227	-.0002066	-4.1493E-12	1.4662E-05	4.6867E-06
626.400	-2.33E-10	.0028565	-.0001715	-2.6816E-13	9.9185E-06	5.0695E-06
633.600	-2.24E-10	.0017532	-.0001354	2.2591E-12	6.0874E-06	4.9641E-06
640.800	-2.01E-10	.0009072	-.0001012	3.7176E-12	3.1499E-06	4.5378E-06
648.000	-1.70E-10	.0002964	-7.0694E-05	4.3775E-12	1.0292E-06	3.9264E-06
655.200	-1.38E-10	-.0001108	-4.4918E-05	4.4792E-12	3.8478E-07	3.2336E-06
662.400	-1.06E-10	-.0003504	-2.4157E-05	4.2264E-12	1.2167E-06	2.5332E-06
669.600	-7.69E-11	-.0004587	-8.2967E-06	3.7828E-12	1.5927E-06	1.8725E-06
676.800	-5.15E-11	-.0004699	3.0386E-06	3.2737E-12	1.6315E-06	1.2762E-06
684.000	-2.98E-11	-.0004149	1.0337E-05	2.7886E-12	1.4407E-06	7.5120E-07
691.200	-1.14E-11	-.0003210	1.4090E-05	2.3851E-12	1.1147E-06	2.9131E-07
698.400	4.55E-12	-.0002120	1.4712E-05	2.0929E-12	7.3621E-07	-1.1855E-07
705.600	1.88E-11	-.0001092	1.2493E-05	1.9168E-12	3.7908E-07	-4.9789E-07
712.800	3.21E-11	-3.2130E-05	7.5815E-06	1.8393E-12	1.1156E-07	-8.6639E-07
720.000	4.53E-11	0.0000	0.0000	1.8217E-12	0.0000	-1.2396E-06

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

Pile-head deflection	=	1.00000000 in
Computed slope at pile head	=	-.00050640
Maximum bending moment	=	-4450770. lbs-in
Maximum shear force	=	132443.48936 lbs
Depth of maximum bending moment	=	0.00000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	7
Number of zero deflection points	=	8

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	440535.	24045.9382
4	y= .500000	M= 0.000	0.0000	.5000000	857249.	42767.5689
4	y= 1.000000	M= 0.000	0.0000	1.0000000	1581346.	64358.1841
5	y= .250000	S= 0.000	0.0000	.2500000	-1357536.	50602.0370
5	y= .500000	S= 0.000	0.0000	.5000000	-2587851.	90714.6704
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-4450770.	132443.

The analysis ended normally.

```
================================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.25)

             Analysis of Individual Piles and Drilled Shafts
            Subjected to Lateral Loading Using the p-y Method

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================================================================================


This program is licensed to:

abakane
Leighton

Path to file locations:      C:\LPile\602231-002 SR-57\Katella\
Name of input data file:     Katella Bent 12 inch_3DR3_1.lpd
Name of output file:         Katella Bent 12 inch_3DR3_1.lpo
Name of plot output file:    Katella Bent 12 inch_3DR3_1.lpp
Name of runtime file:        Katella Bent 12 inch_3DR3_1.lpr

--------------------------------------------------------------------------------
                          Time and Date of Analysis
--------------------------------------------------------------------------------

               Date:  May  8, 2009     Time:  13: 7:38

--------------------------------------------------------------------------------
                               Problem Title
--------------------------------------------------------------------------------

Katella Ave Bent 2/12-inch Square Concrete Pile/ 3D(0.4) Row 3

--------------------------------------------------------------------------------
                               Program Options
--------------------------------------------------------------------------------

Units Used in Computations - US Customary Units, inches, pounds

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =          100
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+02 in

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) =  1

--------------------------------------------------------------------------------
                     Pile Structural Properties and Geometry
--------------------------------------------------------------------------------

Pile Length                                  =     720.00 in
Depth of ground surface below top of pile =    -108.00 in
Slope angle of ground surface                =        .00 deg.

Structural properties of pile defined using  2 points

Point    Depth        Pile      Moment of      Pile      Modulus of
          X         Diameter     Inertia       Area      Elasticity
          in           in        in**4       Sq.in      lbs/Sq.in
-----  ---------   -----------  ----------  ----------  -----------
  1       0.0000   12.00000000   1728.0000    144.0000     3800000.
  2     720.0000   12.00000000   1728.0000    144.0000     3800000.

--------------------------------------------------------------------------------
                        Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using  4 layers

Layer  1 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =     -108.000 in
Distance from top of pile to bottom of layer =      432.000 in
p-y subgrade modulus k for top of soil layer =       60.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =       60.000 lbs/in**3

Layer  2 is stiff clay without free water
Distance from top of pile to top of layer    =      432.000 in
Distance from top of pile to bottom of layer =      480.000 in

Layer  3 is stiff clay without free water
Distance from top of pile to top of layer    =      480.000 in
Distance from top of pile to bottom of layer =      612.000 in

Layer  4 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      612.000 in
Distance from top of pile to bottom of layer =      870.000 in
p-y subgrade modulus k for top of soil layer =      110.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      110.000 lbs/in**3


(Depth of lowest layer extends  150.00 in below pile tip)
```

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 8 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-108.00	.06944
2	432.00	.06944
3	432.00	.06366
4	480.00	.06366
5	480.00	.02755
6	612.00	.02755
7	612.00	.03333
8	870.00	.03333

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 8 points

Point No.	Depth X in	Cohesion c lbs/in**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-108.000	.00000	32.00	------	------
2	432.000	.00000	32.00	------	------
3	432.000	8.33000	.00	.00600	.0
4	480.000	8.33000	.00	.00600	.0
5	480.000	8.33000	.00	.00600	.0
6	612.000	8.33000	.00	.00600	.0
7	612.000	.00000	35.00	------	------
8	870.000	.00000	35.00	------	------

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X in	p-mult	y-mult
1	.000	.4000	1.0000
2	720.000	.4000	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .250 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .500 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = 1.000 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .250 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = .500 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Deflection at pile head = 1.000 in
Slope at pile head = .000 in/in
Axial load at pile head = .000 lbs

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .250000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	0.0000	19122.3575	-.0046452	0.0000	-486.8378
7.200	.216554	125062.	15565.9146	-.0045767	434.2435	-501.0630
14.400	.184096	224149.	11931.4222	-.0043852	778.2957	-508.5182
21.600	.153407	296875.	8382.9861	-.0040996	1030.8146	-477.1585
28.800	.125063	344864.	5187.0368	-.0037477	1197.4450	-410.6052
36.000	.099440	371568.	2471.6631	-.0033549	1290.1665	-343.6653
43.200	.076751	380456.	231.8137	-.0029427	1321.0282	-278.5151
50.400	.057066	374906.	-1551.8324	-.0025285	1301.7572	-216.9421
57.600	.040341	358110.	-2910.0095	-.0021267	1243.4366	-160.3293
64.800	.026442	333002.	-3881.9747	-.0017478	1156.2567	-109.6610
72.000	.015173	302209.	-4512.7223	-.0013995	1049.3378	-65.5466
79.200	.006289	268019.	-4850.4142	-.0010869	930.6206	-28.2567
86.400	-.000478	232363.	-4944.1060	-.0008125	806.8171	2.2312
93.600	-.005411	196824.	-4841.8177	-.0005772	683.4153	26.1822
100.800	-.008791	162641.	-4588.9769	-.0003802	564.7262	44.0513
108.000	-.010886	130742.	-4227.2368	-.0002193	453.9664	56.4320
115.200	-.011949	101769.	-3793.6540	-9.1852E-05	353.3644	64.0077
122.400	-.012208	76113.7171	-3320.1976	5.6713E-06	264.2837	67.5080
129.600	-.011867	53958.1016	-2833.5515	7.6983E-05	187.3545	67.6715
136.800	-.011100	35310.5762	-2355.1626	.0001259	122.6062	65.2143
144.000	-.010054	20043.7597	-1901.4898	.0001563	69.5964	60.8059
151.200	-.008850	7929.1230	-1484.4023	.0001716	27.5317	55.0517
158.400	-.007583	-1331.6338	-1111.6845	.0001752	4.6237	48.4810
165.600	-.006326	-8079.1342	-787.6032	.0001701	28.0525	41.5416
172.800	-.005134	-12673.1203	-513.5018	.0001587	44.0039	34.5977
180.000	-.004041	-15473.5599	-288.3900	.0001433	53.7276	27.9333
187.200	-.003071	-16825.9369	-109.5057	.0001255	58.4234	21.7568
194.400	-.002233	-17050.4425	27.1710	.0001070	59.2029	16.2090
201.600	-.001530	-16434.6752	126.4621	8.8618E-05	57.0648	11.3719
208.800	-.000957	-15229.3886	193.6032	7.1258E-05	52.8798	7.2784
216.000	-.000504	-13646.7898	233.9236	5.5427E-05	47.3847	3.9217
223.200	-.000159	-11860.8883	252.5956	4.1442E-05	41.1836	1.2649
230.400	9.24E-05	-10009.4136	254.4467	2.9452E-05	34.7549	-.7507084
237.600	.000265	-8196.8557	243.8320	1.9471E-05	28.4613	-2.1978
244.800	.000373	-6498.2336	224.5557	1.1414E-05	22.5633	-3.1567
252.000	.000429	-4963.2531	199.8375	5.1304E-06	17.2335	-3.7095
259.200	.000447	-3620.5739	172.3115	4.2440E-07	12.5714	-3.9366
266.400	.000435	-2481.9674	144.0537	-2.9213E-06	8.6179	-3.9128
273.600	.000405	-1546.2010	116.6270	-5.1297E-06	5.3688	-3.7057
280.800	.000362	-802.5381	91.1400	-6.4174E-06	2.7866	-3.3740
288.000	.000312	-233.7847	68.3114	-6.9856E-06	.8117525	-2.9673
295.200	.000261	181.1456	48.5371	-7.0144E-06	.6289776	-2.5256
302.400	.000211	465.1497	31.9560	-6.6601E-06	1.6151	-2.0803
309.600	.000165	641.3121	18.5105	-6.0535E-06	2.2268	-1.6546
316.800	.000124	731.7012	8.0016	-5.3007E-06	2.5406	-1.2646
324.000	8.88E-05	756.5356	.1363723	-4.4848E-06	2.6269	-.9202376
331.200	5.95E-05	733.6649	-5.4325	-3.6678E-06	2.5474	-.6266837
338.400	3.59E-05	678.3070	-9.0748	-2.8937E-06	2.3552	-.3850563
345.600	1.78E-05	602.9877	-11.1580	-2.1912E-06	2.0937	-.1936004
352.800	4.39E-06	517.6321	-12.0296	-1.5769E-06	1.7973	-.0485159
360.000	-4.92E-06	429.7616	-12.0052	-1.0575E-06	1.4922	.0552981
367.200	-1.08E-05	344.7576	-11.3610	-6.3284E-07	1.1971	.1236350
374.400	-1.40E-05	266.1629	-10.3309	-2.9791E-07	.9241768	.1625053
381.600	-1.51E-05	195.9925	-9.1059	-4.4532E-08	.6805295	.1777891
388.800	-1.47E-05	135.0387	-7.8358	1.3695E-07	.4688842	.1750021
396.000	-1.32E-05	83.1569	-6.6328	2.5658E-07	.2887393	.1591632
403.200	-1.10E-05	39.5262	-5.5747	3.2384E-07	.1372438	.1347447
410.400	-8.50E-06	2.8807	-4.7092	3.4709E-07	.0100023	.1056919
417.600	-5.98E-06	-28.2858	-4.0569	3.3316E-07	.0982146	.0754925
424.800	-3.70E-06	-55.5387	-3.6149	2.8720E-07	.1928429	.0472810
432.000	-1.85E-06	-80.3406	-1.0609	2.1271E-07	.2789605	.6621763
439.200	-6.35E-07	-70.8153	2.1411	1.2984E-07	.2458865	.2272525
446.400	2.08E-08	-49.5092	2.9324	6.3871E-08	.1719070	-.0074423
453.600	2.85E-07	-28.5889	2.5379	2.1054E-08	.0992671	-.1021506
460.800	3.24E-07	-12.9641	1.7524	-1.7274E-09	.0450144	-.1160243
468.000	2.60E-07	-3.3540	.9990639	-1.0674E-08	.0116460	-.0932421
475.200	1.70E-07	1.4224	.4438771	-1.1733E-08	.0049388	-.0609764
482.400	9.14E-08	3.0378	.1065249	-9.2875E-09	.0105479	-.0327325
489.600	3.65E-08	2.9563	-.0583926	-6.0012E-09	.0102651	-.0130779
496.800	4.98E-09	2.1969	-.1118894	-3.1759E-09	.0076283	-.0017823
504.000	-9.22E-09	1.3451	-.1064204	-1.2340E-09	.0046706	.0033015
511.200	-1.28E-08	.6644842	-.0780400	-1.3226E-10	.0023072	.0045819
518.400	-1.11E-08	.2213598	-.0472042	3.5340E-10	.0007686	.0039836
525.600	-7.70E-09	-.0152561	-.0229298	4.6640E-10	5.2973E-05	.0027593
532.800	-4.41E-09	-.1088292	-.0073148	3.9837E-10	.0003779	.0015782
540.000	-1.97E-09	-.1205887	.0009040	2.7259E-10	.0004187	.0007048
547.200	-4.81E-10	-.0958121	.0040616	1.5395E-10	.0003327	.0001723
554.400	2.49E-10	-.0621016	.0043609	6.7378E-11	.0002156	-8.9202E-05
561.600	4.89E-10	-.0330152	.0034092	1.5230E-11	.0001146	-.0001752
568.800	4.68E-10	-.0130087	.0021748	-1.0002E-11	4.5169E-05	-.0001677
576.000	3.45E-10	-.0016983	.0011261	-1.8065E-11	5.8968E-06	-.0001236
583.200	2.08E-10	.0032065	.0004127	-1.7238E-11	1.1134E-05	-7.4581E-05
590.400	9.68E-11	.0042449	1.9448E-05	-1.3153E-11	1.4739E-05	-3.4662E-05
597.600	1.88E-11	.0034865	-.0001296	-8.9144E-12	1.2106E-05	-6.7460E-06
604.800	-3.16E-11	.0023784	-.0001132	-5.6990E-12	8.2583E-06	1.1312E-05
612.000	-6.32E-11	.0018567	-6.9007E-05	-3.3771E-12	6.4468E-06	9.5889E-07
619.200	-8.02E-11	.0013847	-6.1084E-05	-1.6001E-12	4.8079E-06	1.2419E-06
626.400	-8.63E-11	.0009771	-5.1707E-05	-3.0523E-13	3.3926E-06	1.3630E-06
633.600	-8.46E-11	.0006401	-4.1891E-05	5.8138E-13	2.2226E-06	1.3636E-06
640.800	-7.79E-11	.0003738	-3.2374E-05	1.1373E-12	1.2981E-06	1.2801E-06
648.000	-6.82E-11	.0001739	-2.3652E-05	1.4376E-12	6.0391E-07	1.1429E-06
655.200	-5.72E-11	3.3260E-05	-1.6023E-05	1.5512E-12	1.1548E-07	9.7613E-07
662.400	-4.59E-11	-5.6806E-05	-9.6369E-06	1.5383E-12	1.9724E-07	7.9783E-07
669.600	-3.50E-11	-.0001055	-4.5316E-06	1.4493E-12	3.6636E-07	6.2030E-07
676.800	-2.50E-11	-.0001221	-6.7526E-07	1.3245E-12	4.2382E-07	4.5091E-07
684.000	-1.60E-11	-.0001152	2.0022E-06	1.1944E-12	4.0012E-07	2.9284E-07
691.200	-7.83E-12	-9.3229E-05	3.5821E-06	1.0801E-12	3.2371E-07	1.4600E-07
698.400	-4.19E-13	-6.3654E-05	4.1363E-06	9.9412E-13	2.2102E-07	7.9545E-09
705.600	6.49E-12	-3.3667E-05	3.7146E-06	9.4076E-13	1.1690E-07	-1.2509E-07
712.800	1.31E-11	-1.0164E-05	2.3380E-06	9.1673E-13	3.5291E-08	-2.5731E-07
720.000	1.97E-11	0.0000	0.0000	9.1116E-13	0.0000	-3.9213E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.25000000 in
Computed slope at pile head	=	-.00464522
Maximum bending moment	=	380456.11866 lbs-in
Maximum shear force	=	19122.35754 lbs
Depth of maximum bending moment	=	43.20000000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	5
Number of zero deflection points	=	8

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .500000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	0.0000	34135.6700	-.0090998	0.0000	-743.7799
7.200	.434481	226498.	28516.4623	-.0089756	786.4516	-817.1111
14.400	.370751	410637.	22650.2417	-.0086263	1425.8231	-812.3946
21.600	.310262	552662.	16861.7078	-.0080982	1918.9636	-795.5315
28.800	.254136	653446.	11230.2450	-.0074370	2268.9085	-768.7638
36.000	.203170	714377.	5934.9404	-.0066871	2480.4759	-702.1542
43.200	.157843	738909.	1345.1799	-.0058903	2565.6555	-572.7793
50.400	.118349	733748.	-2336.5233	-.0050829	2547.7349	-449.9160
57.600	.084648	705263.	-5167.3565	-.0042940	2448.8294	-336.4265
64.800	.056515	659338.	-7222.2635	-.0035459	2289.3671	-234.3810
72.000	.033588	601262.	-8588.3942	-.0028547	2087.7162	-145.0997
79.200	.015407	535665.	-9359.9491	-.0022314	1859.9474	-69.2211
86.400	.001455	466479.	-9633.5880	-.0016820	1619.7187	-6.7897
93.600	-.008814	396941.	-9504.5090	-.0012086	1378.2680	42.6449
100.800	-.015949	329614.	-9063.2581	-.0008103	1144.4933	79.9248
108.000	-.020482	266430.	-8393.2784	-.0004835	925.1051	106.1807
115.200	-.022912	208751.	-7569.1791	-.0002230	724.8294	122.7358
122.400	-.023694	157434.	-6655.6668	-2.2261E-05	546.6461	131.0176
129.600	-.023233	112909.	-5707.0675	.0001260	392.0460	132.4822
136.800	-.021880	75252.3038	-4767.3510	.0002291	261.2927	128.5502
144.000	-.019933	44259.3978	-3870.5626	.0002946	153.6785	120.5577
151.200	-.017637	19516.2026	-3041.5673	.0003296	67.7646	109.7188
158.400	-.015187	460.8290	-2297.0152	.0003406	1.6001	97.1012
165.600	-.012733	-13560.8163	-1646.4438	.0003334	47.0862	83.6130
172.800	-.010387	-23247.9613	-1093.4429	.0003132	80.7221	69.9983
180.000	-.008224	-29306.3940	-636.8208	.0002844	101.7583	56.8412
187.200	-.006292	-32418.1814	-271.7206	.0002505	112.5631	44.5756
194.400	-.004616	-33219.1710	9.3508	.0002146	115.3443	33.4998
201.600	-.003202	-32283.5299	215.6069	.0001786	112.0956	23.7935
208.800	-.002043	-30114.4312	357.1953	.0001444	104.5640	15.5366
216.000	-.001122	-27139.9178	444.5469	.0001130	94.2358	8.7278
223.200	-.000416	-23712.9557	487.8609	8.5160E-05	82.3367	3.3039
230.400	.000104	-20114.7215	496.7167	6.1132E-05	69.8428	-.8439062
237.600	.000465	-16560.2354	479.8040	4.1025E-05	57.5008	-3.8541
244.800	.000695	-13205.5445	444.7544	2.4706E-05	45.8526	-5.8819
252.000	.000820	-10155.7727	398.0608	1.1899E-05	35.2631	-7.0885
259.200	.000866	-7473.4693	345.0670	2.2334E-06	25.9495	-7.6320
266.400	.000853	-5186.8075	290.0122	-4.7076E-06	18.0097	-7.6610
273.600	.000798	-3297.2937	236.1149	-9.3590E-06	11.4489	-7.3104
280.800	.000718	-1786.7525	185.6841	-1.2146E-05	6.2040	-6.6981
288.000	.000623	-623.4424	140.2445	-1.3468E-05	2.1647	-5.9240
295.200	.000524	232.7683	100.6678	-1.3682E-05	.8082232	-5.0695
302.400	.000426	826.1736	67.3015	-1.3101E-05	2.8687	-4.1989
309.600	.000335	1201.9104	40.0904	-1.1989E-05	4.1733	-3.3598
316.800	.000254	1403.4754	18.6855	-1.0561E-05	4.8732	-2.5860
324.000	.000183	1470.9817	2.5398	-8.9851E-06	5.1076	-1.8989
331.200	.000124	1440.0489	-9.0117	-7.3891E-06	5.0002	-1.3098
338.400	7.67E-05	1341.2136	-16.6872	-5.8643E-06	4.6570	-.8222381
345.600	3.98E-05	1199.7536	-21.2078	-4.4712E-06	4.1658	-.4334790
352.800	1.24E-05	1035.8219	-23.2604	-3.2456E-06	3.5966	-.1367072
360.000	-6.92E-06	864.8034	-23.4728	-2.2036E-06	3.0028	.0777035
367.200	-1.94E-05	697.8130	-22.3978	-1.3469E-06	2.4230	.2209122
374.400	-2.63E-05	542.2747	-20.5058	-6.6701E-07	1.8829	.3046427
381.600	-2.90E-05	402.5291	-18.1834	-1.4902E-07	1.3977	.3404679
388.800	-2.85E-05	280.4334	-15.7362	2.2541E-07	.9737270	.3393228
396.000	-2.57E-05	175.9281	-13.3942	4.7561E-07	.6108615	.3112194
403.200	-2.16E-05	87.5564	-11.3194	6.2006E-07	.3040154	.2651323
410.400	-1.68E-05	12.9293	-9.6124	6.7515E-07	.0448932	.2090218
417.600	-1.19E-05	-50.8622	-8.3201	6.5436E-07	.1766050	.1499612
424.800	-7.38E-06	-106.8798	-7.4406	5.6787E-07	.3711103	.0943377
432.000	-3.71E-06	-158.0068	-2.3166	4.2265E-07	.5486347	1.3290
439.200	-1.29E-06	-140.2394	4.1327	2.5914E-07	.4869424	.4624875
446.400	2.09E-08	-98.4966	5.7707	1.2825E-07	.3420022	-.0074831
453.600	5.56E-07	-57.1418	5.0275	4.2925E-08	.1984091	-.1989562
460.800	6.39E-07	-26.1009	3.4873	-2.7124E-09	.0906280	-.2288618
468.000	5.16E-07	-6.9241	1.9976	-2.0818E-08	.0240421	-.1849676
475.200	3.39E-07	2.6639	.8942861	-2.3154E-08	.0092497	-.1214957
482.400	1.83E-07	5.9536	.2209005	-1.8429E-08	.0206722	-.0655559
489.600	7.39E-08	5.8449	-.1103198	-1.1961E-08	.0202947	-.0264498
496.800	1.08E-08	4.3650	-.2194707	-6.3633E-09	.0151562	-.0038699
504.000	-1.78E-08	2.6845	-.2104778	-2.4985E-09	.0093212	.0063680
511.200	-2.52E-08	1.3341	-.1550974	-2.9528E-10	.0046323	.0090155
518.400	-2.20E-08	.4510948	-.0942348	6.8345E-10	.0015663	.0078908
525.600	-1.53E-08	-.0228656	-.0460614	9.1823E-10	7.9394E-05	.0054907
532.800	-8.81E-09	-.2121891	-.0149362	7.8936E-10	.0007368	.0031552
540.000	-3.96E-09	-.2379467	.0015334	5.4258E-10	.0008262	.0014197
547.200	-9.97E-10	-.1901077	.0079294	3.0790E-10	.0006601	.0003570
554.400	4.70E-10	-.1237637	.0086088	1.3582E-10	.0004297	-.0001682
561.600	9.59E-10	-.0661412	.0067665	3.1704E-11	.0002297	-.0003435
568.800	9.26E-10	-.0263257	.0043357	-1.8991E-11	9.1409E-05	-.0003317
576.000	6.86E-10	-.0037078	.0022574	-3.5456E-11	1.2874E-05	-.0002456
583.200	4.16E-10	.0061804	.0008374	-3.4101E-11	2.1460E-05	-.0001489
590.400	1.95E-10	.0083504	5.0506E-05	-2.6134E-11	2.8995E-05	-6.9689E-05
597.600	3.94E-11	.0069077	-.0002511	-1.7769E-11	2.3985E-05	-1.4103E-05
604.800	-6.13E-11	.0047339	-.0002229	-1.1386E-11	1.6437E-05	2.1951E-05
612.000	-1.25E-10	.0036981	-.0001371	-6.7637E-12	1.2841E-05	1.8894E-06
619.200	-1.59E-10	.0027602	-.0001214	-3.2229E-12	9.5841E-06	2.4568E-06
626.400	-1.71E-10	.0019497	-.0001028	-6.4075E-13	6.7698E-06	2.7016E-06
633.600	-1.68E-10	.0012792	-8.3380E-05	1.1295E-12	4.4417E-06	2.7060E-06

640.800	-1.55E-10	.0007490	-6.4484E-05	2.2415E-12	2.6008E-06	2.5426E-06
648.000	-1.36E-10	.0003506	-4.7152E-05	2.8443E-12	1.2175E-06	2.2718E-06
655.200	-1.14E-10	7.0030E-05	-3.1984E-05	3.0750E-12	2.4316E-07	1.9417E-06
662.400	-9.14E-11	-.0001099	-1.9277E-05	3.0531E-12	3.8168E-07	1.5881E-06
669.600	-6.98E-11	-.0002076	-9.1115E-06	2.8790E-12	7.2068E-07	1.2356E-06
676.800	-4.99E-11	-.0002411	-1.4268E-06	2.6331E-12	8.3726E-07	8.9902E-07
684.000	-3.19E-11	-.0002281	3.9147E-06	2.3758E-12	7.9202E-07	5.8472E-07
691.200	-1.57E-11	-.0001848	7.0730E-06	2.1495E-12	6.4153E-07	2.9259E-07
698.400	-9.42E-13	-.0001262	8.1906E-06	1.9789E-12	4.3837E-07	1.7865E-08
705.600	1.28E-11	-6.6814E-05	7.3658E-06	1.8731E-12	2.3199E-07	-2.4699E-07
712.800	2.60E-11	-2.0182E-05	4.6399E-06	1.8254E-12	7.0078E-08	-5.1021E-07
720.000	3.91E-11	0.0000	0.0000	1.8143E-12	0.0000	-7.7864E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

Pile-head deflection	=	.50000000	in
Computed slope at pile head	=	-.00909982	
Maximum bending moment	=	738908.79177	lbs-in
Maximum shear force	=	34135.66997	lbs
Depth of maximum bending moment	=	43.20000000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	5	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = 1.000000 in
Specified moment at pile head = .000 in-lbs
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	0.0000	51581.1770	-.0172626	0.0000	-743.7799
7.200	.875709	352106.	45880.9435	-.0170696	1222.5892	-839.6183
14.400	.754198	660686.	39469.8580	-.0165143	2294.0472	-941.2388
21.600	.637903	920472.	32306.2885	-.0156475	3196.0821	-1048.6416
28.800	.528874	1125896.	24348.6018	-.0145256	3909.3616	-1161.8269
36.000	.428735	1271092.	15724.5641	-.0132114	4413.5122	-1233.7391
43.200	.338630	1352330.	7196.5499	-.0117731	4695.5898	-1135.1537
50.400	.259202	1374722.	-437.3758	-.0102780	4773.3397	-985.3812
57.600	.190626	1346032.	-6712.1996	-.0087864	4673.7210	-757.6254
64.800	.132678	1278066.	-11420.5163	-.0073477	4437.7297	-550.2404
72.000	.084819	1181576.	-14720.4831	-.0059993	4102.6952	-366.4171
79.200	.046288	1066091.	-16788.2536	-.0047670	3701.7056	-207.9636
86.400	.016174	939825.	-17808.5863	-.0036673	3263.2825	-75.4621
93.600	-.006520	809648.	-17966.6789	-.0027081	2811.2763	31.5475
100.800	-.022823	681105.	-17441.3799	-.0018908	2364.9486	114.3689
108.000	-.033748	558492.	-16399.8345	-.0012112	1939.2073	174.9493
115.200	-.040264	444948.	-14993.5454	-.0006611	1544.9569	215.6866
122.400	-.043267	342585.	-13355.7675	-.0002293	1189.5300	239.2517
129.600	-.043566	252625.	-11600.1058	9.7004E-05	877.1685	248.4321
136.800	-.041871	175543.	-9820.1569	.0003317	609.5247	245.9982
144.000	-.038789	111214.	-8090.0162	.0004890	386.1606	234.5965
151.200	-.034830	59046.8858	-6465.4640	.0005823	205.0239	216.6680
158.400	-.030404	18111.5791	-4985.6531	.0006246	62.8874	194.3906
165.600	-.025835	-12746.5183	-3675.1255	.0006275	44.2587	169.6448
172.800	-.021367	-34810.2277	-2546.0102	.0006015	120.8688	143.9983
180.000	-.017174	-49409.0658	-1600.2707	.0005553	171.5593	118.7071
187.200	-.013371	-57854.1255	-831.8955	.0004965	200.8824	94.7304
194.400	-.010025	-61388.3611	-228.9511	.0004311	213.1540	72.7542
201.600	-.007163	-61151.0209	224.5650	.0003639	212.3299	53.2225
208.800	-.004784	-58154.6256	547.1069	.0002985	201.9258	36.3725
216.000	-.002864	-53272.6823	758.2208	.0002374	184.9746	22.2703
223.200	-.001365	-47236.2464	877.4456	.0001823	164.0147	10.8477
230.400	-.000238	-40637.4652	923.4657	.0001342	141.1023	1.9357
237.600	.000567	-33938.3400	913.4973	9.3274E-05	117.8415	-4.7047
244.800	.001105	-27483.1039	862.8836	5.9600E-05	95.4274	-9.3547
252.000	.001425	-21512.8154	784.8695	3.2738E-05	74.6973	-12.3159
259.200	.001576	-16180.9834	690.5240	1.2073E-05	56.1840	-13.8912
266.400	.001599	-11569.2697	588.7813	-3.1410E-06	40.1711	-14.3707
273.600	.001531	-7702.5328	486.5687	-1.3707E-05	26.7449	-14.0217
280.800	.001402	-4562.6804	388.9966	-2.0431E-05	15.8426	-13.0817
288.000	.001237	-2100.9812	299.5858	-2.4084E-05	7.2951	-11.7547
295.200	.001055	-248.6444	220.5126	-2.5372E-05	.8633485	-10.2101
302.400	.000871	1074.4002	152.8558	-2.4920E-05	3.7306	-8.5834
309.600	.000696	1952.4799	96.8337	-2.3260E-05	6.7794	-6.9783
316.800	.000537	2468.8058	52.0209	-2.0836E-05	8.5722	-5.4697
324.000	.000396	2701.5806	17.5408	-1.8002E-05	9.3805	-4.1081
331.200	.000277	2721.3940	-7.7699	-1.5029E-05	9.4493	-2.9227
338.400	.000180	2589.6939	-25.2269	-1.2117E-05	8.9920	-1.9264
345.600	.000103	2358.1270	-36.1907	-9.4042E-06	8.1879	-1.1191
352.800	4.44E-05	2068.5482	-41.9867	-6.9773E-06	7.1825	-.4909441
360.000	2.32E-06	1753.5189	-43.8479	-4.8819E-06	6.0886	-.0260723
367.200	-2.59E-05	1437.1380	-42.8782	-3.1326E-06	4.9901	.2954562
374.400	-4.28E-05	1136.0735	-40.0311	-1.7218E-06	3.9447	.4953827
381.600	-5.07E-05	860.6896	-36.1030	-6.2712E-07	2.9885	.5957541
388.800	-5.18E-05	616.1897	-31.7341	1.8257E-07	2.1395	.6178431
396.000	-4.81E-05	403.7187	-27.4165	7.4173E-07	1.4018	.5814754
403.200	-4.11E-05	221.3915	-23.5063	1.0844E-06	.7687203	.5047091
410.400	-3.25E-05	65.2283	-20.2356	1.2416E-06	.2264871	.4038006
417.600	-2.33E-05	-70.0018	-17.7257	1.2390E-06	.2430620	.2933957
424.800	-1.46E-05	-190.0223	-15.9967	1.0964E-06	.6597998	.1868791
432.000	-7.47E-06	-300.3550	-5.6921	8.2756E-07	1.0429	2.6755
439.200	-2.70E-06	-271.9880	7.4180	5.1378E-07	.9444027	.9661523
446.400	-7.21E-08	-193.5356	10.9891	2.5856E-07	.6719986	.0258106
453.600	1.03E-06	-113.7452	9.7597	9.0092E-08	.3949486	-.3673127
460.800	1.23E-06	-52.9963	6.8576	-1.3232E-09	.1840148	-.4388235
468.000	1.01E-06	-14.9960	3.9801	-3.8600E-08	.0520693	-.3604883
475.200	6.69E-07	4.3166	1.8192	-4.4455E-08	.0149883	-.2397523
482.400	3.66E-07	11.2005	.4836906	-3.5947E-08	.0388905	-.1312215
489.600	1.52E-07	11.2818	-.1844018	-2.3622E-08	.0391728	-.0543597
496.800	2.62E-08	8.5451	-.4139262	-1.2752E-08	.0296704	-.0093970
504.000	-3.18E-08	5.3212	-.4066988	-5.1495E-09	.0184765	.0114046
511.200	-4.79E-08	2.6886	-.3038639	-7.5813E-10	.0093355	.0171606
518.400	-4.28E-08	.9455959	-.1869532	1.2343E-09	.0032833	.0153146
525.600	-3.01E-08	-.0035137	-.0929592	1.7508E-09	1.2200E-05	.0107949

532.800	-1.75E-08	-.3930166	-.0314712	1.5334E-09	.0013646	.0062851
540.000	-8.06E-09	-.4566986	.0015471	1.0676E-09	.0015858	.0028866
547.200	-2.18E-09	-.3707382	.0147448	6.1391E-10	.0012873	.0007794
554.400	7.80E-10	-.2443730	.0165444	2.7668E-10	.0008485	-.0002795
561.600	1.81E-09	-.1324985	.0132071	7.0062E-11	.0004601	-.0006475
568.800	1.79E-09	-.0541911	.0085689	-3.2290E-11	.0001882	-.0006409
576.000	1.34E-09	-.0091061	.0045303	-6.6992E-11	3.1618E-05	-.0004810
583.200	8.25E-10	.0110446	.0017354	-6.5929E-11	3.8349E-05	-.0002954
590.400	3.94E-10	.0158837	.0001646	-5.1166E-11	5.5152E-05	-.0001410
597.600	8.79E-11	.0134149	-.0004562	-3.5103E-11	4.6579E-05	-3.1485E-05
604.800	-1.12E-10	.0093139	-.0004253	-2.2642E-11	3.2340E-05	4.0069E-05
612.000	-2.38E-10	.0072901	-.0002681	-1.3539E-11	2.5313E-05	3.6113E-06
619.200	-3.07E-10	.0054536	-.0002380	-6.5522E-12	1.8936E-05	4.7504E-06
626.400	-3.32E-10	.0038633	-.0002020	-1.4443E-12	1.3414E-05	5.2529E-06
633.600	-3.28E-10	.0025453	-.0001640	2.0691E-12	8.8377E-06	5.2800E-06
640.800	-3.03E-10	.0015010	-.0001271	4.2874E-12	5.2117E-06	4.9739E-06
648.000	-2.66E-10	.0007145	-9.3195E-05	5.5021E-12	2.4810E-06	4.4535E-06
655.200	-2.23E-10	.0001590	-6.3433E-05	5.9810E-12	5.5195E-07	3.8136E-06
662.400	-1.80E-10	-.0001989	-3.8454E-05	5.9591E-12	6.9066E-07	3.1249E-06
669.600	-1.38E-10	-.0003948	-1.8434E-05	5.6336E-12	1.3708E-06	2.4364E-06
676.800	-9.86E-11	-.0004644	-3.2649E-06	5.1626E-12	1.6124E-06	1.7773E-06
684.000	-6.33E-11	-.0004418	7.3117E-06	4.6658E-12	1.5340E-06	1.1607E-06
691.200	-3.15E-11	-.0003591	1.3602E-05	4.2267E-12	1.2468E-06	5.8674E-07
698.400	-2.45E-12	-.0002459	1.5882E-05	3.8950E-12	8.5390E-07	4.6386E-08
705.600	2.46E-11	-.0001304	1.4339E-05	3.6887E-12	4.5269E-07	-4.7491E-07
712.800	5.07E-11	-3.9444E-05	9.0538E-06	3.5956E-12	1.3696E-07	-9.9318E-07
720.000	7.64E-11	0.0000	0.0000	3.5740E-12	0.0000	-1.5218E-06

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

Pile-head deflection	=	1.00000000 in
Computed slope at pile head	=	-.01726263
Maximum bending moment	=	1374722. lbs-in
Maximum shear force	=	51581.17701 lbs
Depth of maximum bending moment	=	50.40000000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	6
Number of zero deflection points	=	8

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .250000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.250000	-1172291.	40441.5679	0.0000	4070.4561	-486.8378
7.200	.245373	-895183.	36532.9759	-.0011335	3108.2740	-542.8565
14.400	.233678	-646216.	32456.3549	-.0019785	2243.8061	-589.5453
21.600	.216881	-427811.	28078.9787	-.0025674	1485.4563	-626.3925
28.800	.196708	-241879.	23498.9766	-.0029345	839.8571	-645.8303
36.000	.174624	-89426.1432	19001.3840	-.0031162	310.5074	-603.5010
43.200	.151835	31741.0759	14845.2605	-.0031478	110.2121	-550.9778
50.400	.129296	124346.	11092.2285	-.0030622	431.7556	-491.5311
57.600	.107739	191469.	7781.2085	-.0028891	664.8235	-428.1967
64.800	.087693	236395.	4930.4492	-.0026545	820.8160	-363.6809
72.000	.069514	262468.	2540.1188	-.0023810	911.3460	-300.2997
79.200	.053407	272973.	595.2363	-.0020875	947.8219	-239.9454
86.400	.039455	271039.	-931.2516	-.0017892	941.1078	-184.0790
93.600	.027642	259563.	-2075.4140	-.0014983	901.2594	-133.7439
100.800	.017879	241153.	-2879.4349	-.0012238	837.3371	-89.5953
108.000	.010020	218099.	-3388.9689	-.0009720	757.2876	-51.9420
115.200	.003882	192352.	-3650.8258	-.0007470	667.8886	-20.7960
122.400	-.000737	165527.	-3711.0252	-.0005508	574.7463	4.0740
129.600	-.004049	138913.	-3613.2408	-.0003839	482.3374	23.0884
136.800	-.006264	113496.	-3397.6271	-.0002455	394.0843	36.8043
144.000	-.007584	89987.3300	-3100.0115	-.0001339	312.4560	45.8667
151.200	-.008193	68856.1116	-2751.4151	-4.6834E-05	239.0837	50.9657
158.400	-.008258	50366.9532	-2377.8603	1.8530E-05	174.8853	52.7995
165.600	-.007926	34614.9234	-2000.4199	6.5120E-05	120.1907	52.0450
172.800	-.007320	21560.9068	-1635.4555	9.5919E-05	74.8643	49.3340
180.000	-.006545	11064.3645	-1294.9993	.0001138	38.4179	45.2372
187.200	-.005682	2912.9171	-987.2332	.0001215	10.1143	40.2534
194.400	-.004796	-3151.7941	-717.0250	.0001213	10.9437	34.8044
201.600	-.003934	-7412.2428	-486.4860	.0001155	25.7370	29.2342
208.800	-.003132	-10157.1927	-295.5229	.0001059	35.2680	23.8112
216.000	-.002409	-11667.7719	-142.3591	9.3948E-05	40.5131	18.7343
223.200	-.001779	-12207.1643	-24.0117	8.0858E-05	42.3860	14.1400
230.400	-.001245	-12013.5409	63.2898	6.7580E-05	41.7137	10.1105
237.600	-.000806	-11295.7910	123.7466	5.4800E-05	39.2215	6.6831
244.800	-.000456	-10231.5900	161.6981	4.2998E-05	35.5264	3.8590
252.000	-.000187	-8967.3376	181.3934	3.2472E-05	31.1366	1.6119
259.200	1.18E-05	-7619.5244	186.8206	2.3379E-05	26.4567	-.1043531
266.400	.000150	-6277.1209	181.5898	1.5760E-05	21.7956	-1.3487
273.600	.000239	-5004.6315	168.8619	9.5747E-06	17.3772	-2.1869
280.800	.000288	-3845.5097	151.3157	4.7227E-06	13.3525	-2.6871
288.000	.000307	-2825.6856	131.1456	1.0652E-06	9.8114	-2.9157
295.200	.000303	-1957.0131	110.0829	-1.5569E-06	6.7952	-2.9350
302.400	.000284	-1240.4922	89.4334	-3.3099E-06	4.3073	-2.8009
309.600	.000256	-669.1719	70.1263	-4.3569E-06	2.3235	-2.5622
316.800	.000222	-230.6738	52.7680	-4.8502E-06	.8009506	-2.2596
324.000	.000186	90.6877	37.6986	-4.9269E-06	.3148878	-1.9264
331.200	.000151	312.1859	25.0457	-4.7061E-06	1.0840	-1.5883
338.400	.000118	451.3453	14.7753	-4.2875E-06	1.5672	-1.2646
345.600	8.89E-05	524.9502	6.7371	-3.7522E-06	1.8227	-.9682826
352.800	6.40E-05	548.3594	.7032189	-3.1638E-06	1.9040	-.7077934
360.000	4.34E-05	535.0766	-3.5991	-2.5698E-06	1.8579	-.4873087
367.200	2.70E-05	496.5317	-6.4618	-2.0042E-06	1.7241	-.3078766
374.400	1.45E-05	442.0264	-8.1756	-1.4897E-06	1.5348	-.1681641
381.600	5.54E-06	378.8036	-9.0155	-1.0396E-06	1.3153	-.0651471
388.800	-4.46E-07	312.2035	-9.2309	-6.6080E-07	1.0840	.0053168
396.000	-3.97E-06	245.8790	-9.0388	-3.5484E-07	.8537466	.0480371
403.200	-5.56E-06	182.0448	-8.6205	-1.2023E-07	.6321000	.0681601
410.400	-5.70E-06	121.7440	-8.1197	4.6322E-08	.4227222	.0709497
417.600	-4.89E-06	65.1212	-7.6423	1.4877E-07	.2261154	.0616659

424.800	-3.56E-06	11.6952	-7.2564	1.9088E-07	.0406084	.0455267
432.000	-2.14E-06	-39.3707	-4.3336	1.7571E-07	.1367038	.7663653
439.200	-1.03E-06	-50.7082	-.2465253	1.2633E-07	.1760702	.3689254
446.400	-3.21E-07	-42.9207	1.4951	7.4994E-08	.1490301	.1148621
453.600	4.98E-08	-29.1786	1.8444	3.5466E-08	.1013147	-.0178438
460.800	1.90E-07	-16.3616	1.5352	1.0499E-08	.0568113	-.0680476
468.000	2.01E-07	-7.0722	1.0310	-2.3488E-09	.0245564	-.0719892
475.200	1.56E-07	-1.5147	.5705108	-7.0566E-09	.0052595	-.0559341
482.400	9.94E-08	1.1431	.2410019	-7.2603E-09	.0039692	-.0355961
489.600	5.16E-08	1.9557	.0462909	-5.5614E-09	.0067906	-.0184903
496.800	1.93E-08	1.8097	-.0451649	-3.4971E-09	.0062837	-.0069141
504.000	1.27E-09	1.3053	-.0716930	-1.7893E-09	.0045323	-.0004548
511.200	-6.46E-09	.7773281	-.0650009	-6.4747E-10	.0026991	.0023137
518.400	-8.05E-09	.3692934	-.0462877	-1.8838E-11	.0012823	.0028844
525.600	-6.73E-09	.1107852	-.0272248	2.4436E-10	.0003847	.0024109
532.800	-4.53E-09	-.0227432	-.0126987	2.9263E-10	7.8969E-05	.0016241
540.000	-2.52E-09	-.0720767	-.0036058	2.4065E-10	.0002503	.0009017
547.200	-1.07E-09	-.0746671	.0010191	1.6020E-10	.0002593	.0003830
554.400	-2.11E-10	-.0574011	.0026699	8.7789E-11	.0001993	7.5503E-05
561.600	1.95E-10	-.0362210	.0026907	3.6462E-11	.0001258	-6.9726E-05
568.800	3.14E-10	-.0186555	.0020345	6.3757E-12	6.4776E-05	-.0001125
576.000	2.86E-10	-.0069241	.0012600	-7.6481E-12	2.4042E-05	-.0001026
583.200	2.04E-10	-.0005119	.0006274	-1.1725E-11	1.7776E-06	-7.3097E-05
590.400	1.18E-10	.0021109	.0002126	-1.0848E-11	7.3294E-06	-4.2139E-05
597.600	4.79E-11	.0025492	-8.5378E-07	-8.2934E-12	8.8515E-06	-1.7149E-05
604.800	-1.77E-12	.0020986	-6.0309E-05	-5.7453E-12	7.2867E-06	6.3330E-07
612.000	-3.49E-11	.0016808	-5.6127E-05	-3.6733E-12	5.8360E-06	5.2851E-07
619.200	-5.47E-11	.0012904	-5.1177E-05	-2.0444E-12	4.4804E-06	8.4630E-07
626.400	-6.43E-11	.0009438	-4.4474E-05	-8.1950E-13	3.2771E-06	1.0157E-06
633.600	-6.65E-11	.0006499	-3.6962E-05	5.4259E-14	2.2567E-06	1.0711E-06
640.800	-6.35E-11	.0004116	-2.9349E-05	6.3622E-13	1.4290E-06	1.0436E-06
648.000	-5.73E-11	.0002273	-2.2137E-05	9.8647E-13	7.8924E-07	9.5977E-07
655.200	-4.93E-11	9.2795E-05	-1.5653E-05	1.1620E-12	3.2220E-07	8.4140E-07
662.400	-4.06E-11	1.9055E-06	-1.0085E-05	1.2139E-12	6.6163E-09	7.0523E-07
669.600	-3.18E-11	-5.2425E-05	-5.5181E-06	1.1862E-12	1.8203E-07	5.6326E-07
676.800	-2.35E-11	-7.7555E-05	-1.9669E-06	1.1149E-12	2.6929E-07	4.2320E-07
684.000	-1.58E-11	-8.0748E-05	5.9730E-07	1.0281E-12	2.8037E-07	2.8908E-07
691.200	-8.68E-12	-6.8954E-05	2.2211E-06	9.4606E-13	2.3942E-07	1.6196E-07
698.400	-2.14E-12	-4.8765E-05	2.9506E-06	8.8152E-13	1.6932E-07	4.0683E-08
705.600	4.01E-12	-2.6466E-05	2.8187E-06	8.4028E-13	9.1896E-08	-7.7318E-08
712.800	9.96E-12	-8.1754E-06	1.8379E-06	8.2129E-13	2.8387E-08	-1.9512E-07
720.000	1.58E-11	0.0000	0.0000	8.1680E-13	0.0000	-3.1541E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

Pile-head deflection	=	.25000000 in
Computed slope at pile head	=	-.00015192
Maximum bending moment	=	-1172291. lbs-in
Maximum shear force	=	40441.56792 lbs
Depth of maximum bending moment	=	0.00000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	5
Number of zero deflection points	=	8

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = .500000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	.500000	-2240142.	72737.8246	0.0000	7778.2704	-743.7799
7.200	.491157	-1738192.	66692.5203	-.0021811	6035.3904	-839.6170
14.400	.468592	-1279769.	60281.5115	-.0038357	4443.6413	-941.2358
21.600	.435923	-870139.	53209.7623	-.0050144	3021.3148	-1023.1390
28.800	.396385	-513548.	45731.2542	-.0057730	1783.1532	-1054.2244
36.000	.352793	-211609.	38099.4082	-.0061705	734.7521	-1065.7328
43.200	.307530	35083.3475	30448.0441	-.0062673	121.8172	-1059.6461
50.400	.262543	226843.	23040.2113	-.0061237	787.6501	-998.0852
57.600	.219348	366862.	16308.7055	-.0057982	1273.8277	-871.7775
64.800	.179049	461689.	10497.1163	-.0053440	1603.0854	-742.5529
72.000	.142395	518021.	5609.3968	-.0048068	1798.6836	-615.1470
79.200	.109831	542464.	1618.4574	-.0042254	1883.5553	-493.4473
86.400	.081549	541327.	-1527.6607	-.0036313	1879.6064	-380.4744
93.600	.057541	520466.	-3899.6255	-.0030491	1807.1722	-278.4047
100.800	.037641	485172.	-5580.9455	-.0024978	1684.6251	-188.6286
108.000	.021572	440100.	-6662.6022	-.0019905	1528.1249	-111.8316
115.200	.008978	389231.	-7238.3313	-.0015358	1351.4950	-48.0932
122.400	-.000544	335868.	-7400.6448	-.0011383	1166.2084	3.0061
129.600	-.007414	282661.	-7237.6306	-.0007992	981.4628	42.2756
136.800	-.012052	231646.	-6830.5269	-.0005172	804.3268	70.8087
144.000	-.014862	184302.	-6252.0318	-.0002892	639.9365	89.8844
151.200	-.016217	141617.	-5565.2812	-.0001105	491.7253	100.8797
158.400	-.016453	104162.	-4823.4122	2.4237E-05	361.6724	105.1950
165.600	-.015867	72159.7361	-4069.6179	.0001209	250.5546	104.1923
172.800	-.014712	45559.1526	-3337.5925	.0001854	158.1915	99.1481
180.000	-.013197	24098.4045	-2652.2732	.0002236	83.6750	91.2184
187.200	-.011492	7366.4183	-2030.7848	.0002409	25.5778	81.4173
194.400	-.009728	-5144.8968	-1483.5057	.0002421	17.8642	70.6047
201.600	-.008006	-13996.0639	-1015.1845	.0002316	48.5974	59.4845
208.800	-.006393	-19763.5539	-626.0478	.0002131	68.6235	48.6090
216.000	-.004937	-23011.1521	-312.8528	.0001896	79.8998	38.3896
223.200	-.003662	-24268.6339	-69.8510	.0001637	84.2661	29.1109
230.400	-.002579	-24017.0068	110.3601	.0001373	83.3924	20.9477
237.600	-.001686	-22679.4487	236.1107	.0001117	78.7481	13.9830
244.800	-.000971	-20617.0134	316.0611	8.7916E-05	71.5869	8.2255
252.000	-.000420	-18128.1695	358.7313	6.6675E-05	62.9450	3.6274
259.200	-1.13E-05	-15451.2822	372.1496	4.8265E-05	53.6503	.0999113
266.400	.000275	-12769.2155	363.6078	3.2793E-05	44.3376	-2.4726
273.600	.000461	-10215.3304	339.5109	2.0192E-05	35.4699	-4.2210
280.800	.000566	-7880.2592	305.3042	1.0271E-05	27.3620	-5.2809
288.000	.000609	-5818.9503	265.4637	2.7605E-06	20.2047	-5.7859
295.200	.000606	-4057.5826	223.5342	-2.6542E-06	14.0888	-5.8612
302.400	.000571	-2600.0575	182.2026	-6.3043E-06	9.0280	-5.6198
309.600	.000515	-1433.8648	143.3929	-8.5158E-06	4.9787	-5.1606

316.800	.000448	-535.1996	108.3741	-9.5954E-06	1.8583	-4.5668
324.000	.000377	126.7223	77.8720	-9.8193E-06	.4400081	-3.9060
331.200	.000307	586.1567	52.1781	-9.4285E-06	2.0353	-3.2312
338.400	.000241	878.0877	31.2521	-8.6257E-06	3.0489	-2.5816
345.600	.000182	1036.1873	14.8127	-7.5762E-06	3.5979	-1.9849
352.800	.000132	1091.3900	2.4169	-6.4098E-06	3.7895	-1.4584
360.000	9.00E-05	1070.9909	-6.4735	-5.2243E-06	3.7187	-1.0112
367.200	5.66E-05	998.1722	-12.4392	-4.0899E-06	3.4659	-.6459623
374.400	3.11E-05	891.8669	-16.0622	-3.0537E-06	3.0968	-.3604405
381.600	1.27E-05	766.8763	-17.8956	-2.1443E-06	2.6628	-.1488386
388.800	2.55E-07	634.1699	-18.4424	-1.3762E-06	2.2020	-.0030414
396.000	-7.15E-06	501.3058	-18.1420	-7.5363E-07	1.7406	.0864854
403.200	-1.06E-05	372.9251	-17.3626	-2.7434E-07	1.2949	.1300154
410.400	-1.11E-05	251.2845	-16.3974	6.7880E-08	.8725156	.1381069
417.600	-9.62E-06	136.8033	-15.4633	2.8065E-07	.4750114	.1213475
424.800	-7.06E-06	28.6127	-14.7015	3.7134E-07	.0993497	.0902659
432.000	-4.27E-06	-74.8984	-8.8679	3.4596E-07	.2600640	1.5302
439.200	-2.08E-06	-99.0845	-.6809020	2.5058E-07	.3440433	.7439633
446.400	-6.64E-07	-84.7034	2.8538	1.4981E-07	.2941091	.2378943
453.600	8.01E-08	-57.9900	3.6070	7.1583E-08	.2013540	-.0286772
460.800	3.67E-07	-32.7631	3.0311	2.1828E-08	.1137608	-.1312832
468.000	3.94E-07	-14.3420	2.0500	-3.9970E-09	.0497986	-.1412521
475.200	3.09E-07	-3.2434	1.1431	-1.3638E-08	.0112617	-.1106693
482.400	1.98E-07	2.1181	.4893573	-1.4255E-08	.0073547	-.0709160
489.600	1.04E-07	3.8034	.1003139	-1.1009E-08	.0132062	-.0371516
496.800	3.95E-08	3.5627	-.0843403	-6.9702E-09	.0123704	-.0141412
504.000	3.36E-09	2.5889	-.1395840	-3.5976E-09	.0089891	-.0012042
511.200	-1.23E-08	1.5527	-.1280332	-1.3270E-09	.0053912	.0044128
518.400	-1.57E-08	.7451957	-.0918443	-6.7242E-11	.0025875	.0056397
525.600	-1.33E-08	.2300978	-.0544069	4.6746E-10	.0007990	.0047596
532.800	-9.02E-09	-.0382638	-.0256486	5.7263E-10	.0001329	.0032289
540.000	-5.04E-09	-.1392413	-.0075219	4.7531E-10	.0004835	.0018063
547.200	-2.17E-09	-.1465786	.0017800	3.1861E-10	.0005090	.0007775
554.400	-4.55E-10	-.1136098	.0051663	1.7597E-10	.0003945	.0001631
561.600	3.63E-10	-.0721842	.0052855	7.4107E-11	.0002506	-.0001300
568.800	6.12E-10	-.0374984	.0040289	1.3974E-11	.0001302	-.0002191
576.000	5.64E-10	-.0141687	.0025128	-1.4353E-11	4.9197E-05	-.0002021
583.200	4.05E-10	-.0013146	.0012632	-2.2841E-11	4.5646E-06	-.0001450
590.400	2.35E-10	.0040207	.0004376	-2.1358E-11	1.3961E-05	-8.4278E-05
597.600	9.74E-11	.0049871	8.6247E-06	-1.6419E-11	1.7316E-05	-3.4888E-05
604.800	-1.12E-12	.0041449	-.0001155	-1.1413E-11	1.4392E-05	4.0174E-07
612.000	-6.69E-11	.0033236	-.0001104	-7.3181E-12	1.1540E-05	1.0150E-06
619.200	-1.07E-10	.0025548	-.0001008	-4.0953E-12	8.8709E-06	1.6489E-06
626.400	-1.26E-10	.0018716	-8.7737E-05	-1.6686E-12	6.4984E-06	1.9891E-06
633.600	-1.31E-10	.0012914	-7.3003E-05	6.5500E-14	4.4840E-06	2.1036E-06
640.800	-1.25E-10	.0008203	-5.8038E-05	1.2232E-12	2.8483E-06	2.0534E-06
648.000	-1.13E-10	.0004557	-4.3838E-05	1.9228E-12	1.5821E-06	1.8912E-06
655.200	-9.73E-11	.0001890	-3.1053E-05	2.2762E-12	6.5640E-07	1.6601E-06
662.400	-8.01E-11	8.4893E-06	-2.0062E-05	2.3845E-12	2.9477E-08	1.3930E-06
669.600	-6.29E-11	-9.9850E-05	-1.1037E-05	2.3344E-12	3.4670E-07	1.1139E-06
676.800	-4.65E-11	-.0001504	-4.0094E-06	2.1972E-12	5.2237E-07	8.3816E-07
684.000	-3.13E-11	-.0001576	1.0735E-06	2.0283E-12	5.4717E-07	5.7375E-07
691.200	-1.73E-11	-.0001350	4.3015E-06	1.8679E-12	4.6869E-07	3.2291E-07
698.400	-4.40E-12	-9.5643E-05	5.7642E-06	1.7415E-12	3.3209E-07	8.3410E-08
705.600	7.76E-12	-5.1979E-05	5.5255E-06	1.6606E-12	1.8048E-07	-1.4971E-07
712.800	1.95E-11	-1.6075E-05	3.6096E-06	1.6233E-12	5.5817E-08	-3.8249E-07
720.000	3.11E-11	0.0000	0.0000	1.6144E-12	0.0000	-6.2019E-07

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection	=	.50000000 in
Computed slope at pile head	=	-.00027519
Maximum bending moment	=	-2240142. lbs-in
Maximum shear force	=	72737.82459 lbs
Depth of maximum bending moment	=	0.00000 in
Depth of maximum shear force	=	0.00000 in
Number of iterations	=	5
Number of zero deflection points	=	8

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Displacement and Slope (BC Type 5)
Specified deflection at pile head = 1.000000 in
Specified slope at pile head = 0.000E+00 in/in
Specified axial load at pile head = .000 lbs

Depth X in	Deflect. y in	Moment M lbs-in	Shear V lbs	Slope S Rad.	Total Stress lbs/in**2	Soil Res p lbs/in
0.000	1.000000	-3865671.	106734.	0.0000	13422.4682	-743.7799
7.200	.984741	-3118948.	100689.	-.0038293	10829.6809	-839.6170
14.400	.944858	-2415751.	94277.8028	-.0068637	8388.0246	-941.2359
21.600	.885904	-1761348.	87114.2628	-.0091537	6115.7907	-1048.6364
28.800	.813044	-1161306.	79156.6248	-.0107561	4032.3114	-1161.8186
36.000	.731017	-621492.	70363.2598	-.0117335	2157.9595	-1280.7827
43.200	.644082	-148075.	60692.5389	-.0121554	514.1484	-1405.5286
50.400	.555979	252480.	50102.8326	-.0120982	876.6674	-1536.0564
57.600	.469869	573406.	38552.5114	-.0116454	1990.9932	-1672.3661
64.800	.388286	807636.	26734.9180	-.0108882	2804.2930	-1610.2987
72.000	.313079	958389.	16068.8431	-.0099200	3327.7391	-1352.4998
79.200	.245438	1039028.	7230.1132	-.0088249	3607.7352	-1102.7029
86.400	.186000	1062502.	136.3006	-.0076728	3689.2447	-867.8006
93.600	.134950	1040990.	-5338.3717	-.0065195	3614.5502	-652.9418
100.800	.092118	985630.	-9350.8080	-.0054085	3422.3262	-461.6239
108.000	.057068	906339.	-12077.6842	-.0043712	3147.0098	-295.8417
115.200	.029173	811711.	-13705.3067	-.0034293	2818.4419	-156.2757
122.400	.007687	708982.	-14420.9143	-.0025956	2461.7445	-42.5042
129.600	-.008203	604050.	-14405.5381	-.0018757	2097.3962	46.7754
136.800	-.019323	501543.	-13828.4438	-.0012696	1741.4676	113.5286
144.000	-.026484	404921.	-12843.1007	-.0007726	1405.9740	160.1778
151.200	-.030449	316602.	-11584.5647	-.0003770	1099.3125	189.4155
158.400	-.031914	238103.	-10168.1153	-7.2910E-05	826.7458	204.0426
165.600	-.031499	170181.	-8688.9642	.0001509	590.9068	206.8327
172.800	-.029740	112982.	-7222.8363	.0003062	392.2976	200.4250
180.000	-.027090	66172.3031	-5827.2264	.0004044	229.7649	187.2444
187.200	-.023917	29069.6480	-4543.1388	.0004566	100.9363	169.4466
194.400	-.020515	751.1042	-3397.1391	.0004730	2.6080	148.8866
201.600	-.017106	-19849.1556	-2403.5627	.0004625	68.9207	127.1068

208.800	-.013855	-33860.1989	-1566.7524	.0004330	117.5701	105.3405
216.000	-.010871	-42410.3902	-883.2217	.0003912	147.2583	84.5291
223.200	-.008221	-46578.5911	-343.6647	.0003424	161.7312	65.3478
230.400	-.005939	-47359.1612	65.2420	.0002909	164.4415	48.2374
237.600	-.004032	-45639.1056	359.2790	.0002400	158.4691	33.4396
244.800	-.002484	-42185.5431	555.3810	.0001918	146.4776	21.0332
252.000	-.001270	-37641.6190	670.5909	.0001480	130.7001	10.9695
259.200	-.000352	-32529.0338	721.2595	.0001096	112.9480	3.1051
266.400	.000308	-27255.4820	722.4699	7.6791E-05	94.6371	-2.7689
273.600	.000753	-22125.4677	687.6606	4.9718E-05	76.8245	-6.9004
280.800	.001024	-17353.1689	628.4181	2.8074E-05	60.2541	-9.5559
288.000	.001158	-13076.2465	554.4067	1.1391E-05	45.4036	-11.0029
295.200	.001188	-9369.7123	473.4070	-9.1505E-07	32.5337	-11.4971
302.400	.001145	-6259.1858	391.4341	-9.4835E-06	21.7333	-11.2732
309.600	.001052	-3733.0609	312.9103	-1.4962E-05	12.9620	-10.5390
316.800	.000929	-1753.2769	240.8701	-1.7970E-05	6.0878	-9.4722
324.000	.000793	-264.5311	177.1799	-1.9076E-05	.9185107	-8.2196
331.200	.000654	798.1132	122.7574	-1.8783E-05	2.7712	-6.8978
338.400	.000522	1503.1754	77.7807	-1.7522E-05	5.2194	-5.5957
345.600	.000402	1918.1551	41.8782	-1.5646E-05	6.6603	-4.3772
352.800	.000297	2106.2211	14.2958	-1.3440E-05	7.3133	-3.2846
360.000	.000209	2124.0142	-5.9615	-1.1120E-05	7.3750	-2.3424
367.200	.000137	2020.3758	-20.0136	-8.8482E-06	7.0152	-1.5609
374.400	8.11E-05	1835.8182	-29.0147	-6.7341E-06	6.3744	-.9393513
381.600	3.99E-05	1602.5646	-34.0840	-4.8490E-06	5.5645	-.4688010
388.800	1.13E-05	1345.0084	-36.2572	-3.2330E-06	4.6702	-.1348489
396.000	-6.66E-06	1080.4616	-36.4527	-1.9032E-06	3.7516	.0805415
403.200	-1.61E-05	820.0900	-35.4518	-8.6127E-07	2.8475	.1974895
410.400	-1.91E-05	569.9564	-33.8871	-9.9186E-08	1.9790	.2371475
417.600	-1.75E-05	332.1164	-32.2375	3.9537E-07	1.1532	.2210694
424.800	-1.34E-05	105.7367	-30.8263	6.3542E-07	.3671413	.1709329
432.000	-8.38E-06	-111.7819	-19.4127	6.3211E-07	.3881314	2.9995
439.200	-4.27E-06	-173.8055	-3.1152	4.7554E-07	.6034914	1.5276
446.400	-1.53E-06	-156.6409	4.3532	2.9437E-07	.5438921	.5470189
453.600	-2.62E-08	-111.1189	6.3563	1.4757E-07	.3858294	.0093860
460.800	5.98E-07	-65.1102	5.6195	5.0956E-08	.2260772	-.2140603
468.000	7.08E-07	-30.1985	3.9366	-1.2970E-09	.1048559	-.2534086
475.200	5.79E-07	-8.4235	2.2778	-2.2471E-08	.0292481	-.2073712
482.400	3.84E-07	2.6015	1.0362	-2.5663E-08	.0090329	-.1375167
489.600	2.09E-07	6.4975	.2710544	-2.0675E-08	.0225608	-.0750177
496.800	8.63E-08	6.5046	-.1102149	-1.3546E-08	.0225856	-.0308904
504.000	1.44E-08	4.9104	-.2399778	-7.2881E-09	.0170501	-.0051548
511.200	-1.87E-08	3.0490	-.2344276	-2.9244E-09	.0105867	.0066966
518.400	-2.77E-08	1.5347	-.1745824	-4.1142E-10	.0053287	.0099271
525.600	-2.46E-08	.5349816	-.1070987	7.2326E-10	.0018576	.0088184
532.800	-1.73E-08	-.0075563	-.0530432	1.0124E-09	2.6237E-05	.0061970
540.000	-1.00E-08	-.2288408	-.0177847	8.8281E-10	.0007946	.0035970
547.200	-4.59E-09	-.2636559	.0010832	6.1280E-10	.0009155	.0016441
554.400	-1.22E-09	-.2132429	.0085735	3.5135E-10	.0007404	.0004366
561.600	4.69E-10	-.1401972	.0095406	1.5757E-10	.0004868	-.0001679
568.800	1.05E-09	-.0758579	.0075822	3.9123E-11	.0002634	-.0003761
576.000	1.03E-09	-.0310143	.0048973	-1.9469E-11	.0001077	-.0003697
583.200	7.70E-10	-.0053367	.0025739	-3.9399E-11	1.8530E-05	-.0002757
590.400	4.65E-10	.0060504	.0009820	-3.9007E-11	2.1008E-05	-.0001665
597.600	2.08E-10	.0088048	.0001144	-3.0863E-11	3.0572E-05	-7.4492E-05
604.800	2.05E-11	.0076975	-.0001803	-2.1816E-11	2.6728E-05	-7.3546E-06
612.000	-1.06E-10	.0062090	-.0002009	-1.4191E-11	2.1559E-05	1.6098E-06
619.200	-1.84E-10	.0048040	-.0001849	-8.1536E-12	1.6680E-05	2.8459E-06
626.400	-2.24E-10	.0035465	-.0001619	-3.5755E-12	1.2314E-05	3.5320E-06
633.600	-2.35E-10	.0024720	-.0001356	-2.7587E-13	8.5834E-06	3.7921E-06
640.800	-2.28E-10	.0015942	-.0001085	1.9534E-12	5.5354E-06	3.7390E-06
648.000	-2.07E-10	.0009102	-8.2510E-05	3.3264E-12	3.1603E-06	3.4701E-06
655.200	-1.80E-10	.0004061	-5.8981E-05	4.0480E-12	1.4099E-06	3.0657E-06
662.400	-1.49E-10	6.0851E-05	-3.8628E-05	4.3040E-12	2.1129E-07	2.5881E-06
669.600	-1.18E-10	-.0001502	-2.1813E-05	4.2550E-12	5.2147E-07	2.0825E-06
676.800	-8.76E-11	-.0002533	-8.6339E-06	4.0339E-12	8.7939E-07	1.5785E-06
684.000	-5.96E-11	-.0002745	9.8028E-07	3.7445E-12	9.5317E-07	1.0921E-06
691.200	-3.37E-11	-.0002391	7.1741E-06	3.4629E-12	8.3037E-07	6.2839E-07
698.400	-9.71E-12	-.0001712	1.0099E-05	3.2379E-12	5.9447E-07	1.8407E-07
705.600	1.29E-11	-9.3722E-05	9.8639E-06	3.0927E-12	3.2542E-07	-2.4938E-07
712.800	3.48E-11	-2.9166E-05	6.5085E-06	3.0253E-12	1.0127E-07	-6.8267E-07
720.000	5.65E-11	0.0000	0.0000	3.0093E-12	0.0000	-1.1252E-06

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

Pile-head deflection	=	1.00000000	in
Computed slope at pile head	=	-.00040939	
Maximum bending moment	=	-3865671.	lbs-in
Maximum shear force	=	106734.11601	lbs
Depth of maximum bending moment	=	0.00000	in
Depth of maximum shear force	=	0.00000	in
Number of iterations	=	7	
Number of zero deflection points	=	8	

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment in
Type 2 = Shear and Slope, M = Pile-head Moment lbs-in
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force lbs
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head in-lbs/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load lbs	Pile-Head Deflection in	Maximum Moment in-lbs	Maximum Shear lbs
4	y= .250000	M= 0.000	0.0000	.2500000	380456.	19122.3575
4	y= .500000	M= 0.000	0.0000	.5000000	738909.	34135.6700
4	y= 1.000000	M= 0.000	0.0000	1.0000000	1374722.	51581.1770
5	y= .250000	S= 0.000	0.0000	.2500000	-1172291.	40441.5679
5	y= .500000	S= 0.000	0.0000	.5000000	-2240142.	72737.8246
5	y= 1.000000	S= 0.000	0.0000	1.0000000	-3865671.	106734.

The analysis ended normally.

APPENDIX C

State of California | Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. JON HAMAGUCHI
Office of Special Funded Projects

Attn: MR. SIDNEY DADRAS

Date: August 3, 2009
File: 12-ORA-57-PM 12.54
12-0F0401

Katella Ave. UC (widen)
Bridge No. 55-0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Subject: Review of the Draft Foundation Report

On July 22, 2009, we received a draft Foundation Report for the right widening of Katella Avenue UC Bridge No. 55-0401. The proposed bridge widening is part of the northbound SR-57 widening between Katella and Lincoln Avenues. The following comments are based on review of the subject report dated July 13, 2009, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

Table 1

- The reason for using same design parameters for granular/cohesive and clay/silt soils.

4.1 Response Spectra

- Has the seismic design evaluation and Acceleration Response Spectra (ARS) Curve been reviewed by Dr. Mohammed Islam as previously requested.

4.3 Foundation Recommendations

- Working Stress Design (WSD) in accordance with current Caltrans' practice and Load and Resistant Factor Design (LRFD) as specified in the current LRFD BDS (AASHTO LRFD Bridge Design Specifications (BDS) with interims, and Caltrans Amendments) should be followed in design of abutments and bents, respectively.

- Tables 3, 4, 5, 6 & 7 of Caltrans Memo to Designers (MTD) 3-1, July 2008 should be followed in presenting foundation design data, loads and recommendations.

- The 4th sentence should be replaced with "Caltrans Standard Plan Class 140 (Alternative "X") concrete piles are recommended for the bridge widening". Also other pile alternatives should be discussed and the reason (s) for not recommending.

4.3.1 Axial Capacities of Precast Concrete Driven Piles

- 4th sentence of 1st paragraph: in Foundation Report stage, foundation configuration should have been determined, assumptions are for preliminary foundation report.

- It should be mentioned if the axial capacity of the piles are attributed to friction, end bearing or combination of both.

Table 5

- Based on As Built records and Driven Pile Program output, abutment piles are too short and bent pile tips may need to be lowered a few feet.

- Pile Data Table should be modified per Table 5 of Caltrans MTD 3-1.

- Design pile tip elevations should be rounded down for ease of construction.

- Settlement design tip elevation should be provided in Pile Data Table and other foundation design tables (MTD 3-1).

- Since tension load is half the compression load, a separate design tip should be provided for tension in Pile Data Table and other foundation design tables (MTD 3-1).

- Letters should be used instead of numbers for different design tips in Pile Data Table and other foundation design tables (MTD 3-1).

5.0 Construction Considerations

- Provisions of Caltrans Standard Specifications, Section 49-1.06 should be complied for piles extending through more than five feet of fill.

- It should be specified that driven piles be installed according to Caltrans Standard Specifications and pile drivability analysis be conducted prior to pile installation to aid in the hammer selection and generation of pile driving acceptance criteria.

5.4 Earthwork

- Embankment within 150 feet of bridge abutments shall be compacted to a relative compaction of not less than 95 percent (Caltrans Standard Specs. Section 19-5.03).

Additional Comments

- Structure approach slab and wing walls at both abutments should be discussed.
- Slope paving: discuss abutment slopes' steepness and/or pavement according to Caltrans Standard Specifications 72-6.
- Slope Stability: discuss global stability at abutments using ultimate and peak shear strength in static and pseudo-static analysis, respectively and the seismic force applied to the soil mass. Method used to compute the static and pseudo-static factor of safety for the most critical circular failure surfaces.
- Settlement waiting period should be specified before piles can be driven at abutments.

Appendix A -- Laboratory Test Results

- A summary table should be provided for all laboratory tests performed.

Log of Test Borings (LOTB)

- Figure 2 with sheet Nos. in parenthesis should be deleted from LOTB and Soil Legend sheets and referred to as LOTB sheets in report text.
- Single post mile (i.e. 12.54) instead of post mile range should be provided in Bottom title blocks of LOTB and Soil Legend sheets.
- EA number should be changed to 0F0401 in LOTB, Soil Legend and report text.
- Boring number should comply with Caltrans Soil and Rock Logging Manual (Section 2.3). Boring number in the report text and laboratory test results should also be changed accordingly.
- Soil Legend sheets (sheet 1 of 4 & 2 of 4) should be placed after LOTB sheet as sheets 2 of 4 and 3 of 4.
- If available, pocket penetrometer (PP) or pocket torvane (TV) values should be shown at the end of each cohesive soil layer. Description and consistency should be based on those values rather than blow counts.

- Use ASTM D 2488-06 standard to describe the plasticity of the fine-grained soils based on observations made during the toughness test as indicated in Figure 2-15 of Caltrans Soil and Rock Logging Manual.

- Correction factor for conversion of 2.4" sampler blow count to 1.4" Standard Penetration Test sampler blow count for granular and cohesive soils should be noted on LOTB sheet.

- Apparent density of granular soil and consistency of cohesive soils should be based on corrected blow counts of both samplers (2.4" & 1.4") for hammer efficiency, in addition to converted blow counts of 2.4" to 1.4" sampler blow counts. However, the actual blow counts (raw field blow counts) as currently shown on LOTB should not be changed.

- The following soil group names should be modified: "SILTY CLAY (CL)" to SILTY LEAN CLAY (CL), "CLAYEY SILT (ML)" to ELASTIC SILT (MH), "CLAYEY SILT WITH SAND (ML)" to ELASTIC SILT WITH SAND (MH), "SANDY SILT WITH CLAY (ML)" to SANDY ELASTIC SILT (MH), "SAND (SP)" to POORLY GRADED SAND (SP), "SAND WITH SILT (SP)" to POORLY GRADED SAND WITH SILT (SP), "SAND WITH GRAVEL (SP)" to POORLY GRADED SAND WITH GRAVEL (SP).

- The group symbol (CL) in "SILTY CLAY" should be changed to (CL-ML).

- Consistency terms (i.e. very soft, stiff, etc.) should be used for sandy silt, clayey silt with sand (Elastic silt with sand) and sandy silt with clay (sandy elastic silt).

- Dotted lines marking elevation intervals should not carry through the boring graphic column which could be mistaken as a break in the layer.

- Legend notes and borings by others plotted on Plan View should be deleted. Only the modified borings B-1, B-2, CPT-1 should be plotted on Plan View.

- The word POMONA with direction arrow on Plan view should be placed on east side of the centerline SR-57.

- In Plan View: provisions of notes c, d, e, g, I, & l in Section 5.2.3.3 of Caltrans Soil and Rock Manual should be followed.

- In Profile View: provisions of notes b, j & k in Section 5.2.3.4 of Caltrans Soil and Rock Manual should be followed.

- Contents of notes a & b in Section 5.2.3.5 of Caltrans Soil and Rock Manual should be included in LOTB sheet.

- Expiration date of Registered Professional Engineer's seal should be updated in Soil Legend, current and as built LOTB sheets.

- It is required to include a conversion factor in the report for converting As-Built LOTB elevations (Datum NGVD 29) to current elevations (Datum NAVD 88).

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by:

Date: 8/3/09

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
NO: C 48408
EXP: 6-30-2010
CIVIL
STATE OF CALIFORNIA

c: OGDS1 - LA. File
OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED AUGUST 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Katella Avenue, SR 57 NB Widening, dated July 13, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Table 1	Faramarz Gerami	The reason for using same design parameters for granular/cohesive and clay/silt soils.	We will revise the design parameters for clayey silt to 28 degrees and 500 psf.
2	4.1	Faramarz Gerami	Has the seismic design evaluation and Acceleration Response Spectra (ARS) Curve been reviewed by Dr. Mohammed Islam as previously requested.	We have provided the ARS curve and our report to Mr. Sidney Dadras and Dr. Mohammed Islam for review.
3	4.3	Faramarz Gerami	Working Stress Design (WSD) in accordance with current Caltrans' practice and Load and Resistant Factor Design (LRFD) as specified in the current LRFD BDS (AASHTO LRFD Bridge Design Specifications (BDS) with interims, and Caltrans Amendments) should be followed in design of abutments and bents, respectively.	We concur.
4	4.3	Faramarz Gerami	Tables 3, 4, 5, 6 & 7 of Caltrans Memo to Designers (MTD) 3-1, July 2008 should be followed in presenting foundation design data, loads and recommendations.	We will add Tables 6 and 7 of Caltrans MTD 3-1, dated July 2008 in our report.
5	4.3	Faramarz Gerami	The 4th sentence should be replaced with "Caltrans Standard Plan Class 140 (Alternative "X") concrete piles are recommended for the bridge widening". Also other pile alternatives should be discussed and the reason (s) for not recommending.	We will revise our report to incorporate this. We will include discussion of other pile alternatives.
6	4.3.1	Faramarz Gerami	4th sentence of 1st paragraph: in Foundation Report stage, foundation configuration should have been determined, Assumptions are for preliminary foundation report.	We concur. We will include the final configuration.
7	4.3.1	Faramarz Gerami	It should be mentioned if the axial capacity of the piles are attributed to friction, end bearing or combination of both.	Axial pile capacity of driven pile was estimated using both skin friction and end bearing. We will revise our report to indicate this.
8	Table 5	Faramarz Gerami	Based on As Built records and Driven Pile Program output, abutment piles are too short and bent pile tips may need to be lowered a few feet.	Abutment and bent piles with the design tip elevations shown in Table 5 will have the nominal resistance indicated in the table.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED AUGUST 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Katella Avenue, SR 57 NB Widening, dated July 13, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
9	Table 5	Faramarz Gerami	Pile Data Table should be modified per Table 5 of Caltrans MTD 3-1.	We will revise the table, if necessary, per Table 5 of Caltrans MTD 3-1.
10	Table 5	Faramarz Gerami	Design pile tip elevations should be rounded down for ease of construction.	We will revise the table accordingly.
11	Table 5	Faramarz Gerami	Settlement design tip elevation should be provided in Pile Data Table and other foundation design tables (MTD 3-1).	We will revise the table accordingly.
12	Table 5	Faramarz Gerami	Since tension load is half the compression load, a separate design tip should be provided for tension in Pile Data Table and other foundation design tables (MTD 3-1).	We will revise the table accordingly.
13	Table 5	Faramarz Gerami	Letters should be used instead of numbers for different design tips in Pile Data Table and other foundation design tables (MTD 3-1).	We will revise the table accordingly.
14	5.0	Faramarz Gerami	Provisions of Caltrans Standard Specifications, Section 49-1.06 should be complied for piles extending through more than five feet of fill.	We will revise our report accordingly.
15	5.0	Faramarz Gerami	It should be specified that driven piles be installed according to Caltrans Standard Specifications and pile drivability analysis be conducted prior to pile installation to aid in the hammer selection and generation of pile driving acceptance criteria.	We will revise our report accordingly.
16	5.4	Faramarz Gerami	Embankment within 150 feet of bridge abutments shall be compacted to a relative compaction of not less than 95 percent (Caltrans Standard Specs. Section 19-5.03).	We will revise our report accordingly.
17	Additional Comments	Faramarz Gerami	Structure approach slab and wing walls at both abutments should be discussed.	We will include the discussion in our report.
18	Additional Comments	Faramarz Gerami	Slope paving: discuss abutment slopes' steepness and/or pavement according to Caltrans Standard Specifications 72-6.	We will include the discussion in our report.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED AUGUST 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Katella Avenue, SR 57 NB Widening, dated July 13, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
19	Additional Comments	Faramarz Gerami	Slope Stability: discuss global stability at abutments using ultimate and peak shear strength in static and pseudo-static analysis, respectively and the seismic force applied to the soil mass. Method used to compute the static and pseudo-static factor of safety for the most critical circular failure surfaces.	Per Section 3.10 of Caltrans Guidelines for Structures Foundation Reports dated March 2006, slope stability analysis does not apply to bridge abutment footings constructed on newly constructed embankment.
20	Additional Comments	Faramarz Gerami	Settlement waiting period should be specified before piles can be driven at abutments.	No waiting period is required if sandy soils are used for the embankment fill.
21	Log of Test Borings (LOTB)	Faramarz Gerami	A summary table should be provided for all laboratory tests performed.	We will We will include the summary table.
22	Log of Test Borings (LOTB)	Faramarz Gerami	Figure 2 with sheet Nos. in parenthesis should be deleted from LOTB and Soil Legend sheets and referred to as LOTB sheets in report text.	We will revise LOTB and our report to incorporate this.
23	Log of Test Borings (LOTB)	Faramarz Gerami	Single post mile (i.e. 12.54) instead of post mile range should be provided in Bottom title blocks of LOTB and Soil Legend sheets.	We will revise LOTB to incorporate this.
24	Log of Test Borings (LOTB)	Faramarz Gerami	EA number should be changed to OF0401 in LOTB, Soil Legend and report text.	We will revise LOTB to incorporate this.
25	Log of Test Borings (LOTB)	Faramarz Gerami	Boring number should comply with Caltrans Soil and Rock Logging Manual (Section 2.3). Boring number in the report text and laboratory test results should also be changed accordingly.	We will revise LOTB and our report to incorporate this.
26	Log of Test Borings (LOTB)	Faramarz Gerami	Soil Legend sheets (sheet 1 of 4 & 2 of 4) should be placed after LOTB sheet as sheets 2 of 4 and 3 of 4.	We will revise LOTB to incorporate this.
27	Log of Test Borings (LOTB)	Faramarz Gerami	If available, pocket penetrometer (PP) or pocket torvane (TV) values should be shown at the end of each cohesive soil layer. Description and consistency should be based on those values rather than blow counts.	We will add PP where available and will revise description and consistency, as necessary.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED AUGUST 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Katella Avenue, SR 57 NB Widening, dated July 13, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
28	Log of Test Borings (LOTB)	Faramarz Gerami	Use ASTM D 2488-06 standard to describe the plasticity of the fine-grained soils based on observations made during the toughness test as indicated in Figure 2-15 of Caltrans Soil and Rock Logging Manual.	We will revise LOTB to incorporate this.
29	Log of Test Borings (LOTB)	Faramarz Gerami	Correction factor for conversion of 2.4" sampler blow count to 1.4" Standard Penetration Test sampler blow count for granular and cohesive soils should be noted on LOTB sheet.	We will revise LOTB to incorporate this.
30	Log of Test Borings (LOTB)	Faramarz Gerami	Apparent density of granular soil and consistency of cohesive soils should be based on corrected blow counts of both samplers (2.4" & 1.4") for hammer efficiency, in addition to converted blow counts of 2.4" to 1.4" sampler blow counts. However, the actual blow counts (raw field blow counts) as currently shown on LOTB should not be changed.	We will revise LOTB to incorporate this.
31	Log of Test Borings (LOTB)	Faramarz Gerami	The following soil group names should be modified: "SILTY CLAY (CL)" to SILTY LEAN CLAY (CL), "CLAYEY SILT (ML)" to ELASTIC SILT (MH), "CLAYEY SILT WITH SAND (ML)" to ELASTIC SILT WITH SAND (MH), "SANDY SILT WITH CLAY (ML)" to SANDY ELASTIC SILT (MH), "SAND (SP)" to POORLY GRADED SAND (SP), "SAND WITH SILT (SP)" to POORLY GRADED SAND WITH SILT (SP), "SAND WITH GRAVEL (SP)" to POORLY GRADED SAND WITH GRAVEL (SP).	We concur. We did not, however, encounter elastic silt.
32	Log of Test Borings (LOTB)	Faramarz Gerami	The group symbol (CL) in "SILTY CLAY" should be changed to (CL-ML).	We will revise LOTB to incorporate this.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED AUGUST 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Katella Avenue, SR 57 NB Widening, dated July 13, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
33	Log of Test Borings (LOTB)	Faramarz Gerami	Consistency terms (i.e. very soft, stiff, etc.) should be used for sandy silt, clayey silt with sand (Elastic silt with sand) and sandy silt with clay (sandy elastic silt).	Since we did not encountered elastic silt, the consistency term in LOTB is correct.
34	Log of Test Borings (LOTB)	Faramarz Gerami	Dotted lines marking elevation intervals should not carry through the boring graphic column which could be mistaken as a break in the layer.	We will revise LOTB to incorporate this.
35	Log of Test Borings (LOTB)	Faramarz Gerami	Legend notes and borings by others plotted on Plan View should be deleted. Only the modified borings B-1, B-2, CPT- 1 should be plotted on Plan View.	We will revise LOTB to incorporate this.
36	Log of Test Borings (LOTB)	Faramarz Gerami	The word POMONA with direction arrow on Plan view should be placed on east side of the centerline SR-57.	We will revise LOTB to incorporate this.
37	Log of Test Borings (LOTB)	Faramarz Gerami	In Plan View: provisions of notes c, d, e, g, I, & l in Section 5.2.3.3 of Caltrans Soil and Rock Manual should be followed.	We will revise LOTB to incorporate this.
38	Log of Test Borings (LOTB)	Faramarz Gerami	In Profile View: provisions of notes b, j & k in Section 5.2.3.4 of Caltrans Soil and Rock Manual should be followed.	We will revise LOTB to incorporate this.
39	Log of Test Borings (LOTB)	Faramarz Gerami	Contents of notes a & b in Section 5.2.3.5 of Caltrans Soil and Rock Manual should be included in LOTB sheet.	We will revise LOTB to incorporate this.
40	Log of Test Borings (LOTB)	Faramarz Gerami	Expiration date of Registered Professional Engineer's seal should be updated in Soil Legend, current and as built LOTB sheets.	We will revise LOTB to incorporate this.
41	Log of Test Borings (LOTB)	Faramarz Gerami	It is required to include a conversion factor in the report for converting As-Built LOTB elevations (Datum NGVD 29) to current elevations (Datum NAVD 88).	We will revise LOTB to incorporate this.

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. JON HAMAGUCHI
Office of Special Funded Projects

Date: December 3, 2009
File: 12-ORA-57-PM 12.54
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES

Katella Ave. UC (widen)
Bridge No. 55-0401

Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Subject: 2nd Review of the Draft Foundation Report

On October 28, 2009, we received a draft Foundation Report for the right widening of Katella Avenue UC Bridge No. 55-0401. The proposed bridge widening is part of the northbound SR-57 widening between Katella and Lincoln Avenues. The following comments are based on review of the subject report dated October 15, 2009, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

3.3 Table 2

- As built groundwater and bottom of boring elevations should not be modified.

3.4.2 Corrosion Potential

- Composite samples at different intervals for the entire boring depth should have been tested for corrosion evaluation.

4.1 Response Spectra

- 2008 USGS Deaggregated Hazard (Beta) curve should be used as design curve since there is a difference of about 16.7% between USGS and ARS online probabilistic data.

- QC/QA sheets should be included for all faults listed in calculated Spectra.

4.4 Table 5 – Pile Data Table

- Tension in the foot note should be deleted since no design tip is provided.

- Based on as built records and Driven Pile Program output, piles are too short at all support locations (15 to 25 feet at abutments 20 feet at bent). It should be noted that at both abutment locations piles shall be predrilled to original ground (elev. $\pm$ 162) and the axial capacity for the predrilled section should be ignored.

Plans

- In General Plan, Foundation Plan and LOTB sheets (current and as built) and other Plan sheets, the word "(widen)" should be added after bridge name. Also post mile 12.54 should be indicated in all plan sheets.

- In Foundation Plan, as built bottom of footing elevations should not be modified. Also Pile Data Table is different than Tables 5 – Pile Data Table in the report.

- In Index to Plans, General notes for seismic design and ARS Curve should be revised.

- Battered driven piles are not indicated in both abutment layout sheets.

Log of Test Borings

- Boring and CPT can not have the same number (i.e. A-09-001 and CPT-09-001). Corrections should also be made in the report, tables and test results.

- The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets.

- The laboratory test symbols should be attached to the boring stick.

- Add bridge name to both Soil Legend sheets (2 of 4 and 3 of 4).

- Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NAVD88.

<u>BORING A-09-001</u>

- There is not such a term as "clayey silt (elev. 163) or clayey silt with sand (elev. 129) ". It was suggested to use elastic silt in previous review comments but the response was that no elastic silt was encountered. However, clayey silt should be changed to an acceptable group name (see Caltrans Soil and Rock Manual).

- Delete the word "wet" at elevation 158 unless it is defining a perched water.

- Delete "with clay" in sandy silt with clay at elevation 134, and change medium dense to "hard".

- Change the word "loose" to medium dense at elevation 129.
- Delete the word "lean" in silty lean clay at elevation 114.
- Delete the sentence "Free groundwater encountered at 49 feet below existing grade during drilling" (also applies to Boring A-09-002).

BORING A-09-002

- Sand with silt (SP) at elevation 162 should be changed to poorly graded sand with silt (SP-SM), loose. Also delete loose at elevation 156 and move up "medium dense" from elevation 146 to 152.
- Consistency of sandy silt at elevation 132, should be stiff instead of loose.
- Delete the word "lean" in silty lean clay at elevations 117 and 107. Also consistency should be "medium stiff" instead of **stif.** at elevation 117.
- Delete "lean" in silty lean clay at elevation 112 and change medium dense to "stiff".
- Clayey silt should be changed to an acceptable group name at elevation 92 in compliance with Caltrans Soil and Rock Manual (same as A-09-001). Also consistency should be "stiff" instead of medium dense.

Appendix B

TABLE 4

- Permanent load per support should be provided (see Table 5 MTD 3-1).
- Total loads per support should be rounded up to nearest 10 kips.
- Compression load per support in Strength Limit State and Extreme Event Limit State does not apply to abutments and should not be provided (see Table 4 MTD 3-1).

TABLE 5

- Provided concrete pile design loads (i.e. Class 140) in second column.

- Total load per support should be rounded up to nearest 10 kips and provide permanent load per support.

TABLE 6

- Round up Service Limit State load per support to nearest 10 kips.

- Tension in the foot note should be deleted since no design tip is provided.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by:

Date: 12/3/2009

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Senior Transportation Engineer
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c: OGDS1 - LA. File
OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Katella Avenue UC Bridge # 55-0401 Widening, dated October 15, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	3.3 Table 2	Faramarz Gerami	As built groundwater and bottom of boring elevations should not be modified.	We will revise our report accordingly.
2	3.4.2	Faramarz Gerami	Composite samples at different intervals for the entire boring depth should have been tested for corrosion evaluation.	We have performed additional tests on two available samples and will include the test results in our report. The tests confirmed that the soils are not considered corrosive.
3	4.1	Faramarz Gerami	2008 USGS Deaggregated Hazard (Beta) curve should be used as design curve since there is a difference of about 16.7% between USGS and ARS online probabilistic data. QC/QA sheets should be included for all faults listed in calculated Spectra.	We will comply. We will include QA/QC sheets.
4	4.4 Table 5	Faramarz Gerami	Tension in the foot note should be deleted since no design tip is provided. Based on as built records and Driven Pile Program output, piles are too short at all support locations (15 to 25 feet at abutments 20 feet at bent). It should be noted that at both abutment locations piles shall be pre drilled to original ground (elev. ± 162) and the axial capacity for the predrilled section should be ignored.	The new pile data table will have tension load. We have performed analysis using both *Driven* and *APile* programs. Only skin friction was used to calculate the pile capacity and skin friction of pre-drilled segment through existing fill was ignored. The results, to be included in our report, showed comparable results.
5	Plans	Faramarz Gerami	In General Plan, Foundation Plan and LOTB sheets (current and as built) and other Plan sheets, the word "(widen)" should be added after bridge name. Also post mile 12.54 should be indicated in all plan sheets. In Foundation Plan, as built bottom of footing elevations should not be modified. Also Pile Data Table is different than Table 5 - Pile Data Table in the report. In Index to Plans, General notes for seismic design and	We understand HDR will revise the plans accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Katella Avenue UC Bridge # 55-0401 Widening, dated October 15, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			ARS Curve should be revised. Battered driven piles are not indicated in both abutment layout sheets.	
6	Log of Test Borings (LOTB)	Faramarz Gerami	Boring and CPT can not have the same number (i.e. A-09-001 and CPT-09-001). Corrections should also be made in the report, tables and test results. The laboratory test results in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets. The laboratory test symbols should be attached to the boring stick. Add bridge name to both Soil Legend sheets (2 of 4 and 3 of 4). Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NA VD88.	We will revise the CPT numbering to CPT-09-003 in the LOTB and report. We will remove the boxes. We will revise our LOTB accordingly.
7	Boring A-09-001	Faramarz Gerami	There is not such a term as "clayey silt (elev. 163) or clayey silt with sand (elev. 129)". It was suggested to use elastic silt in previous review comments but the response was that no elastic silt was encountered. However, clayey silt should be changed to an acceptable group name (see Caltrans Soil and Rock	We will revise our LOTB accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Katella Avenue UC Bridge # 55-0401 Widening, dated October 15, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			Manual). Delete the word "wet" at elevation 158 unless it is defining a perched water. Delete "with clay" in sandy silt with clay at elevation 134, and change medium dense to "hard". Change the word "loose" to medium dense at elevation 129. Delete the word "lean" in silty lean clay at elevation 114. Delete the sentence "Free groundwater encountered at 49 feet below existing grade during drilling" (also applies to Boring A-09-002).	
8	Boring A-09-002	Faramarz Gerami	Sand with silt (SP) at elevation 162 should be changed to poorly graded sand with silt (SP-SM), loose. Also delete loose at elevation 156 and move up "medium dense" from elevation 146 to 152. Consistency of sandy silt at elevation 132 should be stiff instead of loose. Delete the word "lean" in silty lean clay at elevations 117 and 107. Also consistency should be "medium stiff' instead of stiff at elevation 117. Delete "lean" in silty lean clay at elevation 112 and change medium dense to "stiff'. Clayey silt should be changed to an acceptable group name at elevation 92 in compliance with Caltrans Soil and Rock Manual (same as A-09-001). Also consistency should be	We will revise our LOTB accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 3, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Katella Avenue UC Bridge # 55-0401 Widening, dated October 15, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			"stiff' instead of medium dense.	
9	Appendix B Table 4	Faramarz Gerami	Permanent load per support should be provided (see Table 5 MTD 3-1). Total loads per support should be rounded up to nearest 10 kips. Compression load per support in Strength Limit State and Extreme Event Limit State does not apply to abutments and should not be provided (see Table 4 MTD 3-1).	We will revise our table accordingly.
10	Appendix B Table 5	Faramarz Gerami	Provided concrete pile design loads (i.e. Class 140) in second column. Total load per support should be rounded up to nearest 10 kips and provide permanent load per support.	We will comply.
11	Appendix B Table 6	Faramarz Gerami	Round up Service Limit State load per support to nearest 10 kips. Tension in the foot note should be deleted since no design tip is provided.	We will revise our table to incorporate this. The new pile data table will have tension load.

State of California | Business, Transportation and Housing Agency

Memorandum

Flex your power!
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To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: March 15, 2010
File: 12-ORA-57-PM 12.54
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES

Katella Ave. UC (widen)
Bridge No. 55-0401

Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Subject: 3rd Review of the Foundation Report

On February 22, 2010, we received a Foundation Report for the right widening of Katella Avenue UC Bridge No. 55-0401. The proposed bridge widening is part of the northbound SR-57 widening between Katella and Lincoln Avenues. The following comments are based on review of the subject report revised February 15, 2010, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

4.2 Table 4 – As Built Foundation Data

- As Built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified.

- Please explain the reason Nominal Resistances are exceeding 2 x Allowable Capacity.

4.4 Table 5 – Pile Data Table

- Based on as built records and Driven Pile Program output, as built specified pile tip elevations should be matched at all support locations.

Plans

- Post mile 12.54 should be shown on all Plans to match the Log of Test Borings.

- In Index to Plans, "Non-liquefaction Case" (under General Notes for Seismic Loading) should be deleted since "No" is checked for liquefaction.

- As mentioned in previous review comments "in Foundation Plan, as built bottom of footing elevations should not be modified".

- As mentioned in previous comments "battered driven piles are not indicated in both abutment layout sheets".

Log of Test Borings

- In Boring A-09-002, delete "loose" at elevation 156 and move down "medium dense" from elevation 151 to elevation 147.

- Bottom of footing elevations (as built and/or widening) should not be shown on LOTB.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by:

Date: 3/15/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
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OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MARCH 15, 2010
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

3rd Review of the Draft Foundation Report for Katella Avenue UC Bridge # 55-0401 Widening, dated February 15, 2010.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	4.2 Table 4 – As Built Foundation Data	Faramarz Gerami	As built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified. Please explain the reason Nominal Resistances are exceeding 2X Allowable Capacity.	We have revised Page 14 of our report accordingly. We have revised Page 14 of our report to indicate nominal resistance as 2 times the allowable pile capacity.
2	4.4 Table 5 – Pile Data Table	Faramarz Gerami	Based on as built records and Driven Pile Program output, as built specified pile tip elevations should be matched at all support locations.	We have revised Page 16 of our report accordingly.
3	Plans	Faramarz Gerami	Post mile 12.54 should be shown on all Plans to match the Log of Test Borings. In Index to Plans, "Non-liquefaction Case" (under General Notes for Seismic Loading) should be deleted since "No" is checked for liquefaction. As mentioned in previous review comments "in Foundation Plan, as built bottom of footing elevations should not be modified". As mentioned in previous comments "battered driven piles are not indicated in both abutment layout sheets".	HDR has revised plans accordingly. Existing foundation system does not have battered pile and battered pile is not planned for the project.
4	Log of Test Borings	Faramarz Gerami	In Boring A-09-002, delete "loose" at elevation 156 and move down "medium dense" from elevation 151 to 147. Bottom of footing elevations (as built and/or widening) should not be shown on the LOTB.	We have revised our LOTB accordingly.

State of California **Business, Transportation and Housing Agency**

Memorandum

Flex your power!
Be energy efficient!

To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: June 7, 2010
File: 12-ORA-57-PM 12.54
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES

Katella Ave. UC (widen)
Bridge No. 55-0401

Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Subject: 4th Review of the Foundation Report-Addendum

On May 26, 2010, we received an addendum to Foundation Report for the proposed right widening of Katella Avenue UC Bridge No. 55-0401. The subject report including responses dated May 20, 2010, is prepared by Leighton Consulting, Inc.

We have no further comments after reviewing the referenced submittal and responses to previous review comments dated March 15, 2010. Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

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c: OGDS1 - LA. Electronic File
OGDS1 - Sac. Electronic File
GS – Sac. Electronic File

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

TRANSMITTAL

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: August 5, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail	X	Draft Report	X	Your Use
X	Courier/Overnight		Final Report		As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Foundation Report for Proposed Retaining Wall No. 55E0110 at Abutment 3 of Lincoln Avenue Overcrossing (Bridge No. 55-0525), Northbound State Route 57, Orange County, California

LEIGHTON CONSULTING, INC.

By: Tae Kuk Kim/Djan Chandra

Distribution: (4) Addressee

17781 Cowan ■ Irvine, CA 92614-6009
949.253.9836 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

FOUNDATION REPORT FOR
PROPOSED RETAINING WALL NO. 55E0110 AT ABUTMENT 3 OF LINCOLN AVENUE OVERCROSSING (BRIDGE NO. 55-0525), NORTHBOUND STATE ROUTE 57, ORANGE COUNTY, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 57
PROJECT POST MILES: 12.2/15.2, EA # 0F0401

Prepared For:

HDR ENGINEERING, INC.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

August 5, 2010

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

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August 5, 2010

Project No. 602231-002

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Attention: Mr. Scott Bacsikin

Subject: Foundation Report for Proposed Retaining Wall No. 55E0110 at Abutment 3 of Lincoln Avenue Overcrossing (Bridge No. 55-0525), Northbound State Route 57, Orange County, California

In response to your request, Leighton Consulting, Inc. has performed a geotechnical exploration for the proposed Retaining Wall No. 55E0110 at Abutment 3 of Lincoln Avenue overcrossing (Bridge No. 55-0525) at northbound State Route 57 (SR-57) in Orange County, California. The retaining wall will consist of a tieback wall with a Type 1 retaining wall at each end and is part of the proposed widening of northbound SR-57 from approximately 0.3 mile south of Katella Avenue to approximately 0.3 miles north of Lincoln Avenue. This project is sponsored by OCTA and Leighton Consulting has been retained as the geotechnical consultant by HDR Engineering, Inc. The purpose of our study was to evaluate the subsurface conditions at the project site and to provide geotechnical recommendations for design and construction of the proposed retaining wall. A draft version of this report was issued on October 14, 2009 and February 15, 2010 for review by Caltrans and the design team. An addendum report providing response to Caltrans final review comments was issued on May 20, 2010 and approved by Caltrans. Caltrans review comments and our response are included in Appendix C of this report.

Lincoln Avenue is located approximately 25 feet above the SR-57 grade. Based on the available borings, the subject portion of Lincoln Avenue is underlain by approximately 25 feet of man-made fill consisting mainly of medium dense sand, clayey sand and silty sand. The fill is further underlain by alluvium consisting predominantly of medium dense to very dense sand to the maximum depth of our boring of 81½ feet below the street grade. Groundwater was not encountered during our field exploration.

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This report summarizes the results of our geotechnical exploration and presents the geotechnical recommendations for the proposed retaining wall. If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Reviewed by:

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/lr

Distribution: (4) Addressee

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1.0 INTRODUCTION

1.1 Project Overview

The California Department of Transportation (Caltrans), District 12, in cooperation with the Orange County Transportation Authority (OCTA), proposes to widen northbound State Route 57 (SR-57) between approximately 0.3 miles south of Katella Avenue (Post Mile 12.2) and 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project segment of SR-57 is approximately 3 miles long, passing through the City of Anaheim in Orange County, California. The purpose of the proposed project is to improve both existing and future mobility, reduce congestion and improve mainline merge and diverge movements.

This segment of SR-57 is relatively flat with elevations ranging from 186 feet above mean sea level (msl) at Katella Avenue to 200 feet msl at Lincoln Avenue. The southern portion of this segment is higher than the surrounding areas while the northern portion is lower. SR-57 was constructed in 1974 and currently has four general purpose lanes and a high-occupancy vehicle (HOV) lane in each direction. Six grade separations exist within this segment; namely at Katella Avenue, Douglass Road, Ball Road, Wagner Avenue, South Street and Lincoln Avenue. The project consists of widening of approximately 3 miles of northbound SR-57 by approximately 35 feet to provide standard lane widths, an additional general purpose lane (fifth lane) and a standard 10-foot wide inside shoulder.

1.2 Project Description

As part of the northbound SR-57 widening project, the existing sloped embankment at the front of Abutment 3 of Lincoln Avenue overcrossing will be removed and the remaining embankment will be retained by a tieback wall and a Type 1 retaining wall at each end. These walls are collectively identified as Retaining Wall No. 55E0110. Based on the provided plan and information, the proposed tieback wall has a maximum height of approximately 15 feet with two to three rows of tiebacks. The Type 1 retaining walls have a maximum height of 8 feet. The walls will be located approximately 7¼ feet from the center of the existing CIDH piles for Abutment 3. The approximate location of the project site is shown in Figure 1, *Site Location Map*.

Based on the as-built plan (Caltrans 1974), the existing Lincoln Avenue overcrossing (Bridge No. 55-0525) was constructed in 1974 and is supported on two abutments and one bent. The existing bridge is approximately 253 feet long and 102 feet wide. The as-built elevations of the bridge range from 223.87 to 224.29 feet from west to east. Datum

for all elevations referenced in this report is mean sea level (msl). Additionally, the as-built plan was based on the old datum (NGVD29) and approximately 1.84 feet should be added to the as-built elevations to convert them to the current elevations (Datum NAVD88). The elevation of SR-57 freeway is approximately 199 feet. The *General Plan*, *Foundation Plan* and layout plan of the proposed retaining wall prepared by HDR are included at the end of the text of this report.

1.3 Purpose and Scope

The purpose of this report is to review existing geotechnical data, perform subsurface exploration, laboratory testing and geotechnical analysis to provide geotechnical design recommendations for the proposed project.

Our scope of work for this project included the following tasks:

- *Literature Review*: We reviewed various documents pertinent to the project site including the as-built Log of Test Borings (LOTBs) prepared by Caltrans for the existing Bridge No. 55-0525. The as-built LOTBs are included as Sheet 4 of 4 of the attached LOTBs. A list of references used in preparation of this report is presented in Section 6.0.

- *Site Reconnaissance:* We performed a site reconnaissance to visually evaluate the accessibility of the site for drilling equipment and locate and mark the proposed boring location.

- *Subsurface Exploration*: We performed a subsurface exploration that consisted of drilling, logging and sampling of one 8-inch diameter hollow-stem auger boring to a depth of 81½ feet below the existing grade of Lincoln Avenue. Log of the boring is included in Sheet 1 of 4 of the attached LOTBs.

- *Laboratory Testing*: Laboratory testing was performed on selected soil samples collected from our field exploration to evaluate the engineering properties of the soils. The laboratory test results are included in Appendix A.

- *Seismic Analysis*: Based upon the encountered subsurface conditions and regional seismicity of the area, we performed ground motion analysis for the project site for use in structural analysis and design.

- *Geotechnical Design and Analysis*: Geotechnical analysis was performed on the collected data to develop recommendations for design and construction. Results of the analysis are included in Appendix B.

- *Report Preparation*: Relevant geotechnical data were compiled in this report along with our findings and recommendations for the proposed project.

2.0 GEOTECHNICAL FIELD AND LABORATORY INVESTIGATIONS

2.1 Subsurface Exploration

Our field exploration consisted of advancing one hollow-stem boring to a depth of 81½ feet below the existing grade of Lincoln Avenue. The boring was located within the embankment behind the existing Abutment 3 of Lincoln Avenue overcrossing. The approximate location of the boring is shown in the LOTBs.

Standard Penetration Test (SPT) was performed within the hollow-stem boring using a 140-pound automatic hammer falling freely for 30 inches. The samplers were driven for a total penetration of 18 inches and the blow counts were recorded for the last 12 inches of penetration. Relatively undisturbed samples were collected from the boring using the Modified California Ring sampler. The field sampling procedures were conducted in accordance with ASTM Standard Specifications D 1586 and D 3550 for SPT and split-barrel sampling of soil. In addition to driven samples, representative bulk soil samples were also collected from the boring.

The test boring was logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. All samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the boring was backfilled with soil cutting mixed with cement, tamped and capped with cold mix asphalt. Geotechnical log of the boring is included in the LOTBs.

2.2 Geotechnical Laboratory Testing

Laboratory tests were performed on representative soil samples to determine the geotechnical engineering properties of subsurface materials. The following laboratory tests were performed:

- In-situ moisture content and density;
- Percent passing No. 200 sieve;
- Direct shear; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests, except corrosivity tests, were performed in general accordance with ASTM procedures. The corrosivity tests were performed in accordance with Caltrans procedures. Results of the laboratory tests are presented in Appendix A.

3.0 GEOTECHNICAL FINDINGS

3.1 Geologic Setting

The subject site is located in the Tustin Plain within the southeastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. In general, the Tustin Plain consists of approximately 1,400 feet of unconsolidated to semi-consolidated Quaternary-age alluvial sediments. Underlying the Quaternary alluvial deposits are Tertiary-age bedrock units consisting of sandstone, siltstone, shale and conglomerate on the order of 31,000 feet in thickness.

The site lies near the lower reaches of the Santa Ana River. The surface distribution of Holocene sediments, as recorded in early editions of regional soil survey maps (Eckmann et al., 1916), suggests that the Santa Ana River has recently wandered back and forth across the Orange County coastal plain from Alamitos Bay to Newport Bay. Historical accounts and documents further support the process of widespread sheet flooding being the dominant depositional process associated with the Santa Ana River prior to the construction of Prado Dam in 1941 (California Department of Water Resources, 1957). Currently, the Santa Ana River is located approximately 3,000 feet from the Lincoln Avenue overcrossing. Geology map of the area is presented in Figure 2.

3.2 Subsurface Earth Materials

The subsurface soils encountered in our boring consist of approximately 25 feet of embankment fill of Lincoln Avenue overcrossing underlain by alluvial deposits. The upper 15 feet of the fill consists of medium dense sand and clayey sand and the fill below 15 feet to 25 feet generally consists of medium dense silty sand. The alluvium below the fill consists mainly of clayey sand and sand with consistency that increases with depth from loose to very dense.

We have performed direct shear tests on representative samples collected from our boring. The friction angle (ϕ) representing the effective ultimate shear strength of the onsite sandy soils were found to range from 32 to 36 degrees. The test results are presented in Appendix A. Based on these test results, SPT blowcounts, and soil types, the shear strength parameters and unit weights selected for design are presented in Table 1.

Table 1 – Generalized Soil Profile and Design Parameters

Depth below Street Grade[1] (feet)	Elevation (feet, msl)	Generalized Soil Type	Total Unit Weight (pcf)	Friction Angle[2] (degrees)	Undrained Cohesion, Cu[2] (psf)
0 to 25	223 to 198	**Fill**: Sand and Clayey/Silty Sand	120	34	-
25 to 52	198 to 171	**Alluvium**: Clayey Sand and Sand	105	32	-
52 to 81.5	171 to 141.5	Sand	105	34	-

[1]Lincoln Avenue street grade; cutoff elevation of the existing Abutment 3 piles is 207.82 feet; elevation of top of retaining wall is 213 feet.

[2]Ultimate shear strength parameters based on SPT blow counts (NAFVAC, 1986) and laboratory test results.

3.3 Groundwater

Groundwater was not encountered during our field exploration to the maximum depth explored (elevation of 141.5 feet) nor in Caltrans borings in 1969 to the maximum depth explored (elevation of 142 feet). The historically high groundwater table is deeper than 50 feet below the freeway grade (elevation of 149 feet, CDMG, 1997). Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff.

3.4 Engineering Properties of Subsurface Materials

Engineering properties of the subsurface materials were modeled based on results of geotechnical field and laboratory tests performed during our exploration. Results of these laboratory tests that are applicable to the proposed project are presented in Appendix A. These test results are briefly discussed below:

3.4.1 Shear Strength

Based on direct shear test results, the friction angle (ϕ) representing the effective ultimate shear strength of the onsite sandy soils ranges from 32 to 36 degrees. The shear strength parameters used for design are presented in Table 1.

3.4.2 Corrosion Potential

Representative samples of the subsurface soils were subjected to analytical testing to evaluate the potential for corrosion to concrete and ferrous metals. The test results are included in Appendix A and indicate the tested soils exhibited chloride concentration of 32 parts per million (ppm), sulfate concentration of 347 ppm, minimum resistivity of 1,200 ohm-cm, and pH level of 7.18. Caltrans specifications define a corrosive soil as a material in which any of the conditions exist: a chloride content greater than 500 ppm; soluble sulfate content greater than 2,000 ppm; or a pH of 5.5 or less. Based on the guidelines established by Caltrans, the subsurface soils at the Abutment 3 location are not considered corrosive and no special measures are required for corrosion protection of structural concrete and reinforcing steel for structural concrete. Corrosion mitigation measure for the tieback anchors should be performed in accordance with Caltrans *Corrosion Guidelines* (Caltrans, 2003)

3.4.3 Expansion Potential

Based on our boring and previous borings, the near-surface soils on both street and freeway levels mainly consisted of sand. It is our opinion that the on-site near-surface soils are considered to have low expansion potential.

3.5 Faulting and Seismicity

Our review of available in-house literature indicates that there are no known active or potentially active faults that have been mapped at the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in southern California. According to the California Geological Survey fault database, the closest active faults that could affect the site are the Puente Hills Blind Thrust, Whittier, and San Joaquin Hills Blind Thrust faults located approximately 9.9 kilometers (km), 10.1 km and

16.2 km, respectively, from the site. Other known regional active faults that could affect the site include the Newport-Inglewood (L.A. Basin), Elsinore (Glen Ivy), San Jose and Chino Central Ave (Elsinore) faults. The locations of these faults with respect to the site are shown in Figure 3.

We have performed seismic analysis for the site following Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). Distance of faults to the site was estimated using Caltrans ARS online program and peak ground acceleration for each fault was estimated using Caltrans excel worksheet. The estimated peak ground accelerations caused by various faults near the site are summarized in the following table.

Table 2 – Peak Bedrock Accelerations

Fault	Maximum Magnitude	Distance (km)	Peak Bedrock Acceleration
Peralta Hills	6.2	2.8	0.42g
Puente Hills Blind Thrust	7.3	10.4	0.36g
Elsinore fault zone (Whittier section)	7.6	10.4	0.32g

As shown in the table above, the Peralta Hills fault is the nearest fault to the site at a distance of approximately 2.8 km. A maximum earthquake magnitude of 6.2 has been estimated for this fault, resulting in a peak horizontal ground acceleration of about 0.42g at the site. This fault, however, is not included in the latest California Geological Survey fault database.

We have also performed probabilistic seismic analysis using Caltrans ARS online program. The peak ground acceleration was calculated to be 0.50g with a deaggregated moment magnitude (Mw) of 6.6. We have used this ground acceleration and earthquake magnitude in our seismic analysis.

3.6 Seismic Hazards

3.6.1 Fault Rupture

Based on available literature and reports, no known active faults are known to traverse the project site, and the site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. As such, the principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in the region as discussed in Section 3.5.

3.6.2 Liquefaction

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading.

The site is not located within an area designated as potentially liquefiable on the *California Seismic Hazard Zone Map* (CDMG, 1998). The historically high groundwater table at the site is deeper than 50 feet and, based on our boring, the subsurface soils below the historically high groundwater table consisted of dense to very dense sand with SPT N values ranging from 43 to 57. Due to the absence of shallow groundwater and the dense nature of the subsurface soils, the liquefaction potential of the site is considered low.

3.6.3 Seismically Induced Settlement

Seismically induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). This settlement occurs primarily within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event. The seismically induced settlement, including that of the embankment fill, was estimated to be on the order of 1 inch. The magnitude of the estimated settlement is considered relatively minor.

3.6.4 Tsunami and Seiches

Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Based on the inland location of the site and the absence of enclosed bodies of water near the site, tsunami and seiches risks at the site are considered negligible.

3.7 Slope Stability

For our slope stability analyses, we have considered three different sections of the proposed retaining wall: 1) with three rows of tiebacks; 2) with two row of tiebacks; and 3) Type 1 retaining wall without tieback. The slope stability analyses were performed using the Modified Bishop's method. The tieback spacing, location and tension force shown in the attached layout plan by HDR were incorporated in the analysis of the tieback wall. For pseudo-static analysis, a horizontal seismic coefficient of 0.20g (Caltrans, 2004) was used. Our analysis indicates that the walls have a global factor of safety higher than 1.5 and 1.1 for static and pseudo-static conditions, respectively. The results are summarized in Table 3 and computer printouts of the analyses are attached to this report.

Table 3 – Summary of Slope Stability Analyses

Retaining Wall Type	Calculated Factor of Safety	
	Static	Pseudo-Static
Retaining Wall with 3-Row of Tiebacks	1.52	1.21
Retaining Wall with 2-Row of Tiebacks	2.18	1.55
Type 1 Retaining Wall	2.06	1.43

4.0 GEOTECHNICAL AND FOUNDATION DESIGN RECOMMENDATIONS

Based upon our evaluation of the soils and geologic information, we conclude that the proposed project is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in the design and construction of the project. The recommendations in this report are considered minimum and may be superseded by more stringent requirements of the structural engineer and/or the governing agencies. Leighton Consulting should be notified, in a timely manner, of changes in the project plans that might impact recommendations in this report.

4.1 As-Built Foundation Data

Based on the as-built plan for the Lincoln Avenue Overcrossing (Caltrans, 1974), we have summarized the as-built foundation types and characteristics in Table 3. The nominal resistance shown in the table was calculated using the computer program *SHAFT* (O'Neill and Reese, 1999). The computer printouts are included in Appendix B. Elevations in Table 4 were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).

Table 4 – As-Built Bridge Foundation Data (Caltrans, 1974)

Structure(1)	Pile Size and Type	Pile Cutoff Elevation (feet)	Pile Tip Elevation (feet)	Nominal Resistance(2) (kips)	Allowable Capacity (3) (kips)
Abutment 3(4)	16-inch Diameter CIDH Pile	207.82	162.80	280(5)	140

(1)Elevations of freeway and Lincoln Avenue grade are approximately 199 and 222 feet, respectively.
(2)A minimum factor of safety of 2.0 should be applied to calculate the allowable capacity.
(3)Design load of 70 tons (140 kips) per as-built plan
(4)Abutment 3 is supported on a single row of 18 piles with minimum pile spacing of 4 times the pile diameter.
(5)The upper 9 feet of pile capacity within the existing fill was ignored.

4.2 Lateral Earth Pressure and Tieback Design Parameters

Based on the plan provided by the structural engineer, the proposed tieback system consists of two to three rows of tiebacks. The lateral loads on the retaining wall is expected to consist of the following: (a) the active earth pressure and passive earth pressure below the bottom of the excavation in accordance with Caltrans *Bridge Design Specifications* (*BDS*, September 2004), (b) the surcharge pressure from Abutment 3 backfill, (c) the surcharge pressure corresponding to traffic loading, and (d) the seismic pressure resulting from the lateral loads of the existing piles. A diagram of these lateral earth pressures are provided in Figure 4. Under service loading, the pressures of (a), (b) and (c) should be used and, under seismic loading, the pressures of (a), (b) and (d) should be used.

The active and passive pressure coefficients (Ka and Kp) of 0.28 and 3.54, respectively, and an average soil unit weight (γ) of 120 pcf may be used to estimate the active and passive earth pressures. Traffic loading may be considered as equivalent to a vertical pressure produced by 2 feet of soils. The intensity of the pressure from the existing piles shown in Figure 4 was based on a lateral load of 40 kips per pile under the seismic loading (Caltrans, 1992).

The design values indicated above are based upon drained conditions. The tieback and Type 1 retaining walls should, therefore, be provided with a subdrain system to prevent buildup of hydrostatic pressure behind the walls. The *General Plan* shows that geocomposite drain is proposed behind the walls with weep holes at the bottom of the walls. The drainage systems shown on the plan are acceptable from a geotechnical standpoint.

The anchored portion of the tieback should extend into competent material at least 5 feet beyond the critical failure surface or H/5, where H is the height of the retaining wall, whichever is longer. The critical failure surface was determined from slope stability analysis where a tieback force is applied to achieve a factor of safety of 1.3 (Caltrans, 2004). Based on the slope stability analysis and Caltrans *BDS* (2004), the tieback anchors should have a minimum unbonded length of 15 feet. The slope stability analysis to determine the critical failure surface is presented in Appendix B.

The allowable pullout resistance of anchor should be estimated by multiplying ultimate anchor bond stress, bonded length and perimeter of the drilled hole, and dividing by a minimum factor of safety of 2.5 (Caltrans, 2004). For the purpose of estimating the anchor bond stress, an average soil unit weight (γ) of 120 pcf and an average soil internal

friction angle of 34 degrees may be used for the upper and middle rows and an average soil unit weight (γ) of 105 pcf and an average soil internal friction angle of 32 degrees may be used for the lower row. The contractor is responsible for the final design of the bonded length of tieback anchors and the bonded length should be verified by load test of each anchor.

The tieback anchors should be installed at a minimum spacing of three times the diameter of the bond zone or 5 feet, whichever is greater. The preferred installation angle is between 5 and 20 degrees from horizontal to facilitate tendon installation and grouting, and to avoid application of excessive vertical loads that could induce downward movement of the wall. Tieback anchors should be located to maximize their distance from the existing abutment piles.

4.3 Allowable Bearing Capacity

An allowable soil bearing pressure of 2,500 psf may be used for design of tieback and Type 1 retaining wall footing having a minimum width of 12 inches and a minimum embedment of 18 inches below the lowest adjacent ground surface. This allowable bearing pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions only and may be increased by one-third for short-term loading..

The frictional resistance between the tieback wall (concrete) and the backfill soil may be computed using a coefficient of friction of 0.45, provided that no forms are used for the concrete surfacing against the soil.

4.4 Settlement and Lateral Displacement

The tension force of each row of tiebacks is shown in the attached layout plan. The vertical components of the tension forces of the tiebacks were calculated to be a maximum of 28.5 kips (approximately 1,630 psf). Settlement of the tieback wall due to the vertical pressure was estimated to be on the order of ½ inch. Settlement of the Type 1 retaining walls was also estimated to be on the order of ½ inch. This magnitude of settlement is considered relatively minor for the proposed walls.

Tiebacks for the tieback wall will be installed as the excavation progresses. The tiebacks will be tensioned before additional excavation is made, providing lateral support for the wall. Lateral displacement of the tieback wall is, therefore, expected to be negligible. For the Type 1 retaining walls, using the method in Caltrans *BDS* (2004), the lateral

displacement is estimated to be on the order of 0.2 inches to mobilize the active earth pressure condition. Considering the relatively minor lateral displacement and that these walls will be located to the north and south of the existing abutment, the estimated lateral displacement is not expected to impact the existing abutment piles.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Tieback Installation

Due to the close proximity of the proposed tieback wall to Abutment 3 and its existing piles, the contractor should exercise care to minimize impact to the piles and abutment from the installation of the tieback wall. We recommend that a monitoring program be implemented during the construction to monitor movement of Abutment 3. If excessive lateral and/or vertical movements are measured, construction should be suspended immediately and mitigation measurement should be implemented. The installation of the tieback anchors should be in accordance with the Caltrans *Standard Specifications*. All tieback anchors for the wall should be load tested with either a proof test, performance test or creep test. The maximum test load for an anchor should generally be 1.5 times the design force of the anchor. The tests should be performed in accordance with Caltrans specifications.

5.2 Temporary Excavations

Excavations and removal of the existing sloped embankment fill are required to construct the proposed retaining wall. The excavation and removal should be shored by either bracing or sheeting. Design of shoring should be performed by the shoring contractor. For cantilever shoring, the active and passive pressure coefficients (Ka and Kp) of 0.28 and 3.54, respectively, and an average soil unit weight (γ) of 120 pcf may be used. For braced excavation, the lateral earth pressure is estimated as 22H pcf with a rectangular pressure distribution, where H is the depth (height) of excavation. The above lateral pressure is only appropriate for level backfill and a drained condition behind the shoring. Appropriate surcharge loads from traffic loading, heavy equipment, and stockpiles of materials should be incorporated in the shoring design. The final shoring plan should be reviewed by the geotechnical consultant.

5.3 Earthwork

Onsite soils to be used as compacted structural fill should be free of organic material and/or construction debris. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches for structural fill placement, moisture-conditioned as necessary to within two percent above optimum, and compacted to a minimum of 95 percent of the maximum

density as determined by Caltrans Test Method 216. Crushed aggregate base should be compacted to a minimum of 95 percent relative compaction. Subgrade within a depth of 30 inches below the finished grade should also be compacted to at least 95 percent relative compaction.

5.4 Additional Geotechnical Services

The proposed construction involves various activities that would require geotechnical observation and testing. These include:

- Placement of compacted fill;
- Shoring installation, if any;
- Installation of tieback anchors;
- Backfill of retaining walls; and
- When any unusual surface conditions are encountered.

These and other soils related activities should be observed and tested by a qualified representative of the geotechnical engineer. Geotechnical recommendations presented in this report are based on the conditions encountered at the test boring location and information gained from review of as-built plans as well as our understanding of the current project plan. Our recommendations should be revised, as necessary, based on the actual soil condition and any modification of the current plans, and incorporated into the final design plans and specifications. Conclusions and recommendations presented in this report should be reviewed and verified by the geotechnical engineer during site construction and revised accordingly, if exposed geotechnical conditions vary from our current understanding and interpretations.

6.0 REFERENCES

The following references were used in preparation of this report:

Bryant, W.A., and Hart, E.W, Interim Revision 2007, Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps: California Geological Survey, Special Publications 42.

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O'Neill, M.W., and Reese, L.C., 1999, Drilled Shafts: Construction Procedures and Design Methods prepared for U.S. Department of Transportation, Federal Highway Administration, Office of Infrastructure, Washington D.C., 1999

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ERIC A. JOHNSON No. C57355 Exp. 12/31/11 CIVIL STATE OF CALIFORNIA

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HDR ENGINEERING, INC.
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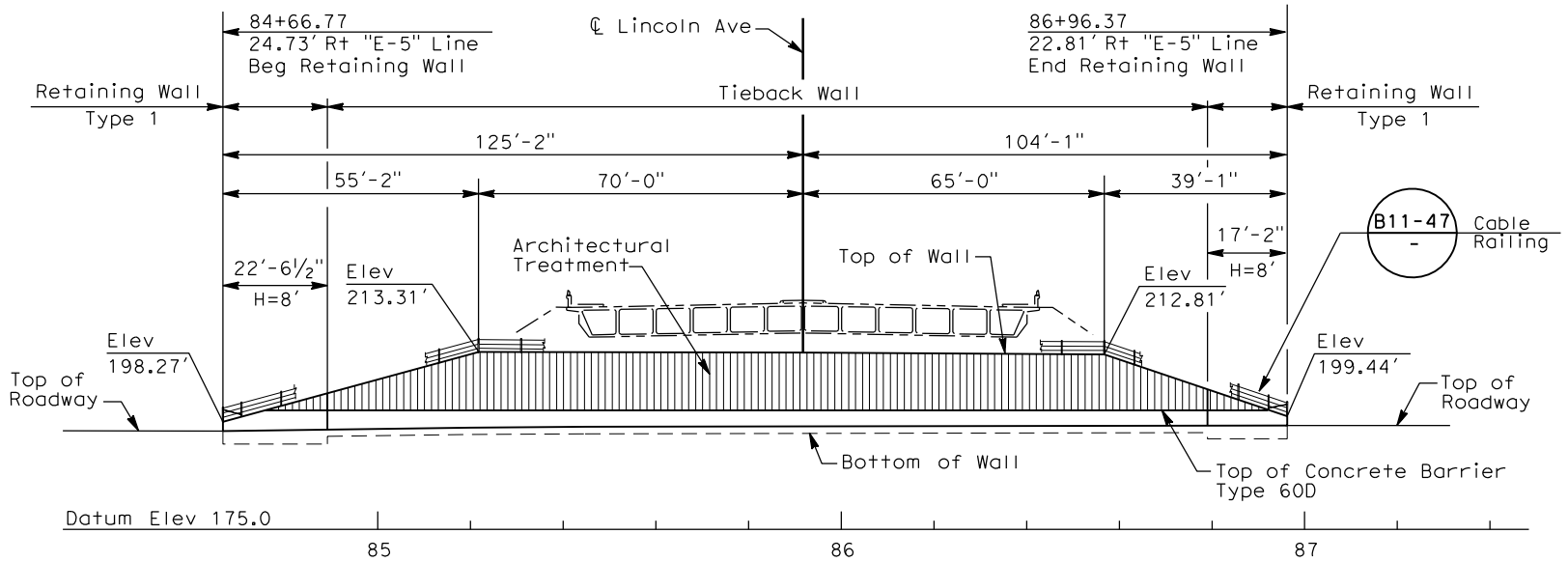
IRVINE, CA 92602-1377

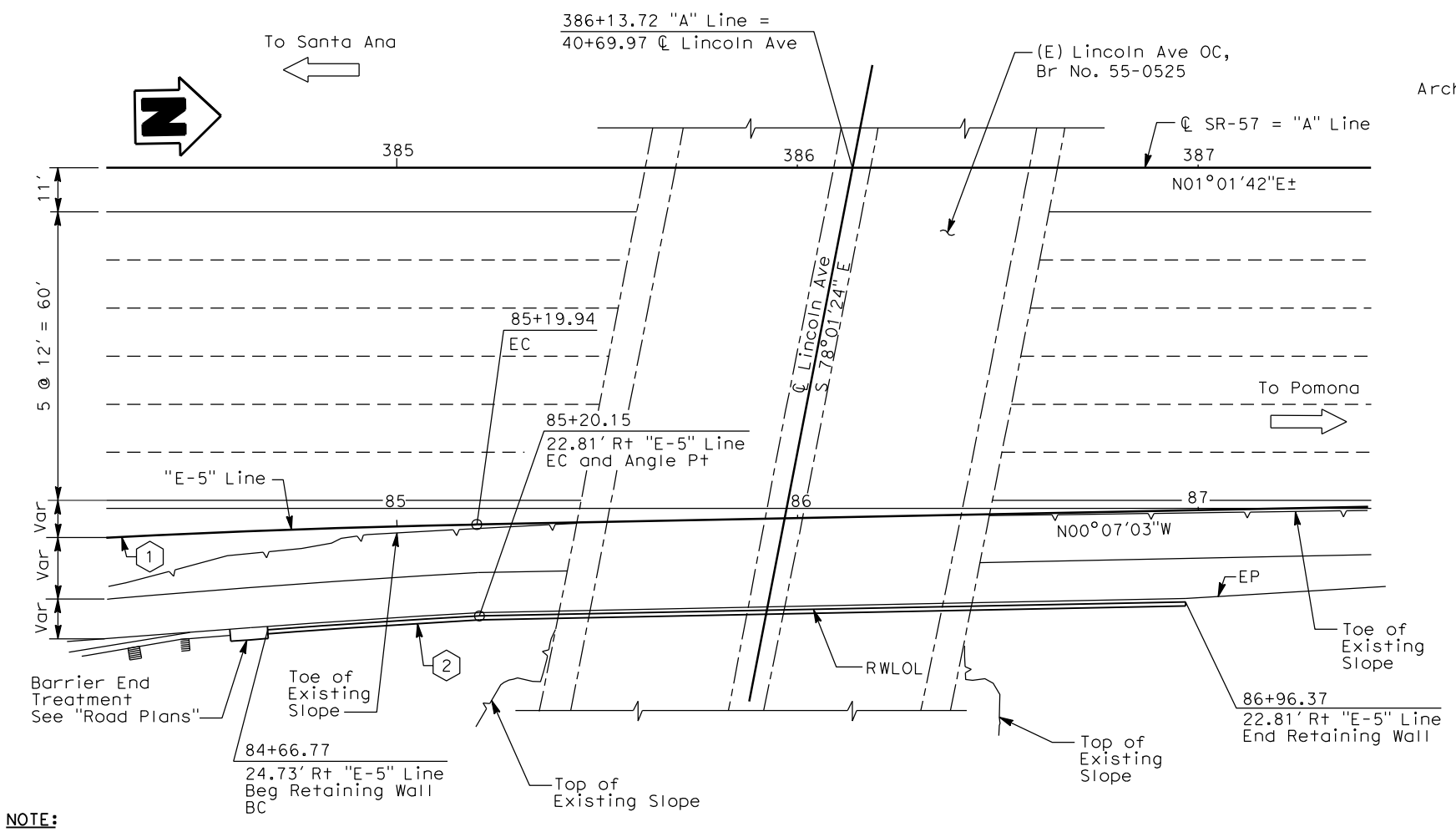


MIRROR ELEVATION

SCALE 1"=20'

LEGEND

- Indicates Limits of Shotcrete
- Indicates New Construction
- Indicates Foundation or Hidden Lines
- Indicates Existing Structure
- RWLOL Indicates Retaining Wall Layout Line

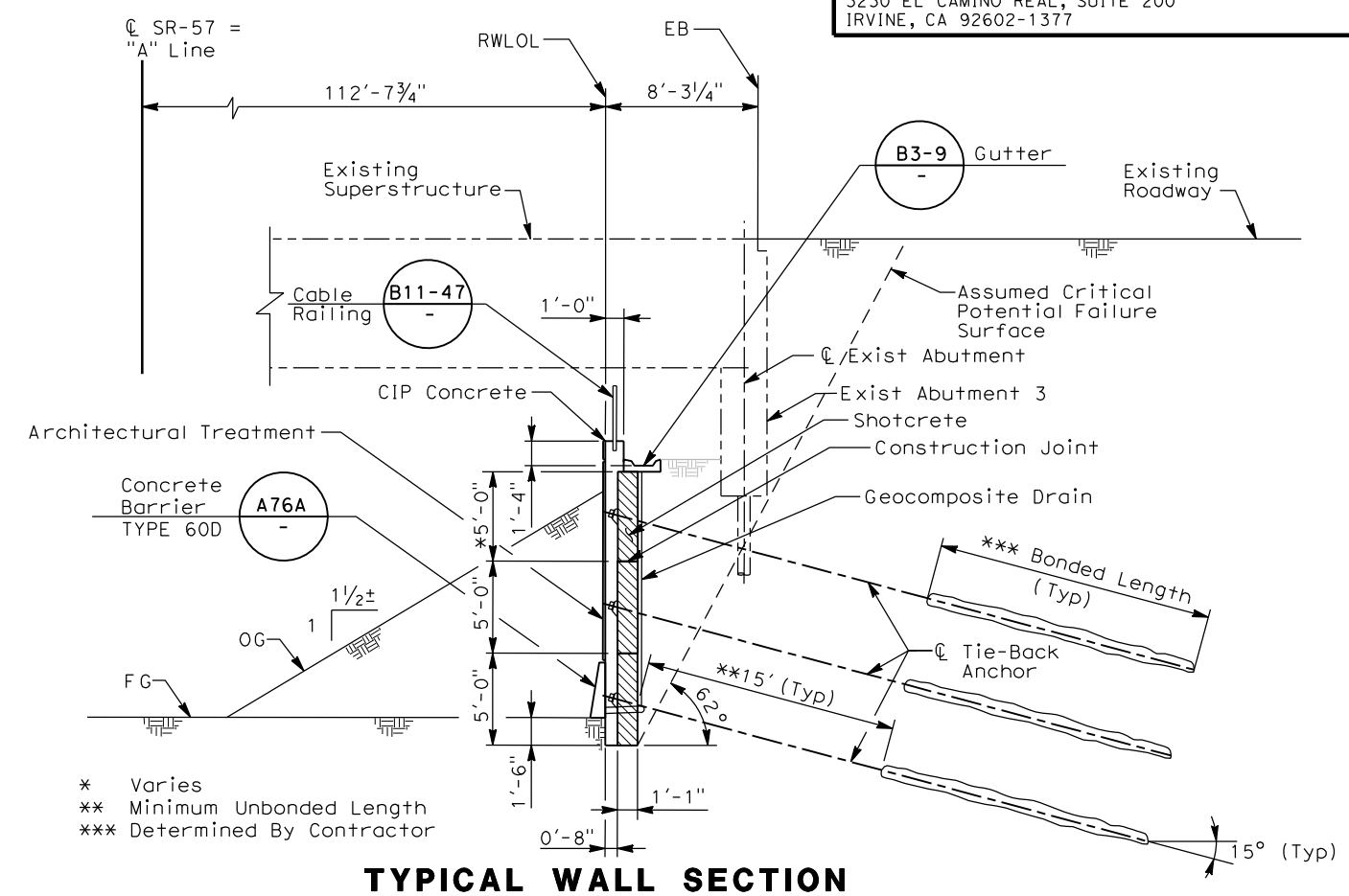


PLAN

SCALE 1"=20'

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.



* Varies
** Minimum Unbonded Length
*** Determined By Contractor

TYPICAL WALL SECTION

SCALE: 1"=5'

CURVE DATA

(1) ℄ "E-5" Line	(2) RWLOL
R = 3000.00'±	R = 2972.26'
Δ = 03°11' 52"±	Δ = 01°01'16"
T = 83.74'±	T = 26.49'
L = 167.44'±	L = 52.97'

NOTES:

For "General Notes" And "Standard Plans List" See "General Notes" Sheet.

DESIGN OVERSIGHT	DESIGN	BY D. Peavey	CHECKED E. Johnson	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE
SIGN OFF DATE	DETAILS	BY E. Gray	CHECKED E. Johnson	LAYOUT BY D. Peavey	CHECKED W. Chu
	QUANTITIES	BY D. Peavey	CHECKED E. Johnson	SPECIFICATIONS BY E. Johnson	PLANS AND SPECS COMPARED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0110
POST MILES 14.8

LINCOLN AVE OC - RET WALL
GENERAL PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 1 OF 12

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12	Ora	57	12.2/15.2		

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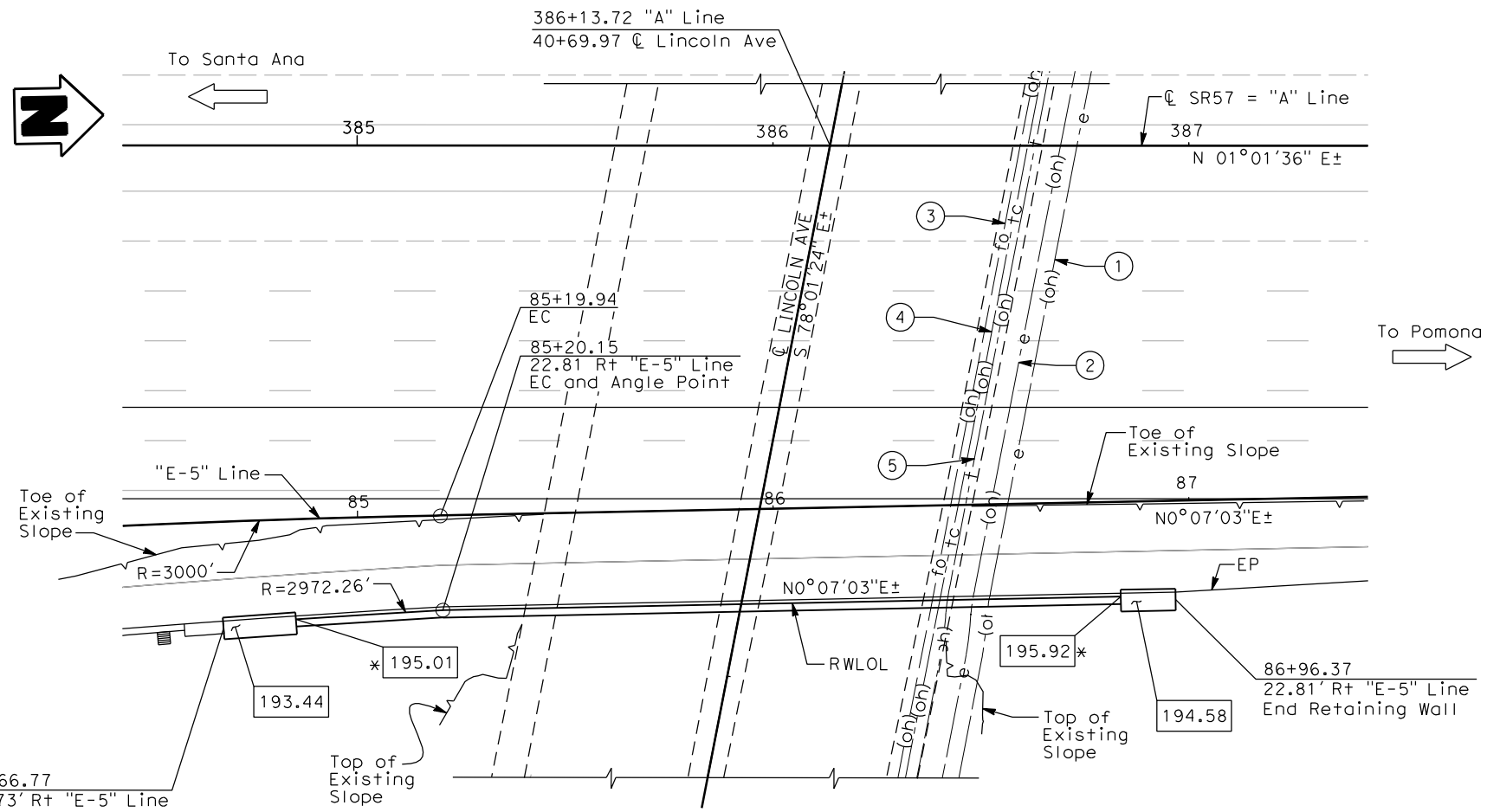

PLAN

SCALE 1"=20'
Note: Tiebacks Not Shown For Clarity.

EXISTING UTILITY LINES TABLE

(BASED ON AS-BUILT DATA)

NO.	UTILITY	OWNER	ACTION
1	69 Kv OH	City Of Anaheim	Overhead - Protect In Place
2	12 Kv OH	City Of Anaheim	Overhead - Protect In Place
3	OH F/O	City Of Anaheim	Within Bridge - Protect In Place
4	Telephone	Pac Bell	Within Bridge - Protect In Place
5	Telephone	Adelphia	Within Bridge - Protect In Place

LEGEND

Indicates New Construction

Indicates Existing

xxx.xx — Denotes Bottom of Footing Elevation @ Type 1 Retaining Wall

* xxx.xx — Denotes Bottom of Wall Elevation @ Tieback Wall

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

DESIGN OVERSIGHT

SIGN OFF DATE

SCALE: 1"=20'	VERT.DATUM	HORZ.DATUM
PHOTOGRAMMETRY AS OF:	ALIGNMENT TIES	
SURVEYED BY E. Martinez	DRAFTED BY	
FIELD CHECKED BY D. Williams	CHECKED BY	

	BY	CHECKED
DESIGN	D. Peavey	E. Johnson
DETAILS	E. Gray	E. Johnson
QUANTITIES	D. Peavey	E. Johnson

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0110
POST MILE 14.8

LINCOLN AVE OC - RET WALL
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 3 OF 12

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12	Ora	57	12.2/15.2		

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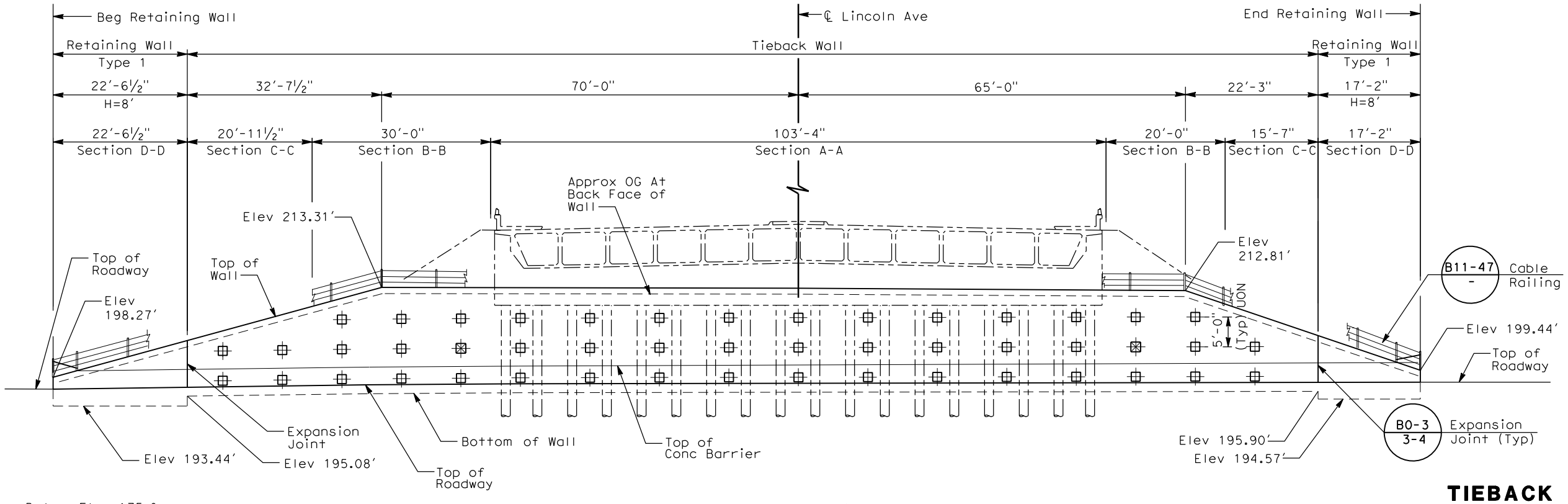
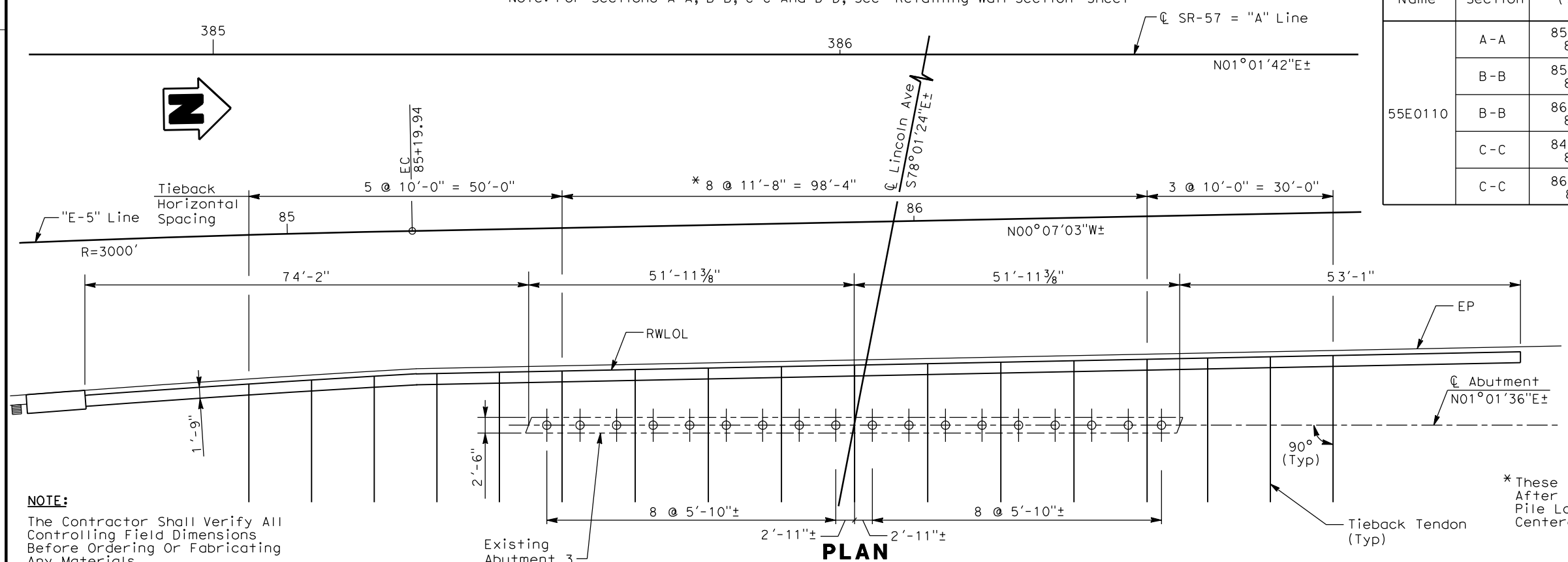


ELEVATION

SCALE 1"=10'

Note: For Sections A-A, B-B, C-C And D-D, See "Retaining Wall Section" Sheet



PLAN

SCALE 1"=10'

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

* These Dimensions Are Approximate. After Contractor Verification Of Existing Pile Locations, The Tieback Shall Be Placed Centered Between The Adjacent Piles.

LEGEND

- Indicates Existing 16" CIDH Piles.
- Indicates Location Of Tieback Assembly Or As Directed By The Engineer.
- Indicates Location Of Tieback Assembly Requiring Performance Test Or As Directed By The Engineer.

TIEBACK DESIGN FORCE TABLE

Tieback Wall Name	Tieback Wall Section	Tieback Location (Station)	Lift Ht (Ft) / T (Kip) Upper	Lift Ht (Ft) / T (Kip) Middle	Lift Ht (Ft) / T (Kip) Lower
55E0110	A-A	85+40.27 To 86+43.60	5.8 / 52.8	5 / 26.6	5 / 22.2
	B-B	85+10.27 To 85+40.27	5.8 / 21.5	5 / 22.8	5 / 19
	B-B	86+43.60 To 86+63.60	5.8 / 21.5	5 / 22.8	5 / 19
	C-C	84+89.30 To 85+10.27	6 / 15.8	NA	5 / 14.7
	C-C	86+63.60 To 86+79.21	6 / 15.8	NA	5 / 14.7

NOTES:

1. Prior To Installing Tiebacks, Contractor Shall Verify The Existing Footing And Pile Locations By Exposing, By Hand, One Pile At Each End Of Each Abutment.

DESIGN OVERSIGHT

SIGN OFF DATE

	BY	CHECKED
DESIGN	D. Peavey	E. Johnson
DETAILS	E. Gray	E. Johnson
QUANTITIES	D. Peavey	E. Johnson

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0110
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LINCOLN AVE OC - RET WALL
RETAINING WALL LAYOUT

DESIGN DETAIL SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

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SHEET 4 OF 12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

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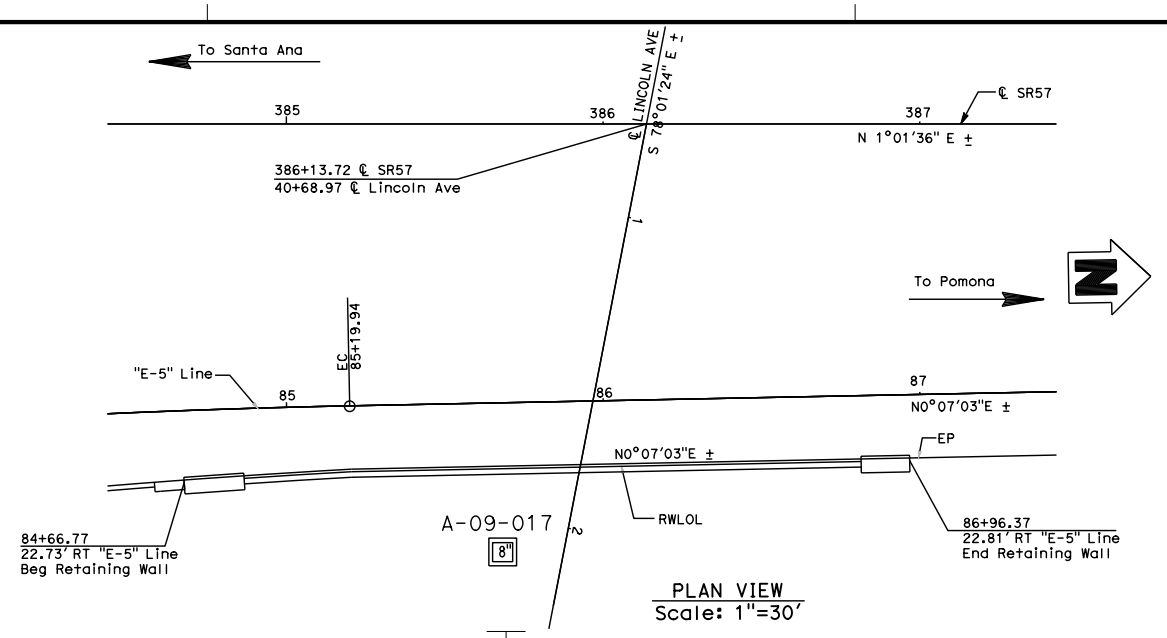
IRVINE, CA 92614

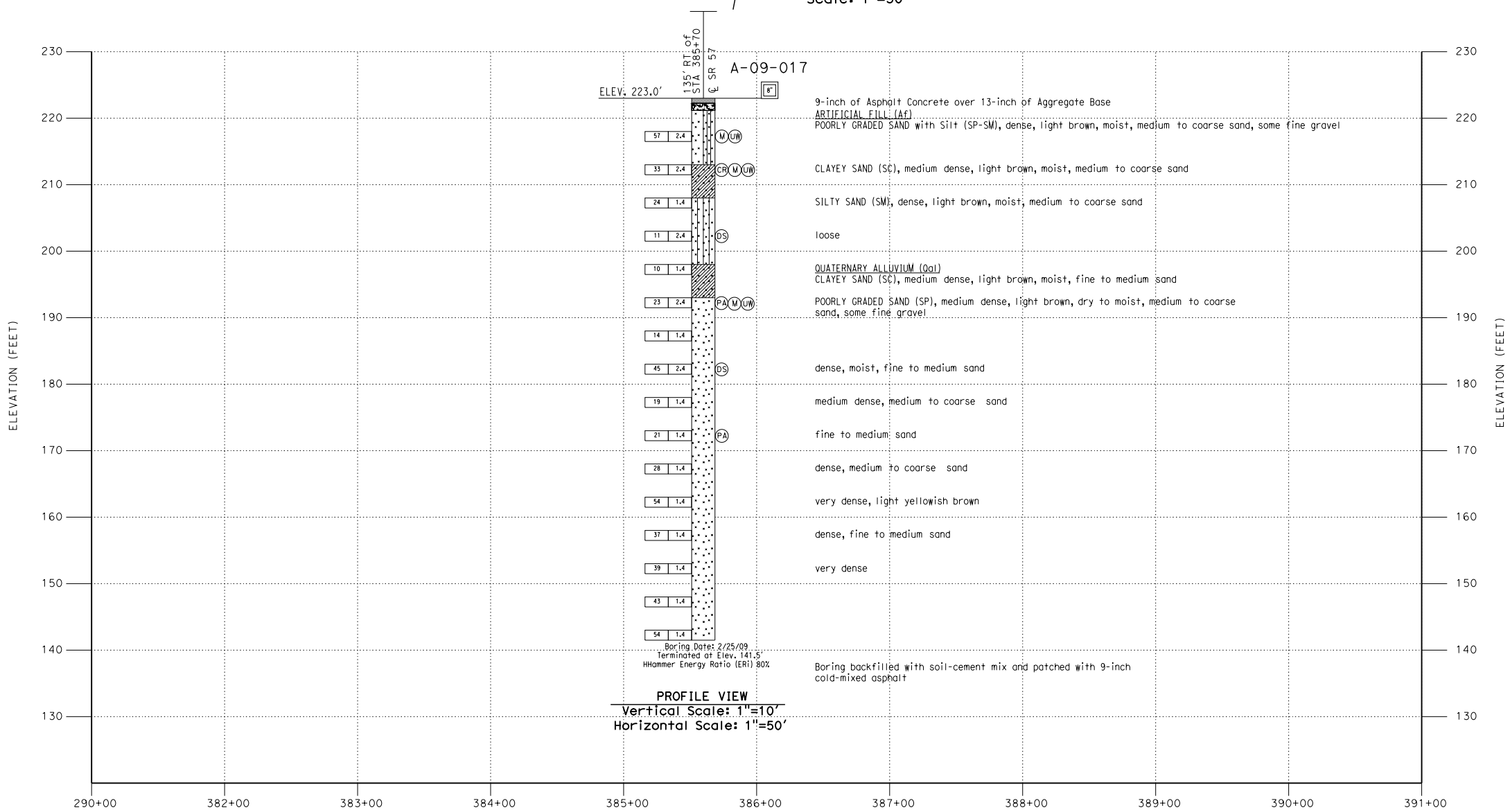
This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.



PLAN VIEW
Scale: 1"=30'



PROFILE VIEW
Vertical Scale: 1"=10'
Horizontal Scale: 1"=50'

Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.

DESIGN OVERSIGHT	DRAWN BY Buu Tran	Amit Bakane FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55E010
SIGN OFF DATE	CHECKED BY Taekuk Kim	DATE: 2/25/09			POST MILES 14.78

LINCOLN AVENUE OC-RET WALL
LOG OF TEST BORINGS 1 OF 4

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10

REVISION DATES

SHEET 9 OF 12

FILE => FIGURE-2-Lincoln-Avenue_1of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 14:18

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

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17781 COWAN
IRVINE, CA 92614

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

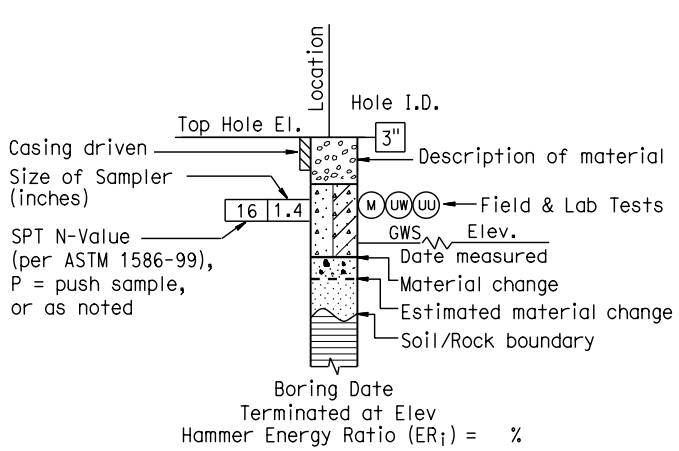
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
⛶	O	Other

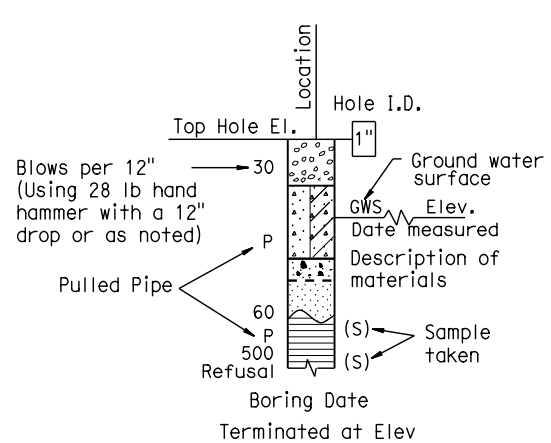
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

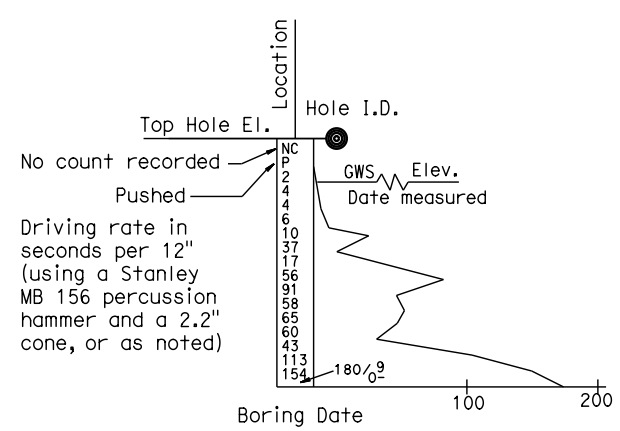
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



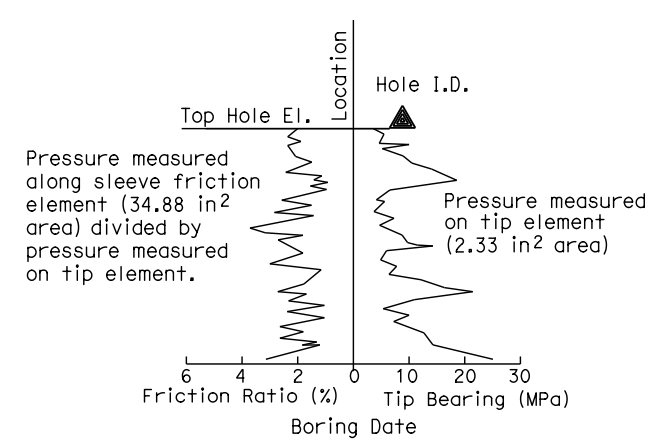
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT	DRAWN BY Buu Tran	Amit Bakane FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55E010
SIGN OFF DATE	CHECKED BY Taekuk Kim	DATE: 2/25/09			POST MILES 14.78

LINCOLN AVENUE OC-RET WALL

LOG OF TEST BORINGS 2 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES: ~~10/09~~ ~~2/10~~ 5/10

SHEET 10 OF 12

FILE => FIGURE-2-Lincoln-Avenue_2of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 14:19

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

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REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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LEIGHTON CONSULTING INC.
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IRVINE, CA 92614

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY Buu Tran

CHECKED BY Taekuk Kim

Amit Bakane
FIELD INVESTIGATION BY:
DATE: 2/25/09

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Djan Chandra
PROJECT ENGINEER

BRIDGE NO. 55E010
POST MILES 14.78

LINCOLN AVENUE OC-RET WALL
LOG OF TEST BORINGS 3 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10

REVISION DATES

SHEET 11 OF 12

FILE => FIGURE-2-Lincoln-Avenue_3of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 14:20

DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	Ora	57,91	12.5/15.91 6.9/10.0	344	443

A.E. Bacher
DESIGN METHODS ENGINEER — REGISTERED CIVIL ENGINEER NO. 8558
DATE APPROVED December 18, 1972

BENCH MARK

B.M. # 388-Ana-63 Elev. 190.11
Found City of Anaheim brass cap in top of curb. 1 ft. north of end of curb return on Sunkist at northwest corner of Sunkist and Lincoln #2600 D.

To convert to current datum NAVD88, approximately 1.84 feet should be added to the as-built elevations.

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	12.2/15.2	12	12

REGISTERED ENGINEER-GEOTECHNICAL

LINCOLN AVE OC - RET WALL

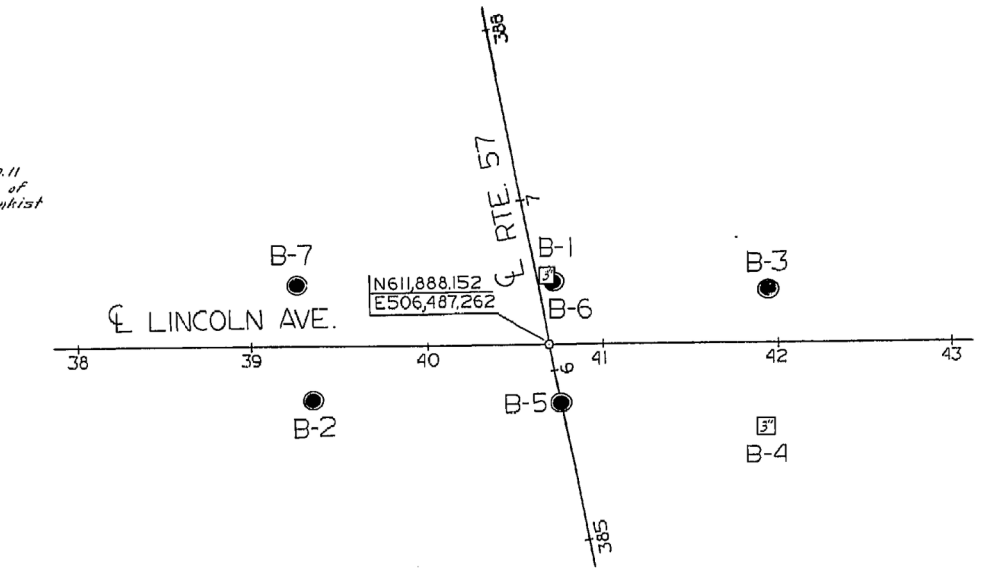
LOG OF TEST BORINGS 4 OF 4

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 12231
EA: 0F0401

BRIDGE NO. 55E010

REGISTERED PROFESSIONAL ENGINEER — DJAN CHANDRA — No. 2376 — Exp. 6/30/11 — GEOTECHNICAL — STATE OF CALIFORNIA



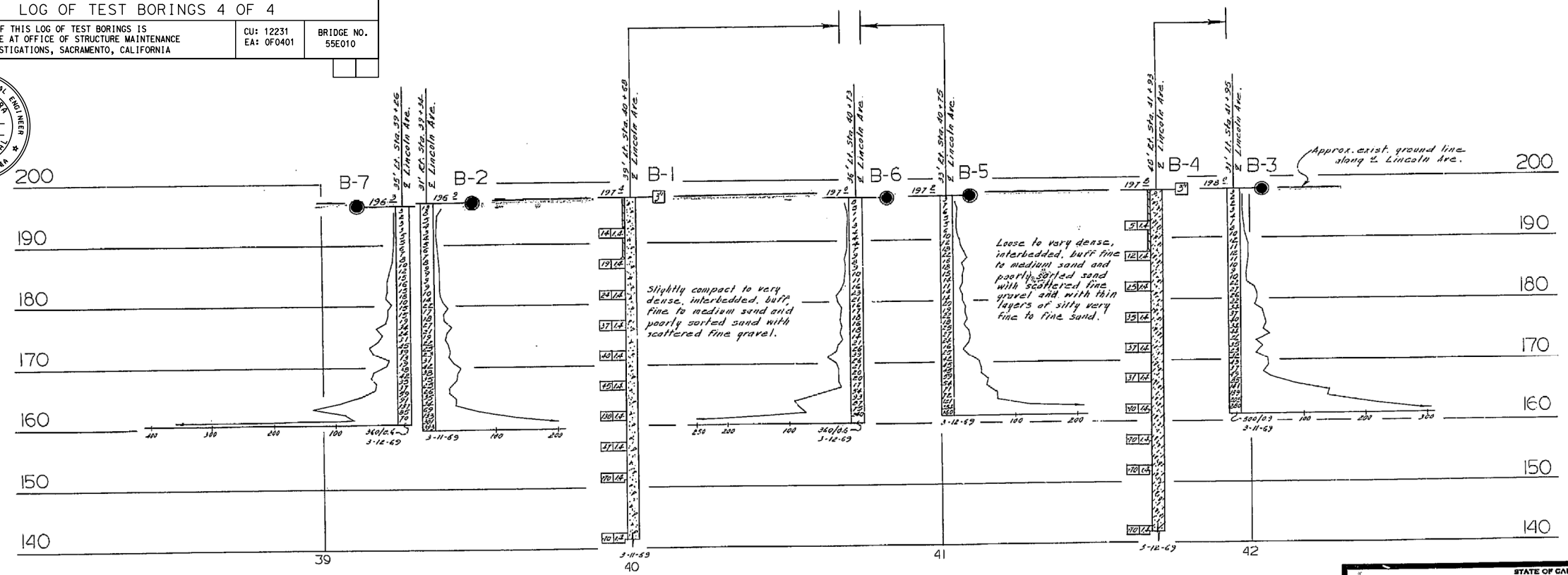
PLAN

Scale: 1" = 50'

PROFILE

Scale: Vert 1" = 10'
Horiz 1" = 20'

NO FURTHER WATER CONTROL USED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE March 1969



LEGEND OF BORING OPERATIONS

PENETROMETER — 2½" CONE PENETROMETER — SAMPLER BORING (DRY) — ROTARY BORING (WET) — AUGER BORING (DRY) — JET BORING — CORE BORING — TEST PIT

LEGEND OF EARTH MATERIALS

GRAVEL — SILTY CLAY OR CLAYEY SILT — SAND — PEAT AND ORGANIC MATTER — SILT — FILL MATERIAL — CLAY — IGNEOUS ROCK — SANDY CLAY OR CLAYEY SAND — SEDIMENTARY ROCK — SANDY SILT OR SILTY SAND — METAMORPHIC ROCK

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

FIELD STUDY	by A.C. Cain	3-13-69
DRAWN	by J. Lane	3-27-69
CHECKED	by R. Corbett	4-2-69

Approval Recommended by: Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000 6373

No AS BUILT changes
CORRECTIONS BY R. Stroups
CONTRACT NO. 032021
DATE 10-11-74

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

LINCOLN AVENUE OVERCROSSING

LOG OF TEST BORINGS

05-11-69	POST MILE 12.5	DRAWING NO.	SHEET 11	OF 11

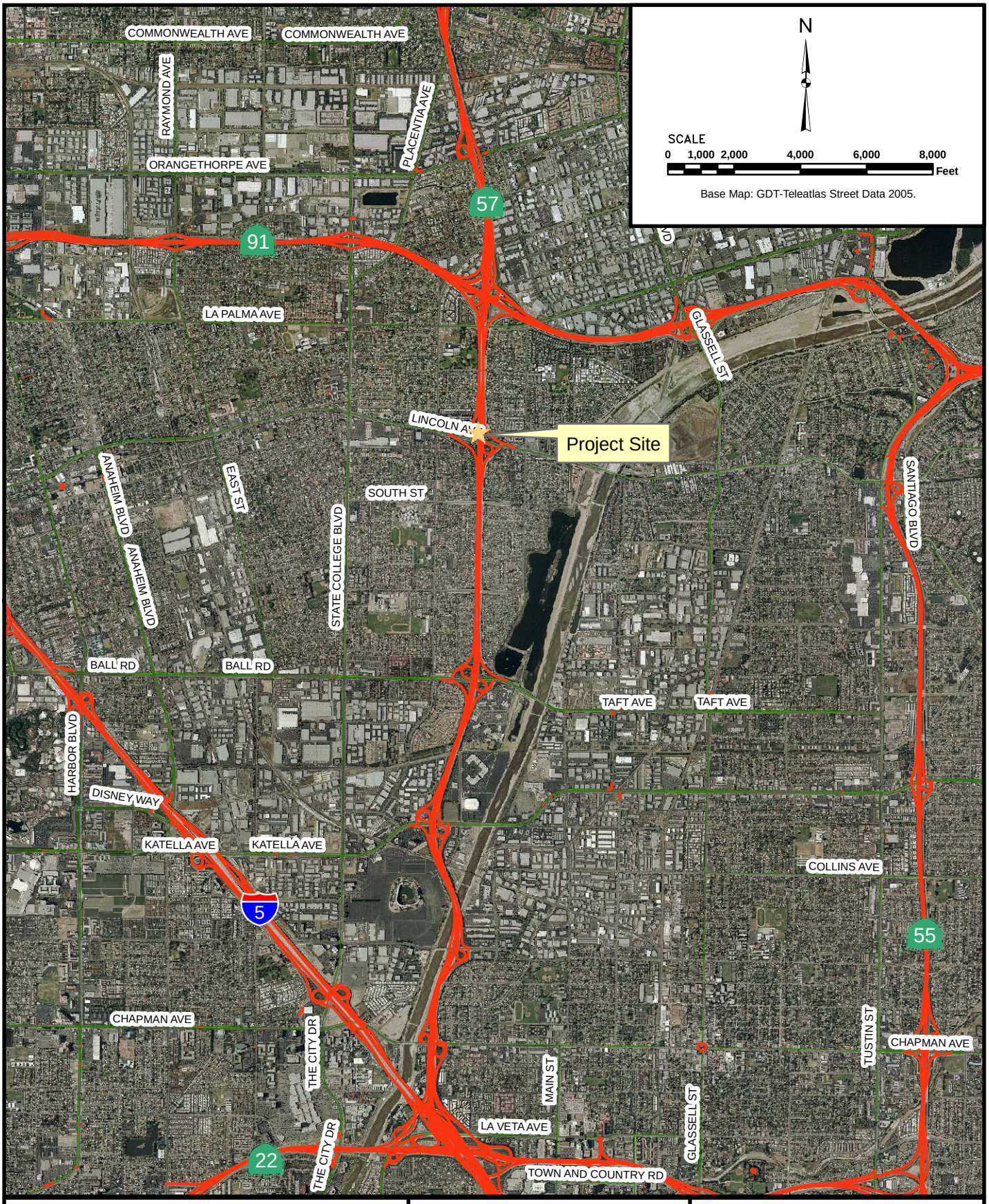
REVISION DATES (PRELIMINARY STAGE ONLY) 10/7/69

WO 032021
CU 07203

Disregard prints bearing earlier revision dates

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 1/23/75 SIGNATURE TITLE



Retaining Wall
at Lincoln Avenue Overcrossing
Northbound SR-57 Widening
Orange County, California

SITE LOCATION MAP

Project No.

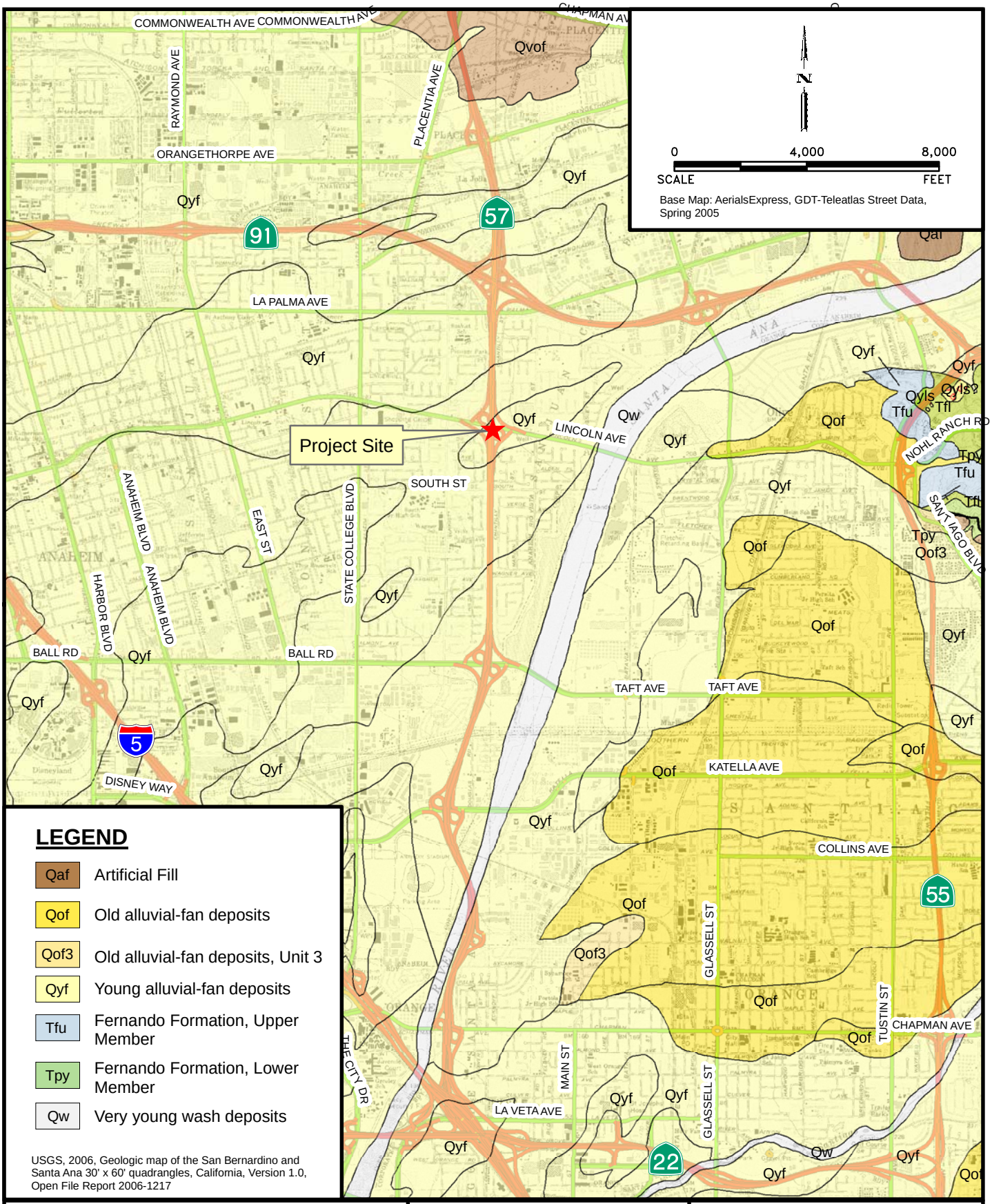
602231-002

Date

May 2009

Figure 1

P:\Drafting\602231\002\GIS\602231002_SiteLocationMap_DouglsRd.mxd



LEGEND

Qaf	Artificial Fill
Qof	Old alluvial-fan deposits
Qof3	Old alluvial-fan deposits, Unit 3
Qyf	Young alluvial-fan deposits
Tfu	Fernando Formation, Upper Member
Tpy	Fernando Formation, Lower Member
Qw	Very young wash deposits

USGS, 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, Version 1.0, Open File Report 2006-1217

Retaining Wall
at Lincoln Avenue Overcrossing
Northbound SR-57 Widening
Orange County, California

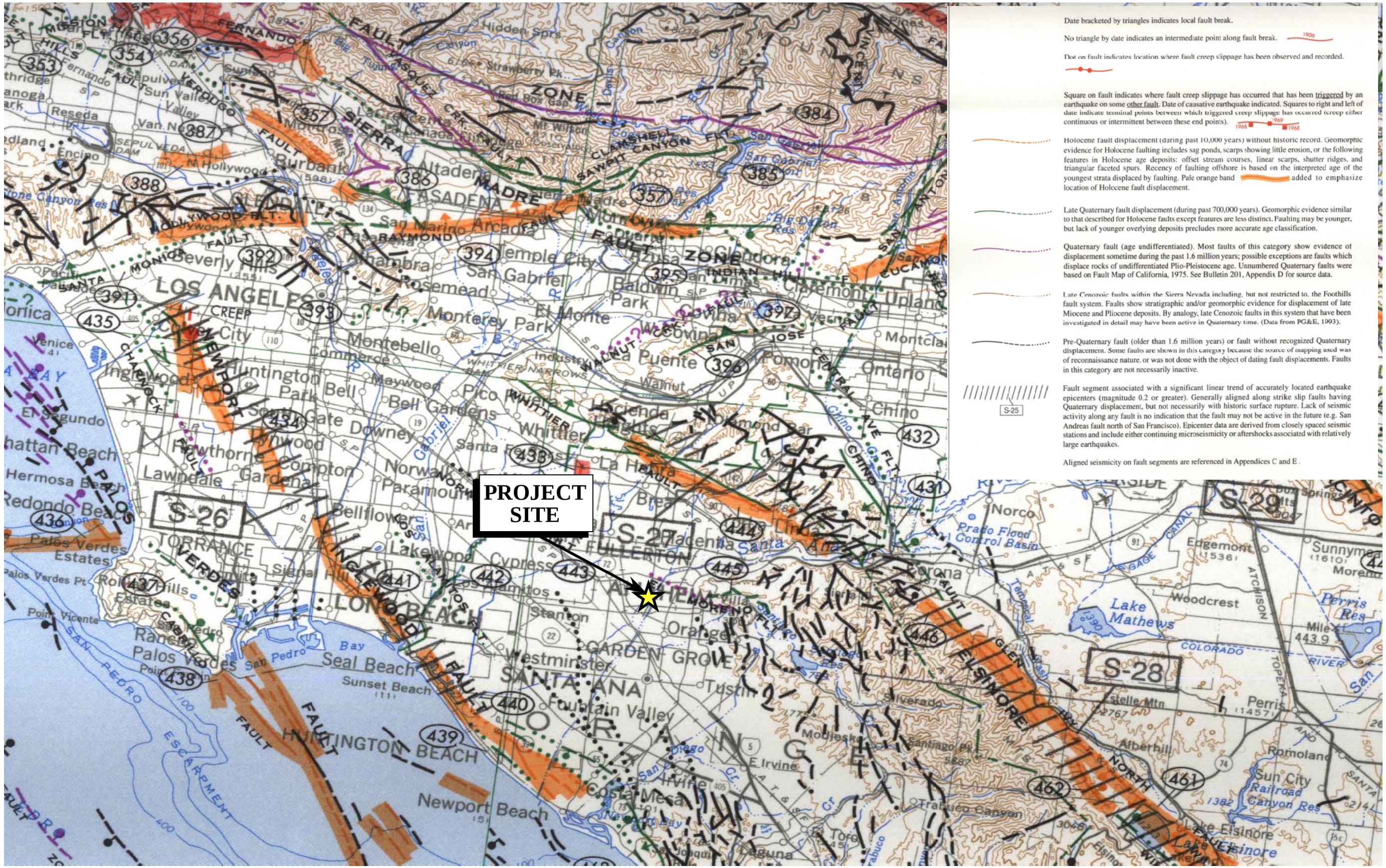
REGIONAL GEOLOGIC MAP

Project No.
602231-002

Date
May 2009

Figure 2

\\GIS\Drafting\602231\002\GIS\Figure3-GeologyMap-LincolnAve.mxd



Base Map: Fault Activity Map of California and Adjacent Areas with Location and Ages of Recent Volcanic Eruptions; CDMG 1994

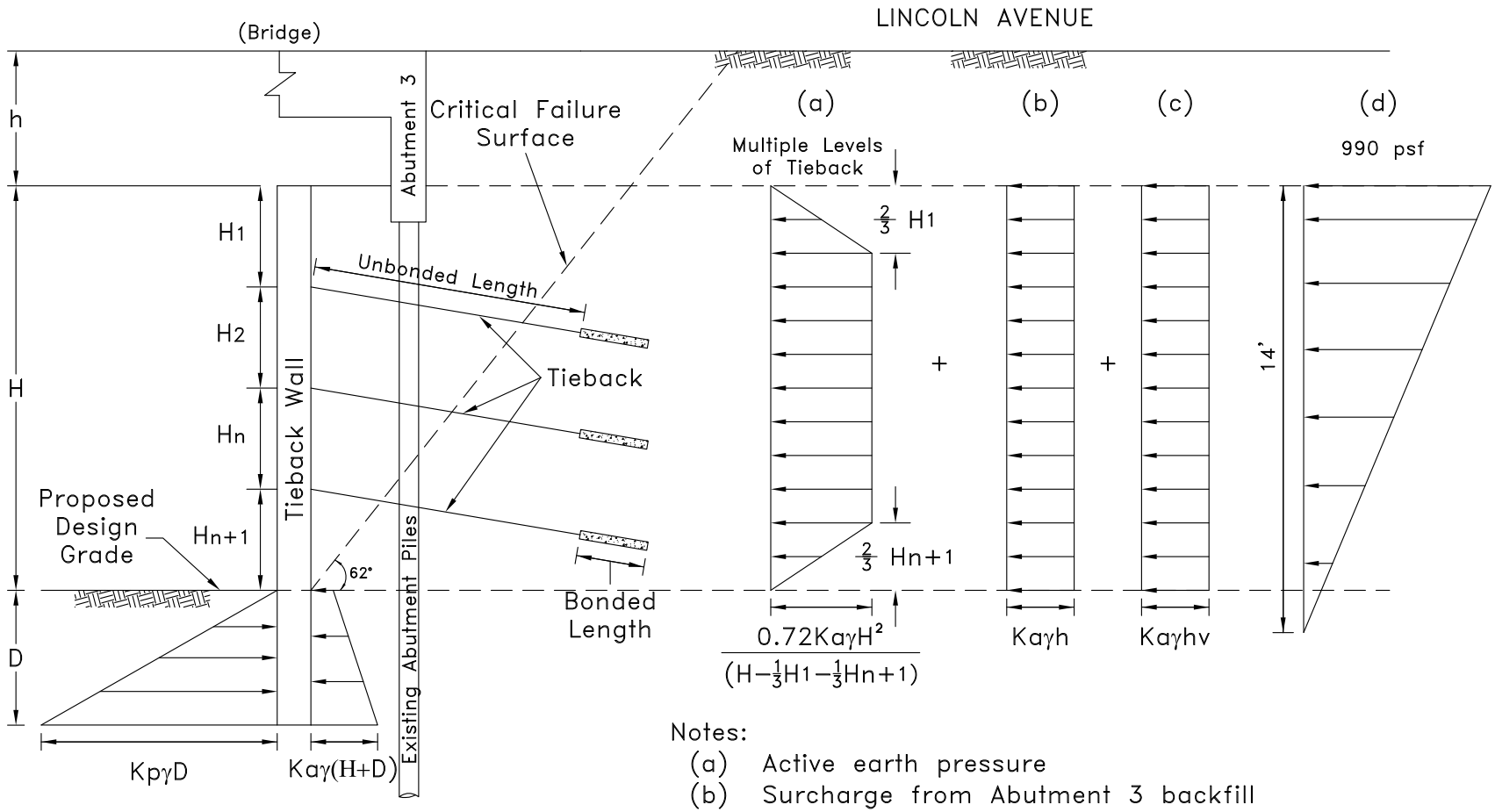
FAULT ACTIVITY MAP

Retaining Wall at Lincoln Avenue Overcrossing
Northbound SR 57 Widening
Anaheim, California

Project No.	602231-002
Scale (Approx)	1:750,000
Engr./Geol.	DJC / ELB
Drafted By	BQT
Date	5/09

Leighton

Figure 3



Notes:

(a) Active earth pressure
(b) Surcharge from Abutment 3 backfill
(c) Surcharge from traffic loading
(d) Seismic pressure resulting from lateral load of the existing piles

hv –Equivalent soil height for traffic surcharge (min. 2 feet)
ka –Active earth pressure coefficient
kp –Passive earth pressure coefficient
γ –Soil unit weight

Reference: Caltrans Bridge Design Specification (2004)

Figure 4

LATERAL EARTH PRESSURE ON TIEBACK WALL LINCOLN AVENUE OVERCROSSING	Leighton	Proj: 602231-002 Eng./Geol. DJC	Scale: As-Shown Drafted By: VMN	Date: 2/10 CP By: BQT

P:\DRAFTING\602231\002\OF_2010-01-12-LOTB\LINCOLN-AVENUE\FIGURE4.DWG (02-05-10 4:14:44PM) Plotted by: btran

APPENDIX A

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

				Gradation				Atterberg Limits		Maximum Density		Shear Strength: Peak		Shear Strength: Ultimate		Chemical Analyses					
Boring No.	Sample Type	Top of Sample (ft)	Bottom of Sample (ft)	Gravel (%)	Sand (%)	Silt (%)	Clay <5μm (%)	LL:PL:PI	Sand Equivalent	Max Dry Density (pcf)	Optimum Moisture Content (%)	ϕ' (deg)	C' (psf)	ϕ' (deg)	C' (psf)	pH	Sulfate (ppm)	Chloride (ppm)	Resistivity (Ω-cm)	Expansion Index of Soil	R-Value
A-09-017	R/sPT	10.0	20.0													7.2	347	32	1200		
	RING	20.0	21.5									38	0	36	0						
	RING	30.0	31.5	98		2															
	RING	40.0	41.5									41	200	32	0						
	SPT	50.0	51.5	94		6															

NOTE: The laboratory tests were performed in general accordance with the following standards:

Sieve Analysis - ASTM D422

Direct Shear Test - ASTM D3080

Corrosivity Tests - DOT CA 532/643 - pH, DOT CA 417 - soluble sulfates, DOT CA 422 - chlorides, DOT CA 643- minimum resistivity

Boring No.	A-09-017	A-09-017	A-09-017					
Sample No.	R-1	R-2	R-4					
Depth (ft.)	5.0	10.0	30.0					
Sample Type	Drive	Drive	Drive					
Soil Identification	Light brown poorly-graded sand with silt (SP- SM)	Light brown clayey sand (SC)	Light brown poorly-graded sand (SP), very loose					
Pocket Penetrometer (tons/ft^2)	>4.50	>4.50	0.00					
Weight Soil + Rings / Tube (g)	1137.53	944.35	1009.21					
Weight of Rings / Tube (g)	266.40	222.00	266.40					
Average Length (in.)	6.00	5.00	6.00					
Average Diameter (in.)	2.416	2.416	2.416					
Wet. Wt. of Soil + Cont. (g)	214.50	314.97	1018.65					
Dry Wt. of Soil + Cont. (g)	209.85	307.15	1000.98					
Weight of Container (g)	39.72	39.33	251.84					
Container No.								
Wet Density	120.6	120.1	102.9					
Moisture Content (%)	**3**	**3**	**2**					
Dry Density (pcf)	**117**	**117**	**101**					
Degree of Saturation (%)	17.0	17.7	9.4					

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

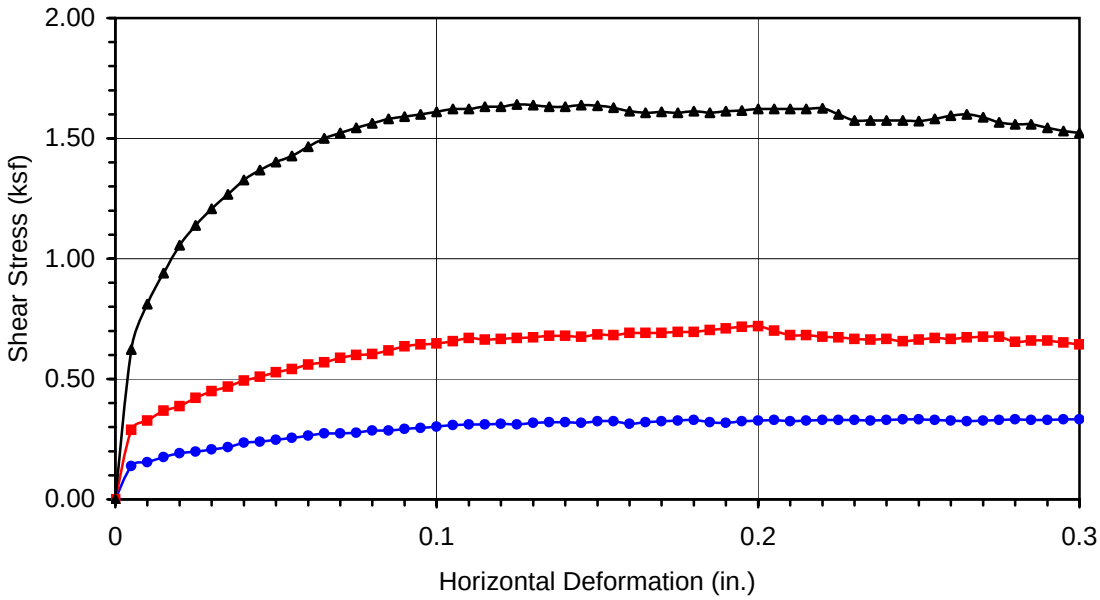
Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/06/09

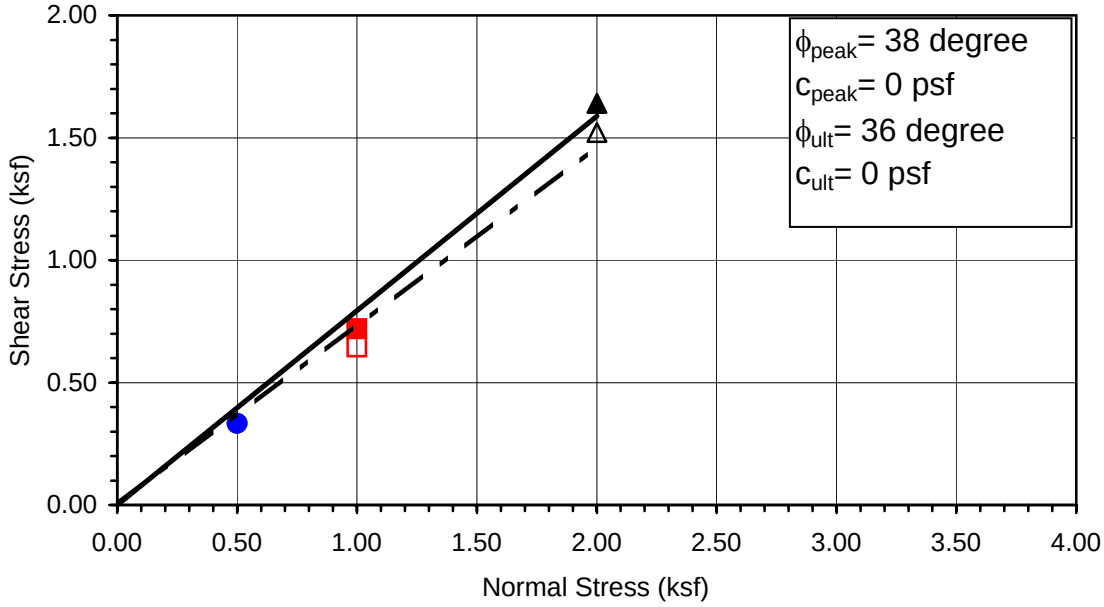
Boring No.	A-09-017	A-09-017						
Sample No.	R-4	S-5						
Depth (ft.)	30	50						
Sample Type	Drive	SPT						
Soil Identification	Light brown poorly-graded sand (SP)	Light brown poorly-graded sand (SP)						
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00						
Dry Weight of Soil + Container (g)	0.00	0.00						
Weight of Container (g)	1.00	1.00						
Moisture Content (%)	0.00	0.00						
Sample Dry Weight Determination								
Weight of Sample + Container (g)	1000.98	649.06						
Weight of Container (g)	251.84	220.08						
Weight of Dry Sample (g)	749.14	428.98						
Container No.:								
After Wash								
Method (A or B)	B	B						
Dry Weight of Sample + Cont. (g)	983.60	624.38						
Weight of Container (g)	251.84	220.08						
Dry Weight of Sample (g)	731.76	404.30						
% Passing No. 200 Sieve	**2.3**	**5.8**						
% Retained No. 200 Sieve	97.7	94.2						

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/05/09





Boring No.	**A-09-017**
Sample No.	**R-3**
Depth (ft)	**20**

Sample Type:

Drive

Soil Identification:
Light brown silty sand (SM)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.333	■ 0.720	▲ 1.641
Shear Stress @ End of Test (ksf)	○ 0.333	□ 0.644	△ 1.522
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	4.83	4.83	4.83
Dry Density (pcf)	103.9	108.9	116.2
Saturation (%)	21.0	23.8	28.9
Soil Height Before Shearing (in.)	0.9949	0.9889	0.9850
Final Moisture Content (%)	17.2	16.3	18.6

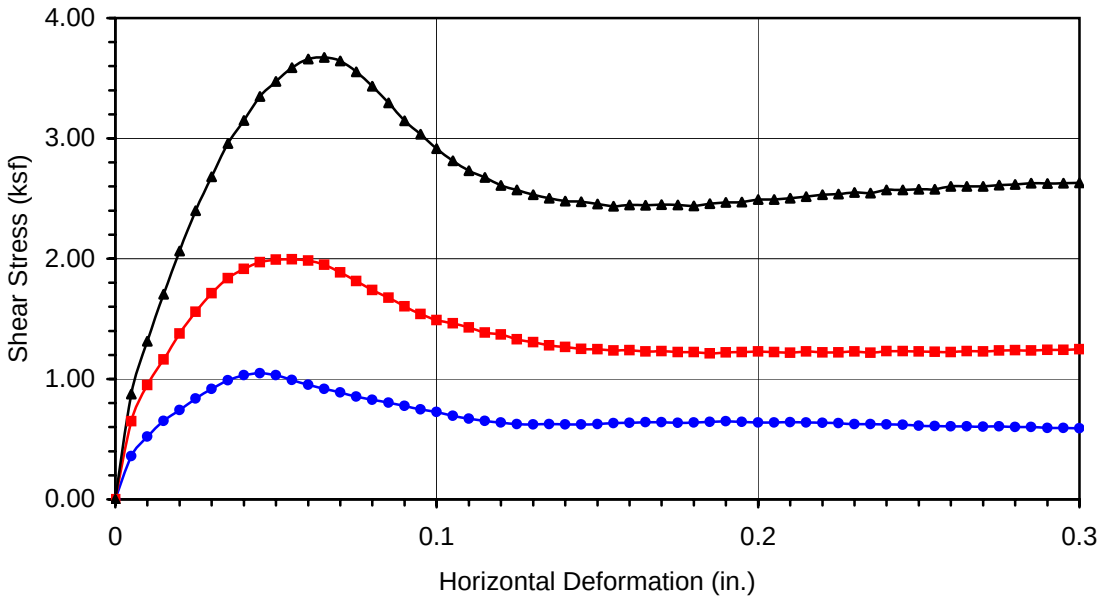
Leighton

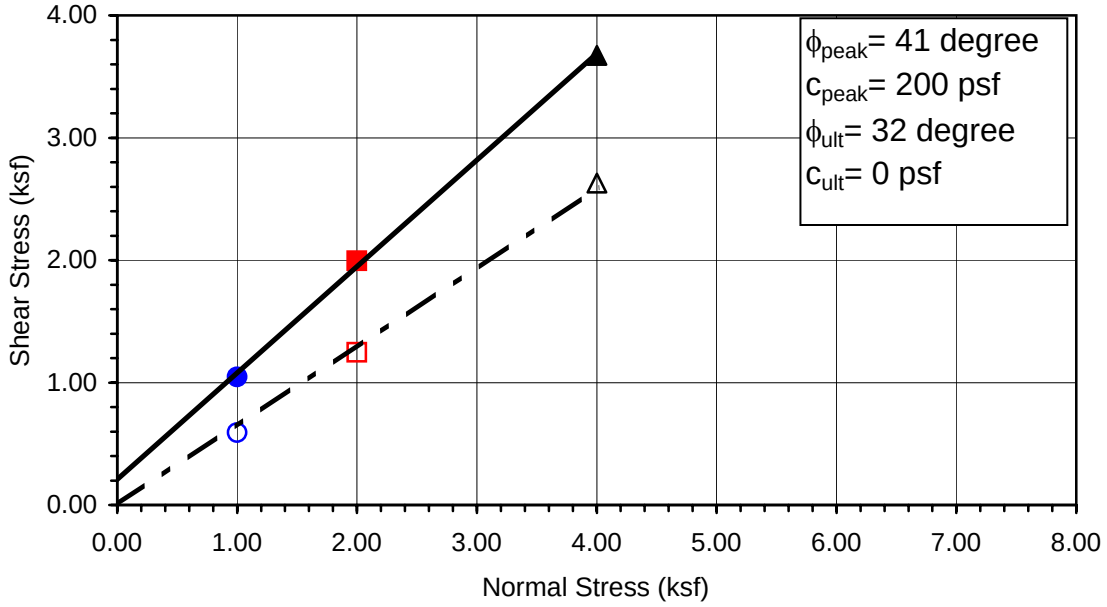
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09





Boring No.	**A-09-017**
Sample No.	**R-5**
Depth (ft)	**40**

Sample Type:

Drive

Soil Identification:
Light brown poorly graded sand (SP)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.047	■ 1.996	▲ 3.672
Shear Stress @ End of Test (ksf)	○ 0.591	□ 1.248	△ 2.631
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	3.63	3.63	3.63
Dry Density (pcf)	102.5	103.0	104.8
Saturation (%)	15.2	15.4	16.1
Soil Height Before Shearing (in.)	0.9943	0.9884	0.9789
Final Moisture Content (%)	22.8	22.1	22.7

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09

Leighton

SOIL RESISTIVITY TEST

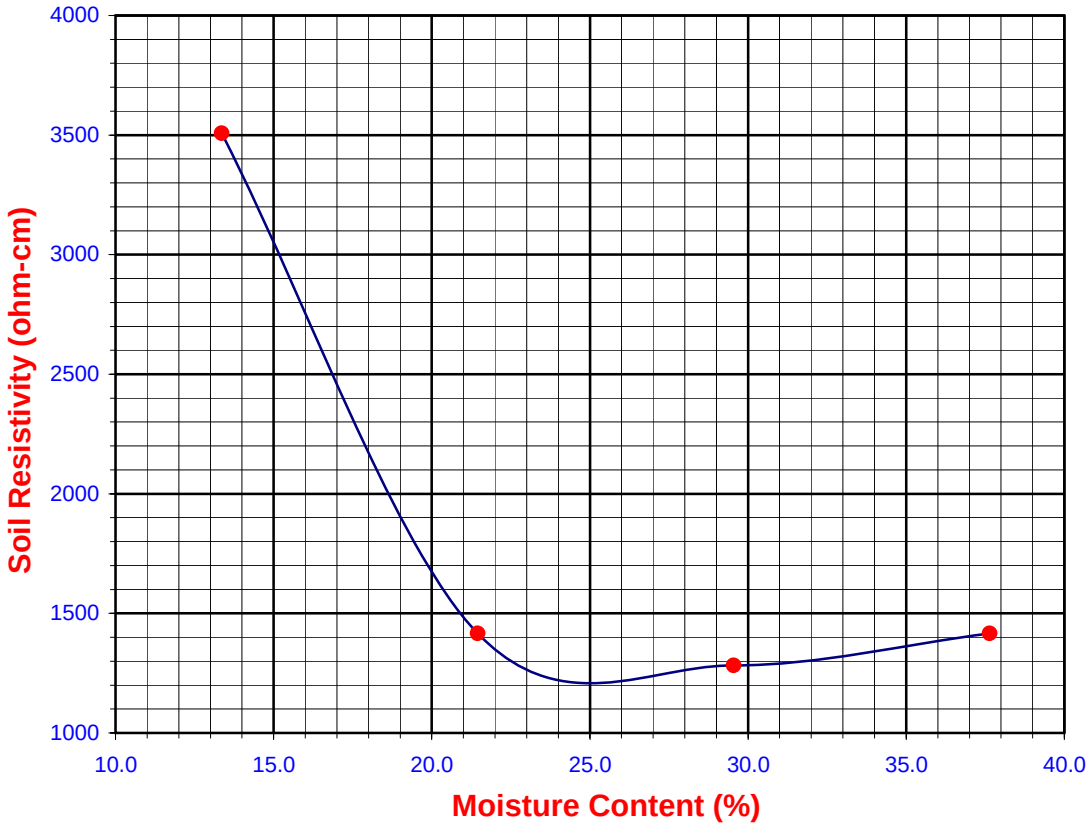
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/17/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/19/09
Boring No.:	A-09-017	Depth (ft.) :	10-20		
Sample No. :	R-2, S-1, R-3				
Soil Identification:	Light brown (SC/SM)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	13.36	520	3508
2	200	21.45	210	1417
3	300	29.55	190	1282
4	400	37.65	210	1417
5				

Moisture Content (%) (MCi)	5.26
Wet Wt. of Soil + Cont. (g)	200.20
Dry Wt. of Soil + Cont. (g)	192.10
Wt. of Container (g)	38.10
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
1200	**25.2**	**347**	**32**	**7.18**	**19.1**



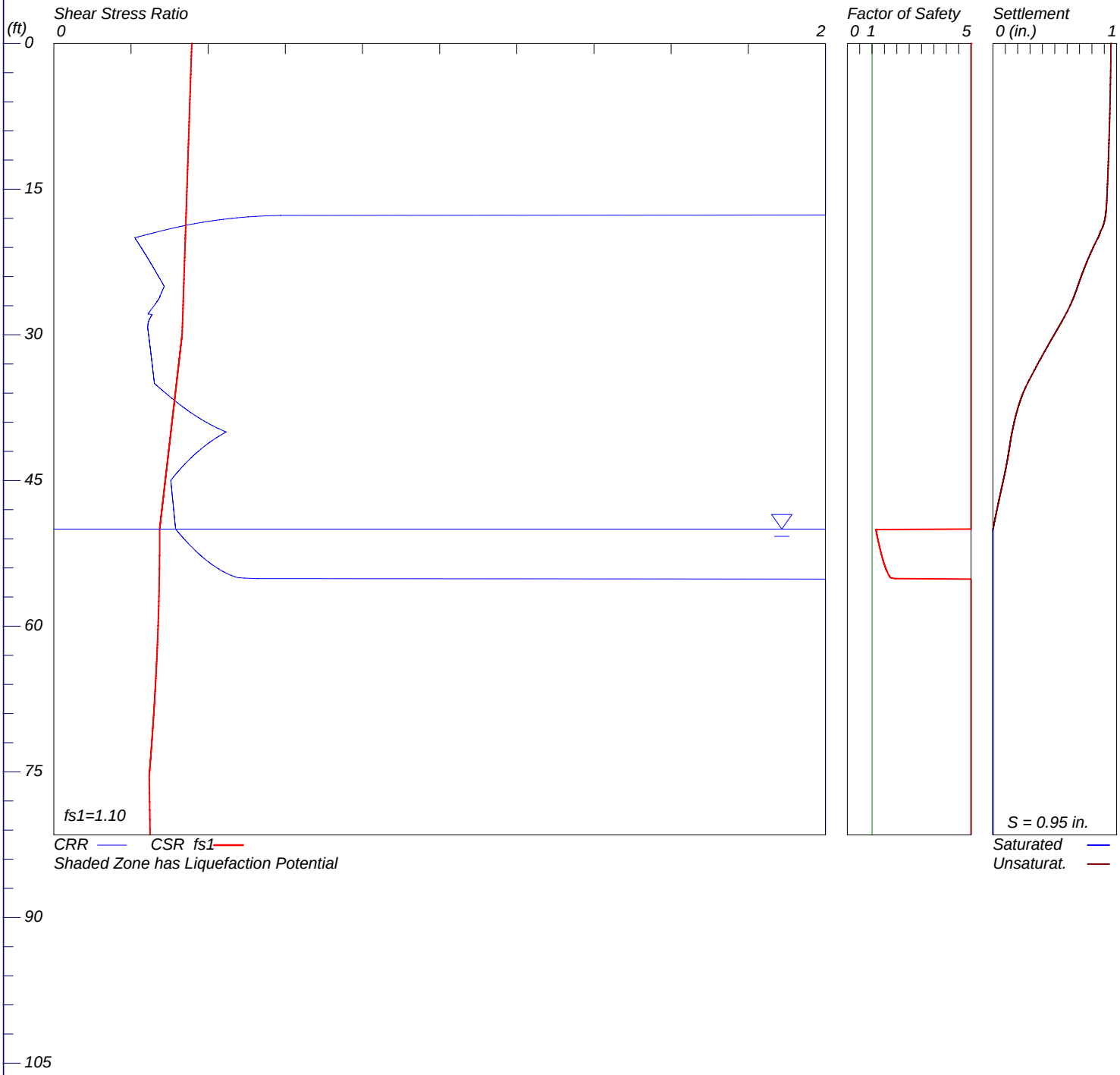
APPENDIX B

LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/ Lincoln Ave Tieback Wal

Hole No.=A-09-017 Water Depth=50 ft Surface Elev.=223

Magnitude=6.6
Acceleration=0.50g



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LIQUEFACTION ANALYSIS SUMMARY
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Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 2/4/2010 12:31:34 PM

Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\B-17.liq
Title: SR-57 Northbound Widening/ Lincoln Ave Tieback Wal
Subtitle: 602231-002

Surface Elev.=223
Hole No.=A-09-017
Depth of Hole= 81.50 ft
Water Table during Earthquake= 50.00 ft
Water Table during In-Situ Testing= 81.50 ft
Max. Acceleration= 0.5 g
Earthquake Magnitude= 6.60

Input Data:
Surface Elev.=223
Hole No.=A-09-017
Depth of Hole=81.50 ft
Water Table during Earthquake= 50.00 ft
Water Table during In-Situ Testing= 81.50 ft
Max. Acceleration=0.5 g
Earthquake Magnitude=6.60

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.333
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	29.00	120.00	5.00
10.00	17.00	120.00	20.00
15.00	24.00	120.00	20.00
20.00	6.00	115.00	20.00
25.00	10.00	115.00	20.00
30.00	12.00	103.00	2.30
35.00	14.00	103.00	5.00
40.00	23.00	107.00	5.00
45.00	19.00	107.00	5.00
50.00	21.00	107.00	5.80
55.00	28.00	107.00	5.00
60.00	54.00	107.00	5.00
65.00	37.00	107.00	5.00
70.00	39.00	107.00	5.00
75.00	43.00	107.00	5.00
80.00	54.00	107.00	5.00

Output Results:
Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.95 in.
Total Settlement of Saturated and Unsaturated Sands=0.95 in.
Differential Settlement=0.477 to 0.629 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.77	0.36	5.00	0.00	0.95	0.95
5.00	2.77	0.35	5.00	0.00	0.95	0.95
10.00	2.77	0.35	5.00	0.00	0.94	0.94
15.00	2.77	0.34	5.00	0.00	0.92	0.92
20.00	0.21	0.34	5.00	0.00	0.85	0.85
25.00	0.29	0.34	5.00	0.00	0.69	0.69
30.00	0.25	0.33	5.00	0.00	0.49	0.49
35.00	0.26	0.32	5.00	0.00	0.28	0.28
40.00	0.45	0.30	5.00	0.00	0.16	0.16
45.00	0.30	0.29	5.00	0.00	0.08	0.08
50.00	0.32	0.27	5.00	0.00	0.00	0.00
55.00	0.48	0.27	1.74	0.00	0.00	0.00
60.00	2.37	0.27	5.00	0.00	0.00	0.00
65.00	2.32	0.26	5.00	0.00	0.00	0.00
70.00	2.27	0.26	5.00	0.00	0.00	0.00
75.00	2.23	0.25	5.00	0.00	0.00	0.00
80.00	2.19	0.25	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Lateral Earth Pressure Calculation

ϕ (degree)	34
γ (pcf)	120.0
Factor of Safety	1.0

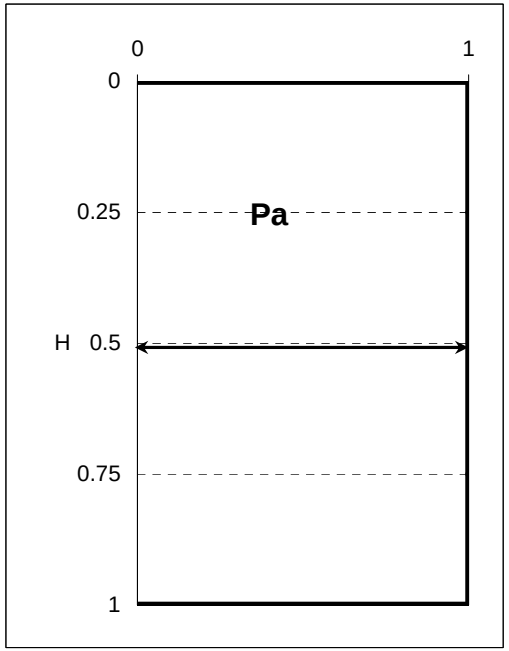
Temporary Excavation - Braced Cut

	1	2	3	
	Sand	Soft & Medium Clay	Stiff Clay	

Soil Type: 1

Soil Pressure (psf): **22**

	Level Backfill
Friction resistance	0.45
K_p	3.54
K_0	0.44
K_a	0.28
P_p (pcf)	**424.5**
P_0 (pcf)	**52.9**
P_a (pcf)	**33.9**



Assumption: Wall friction (δ) assumed to be 0.
Passive Pressure: Rankine Theory
Active Pressure: Rankine Theory for Level Backfill and NAVFAC DM 7.02 Ch3 for Sloping Backfill.
At rest condition: empirical relationship by Jaky 1944

Jaky, J., 1944, The Coefficient of Earth Pressure at Rest," Journal of the Society of Hungarian Architects and Engineers, Vol 7, 355-358

NAVFAC Figure 33, Passive pressure distribution for solider piles, p7.2-112

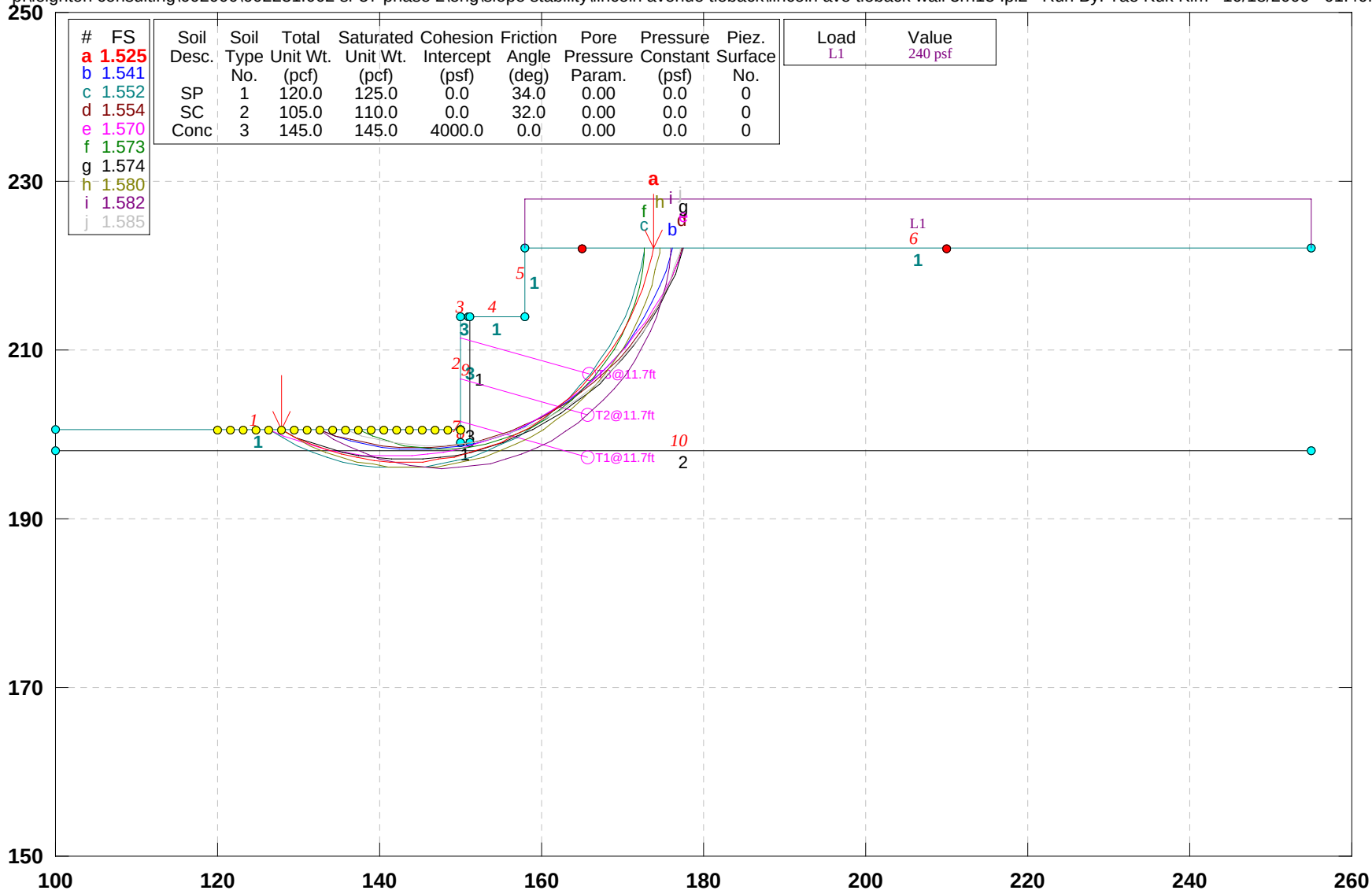
LATERAL EARTH PRESSURES-STATIC CONDITION
SR-57 RETAINING WALL
AT LINCOLN AVENUE OVERCROSSING
ANAHEIM, CALIFORNIA

PROJECT NAME : SR-57/Tieback Wall at Lincoln
PROJECT NO: 602231-002
DESIGNED BY: TK
CHECKED BY: DJC
DATE: 2/3/2010

Figure B2

602231-002/ SR 57 N Widening/Lincoln AveTieback Wall/3 Rows H=15ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\lincoln avenue tieback\lincoln ave tieback wall 3rh15 .pl2 Run By: Tae Kuk Kim 10/18/2009 01:40PM

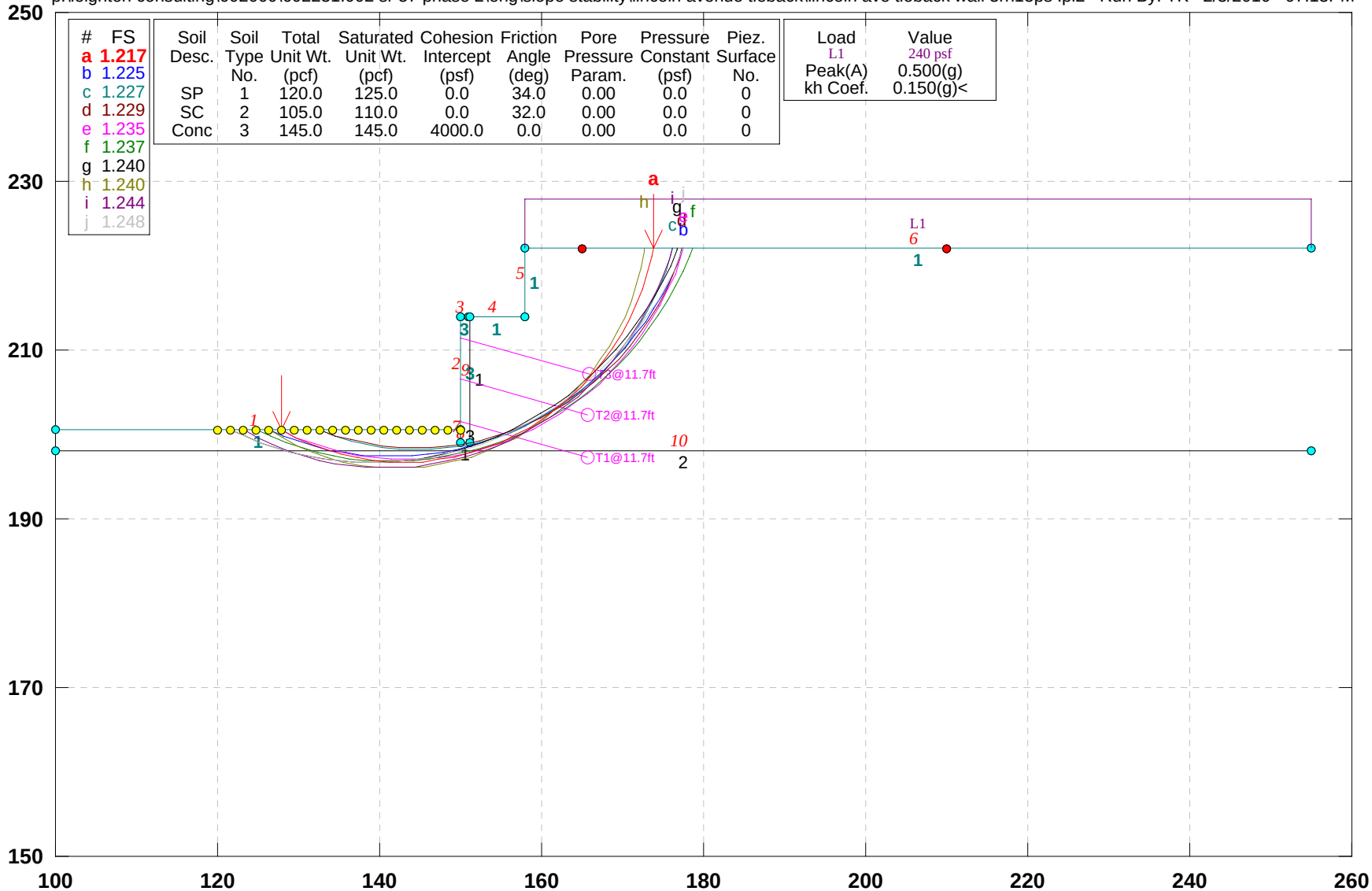


GSTABL7 v.2 FSmin=1.525

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Lincoln AveTieback Wall/Pseudo Static/3 Rows H=15ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\lincoln avenue tieback\lincoln ave tieback wall 3rh15ps .pl2 Run By: TK 2/3/2010 07:13PM

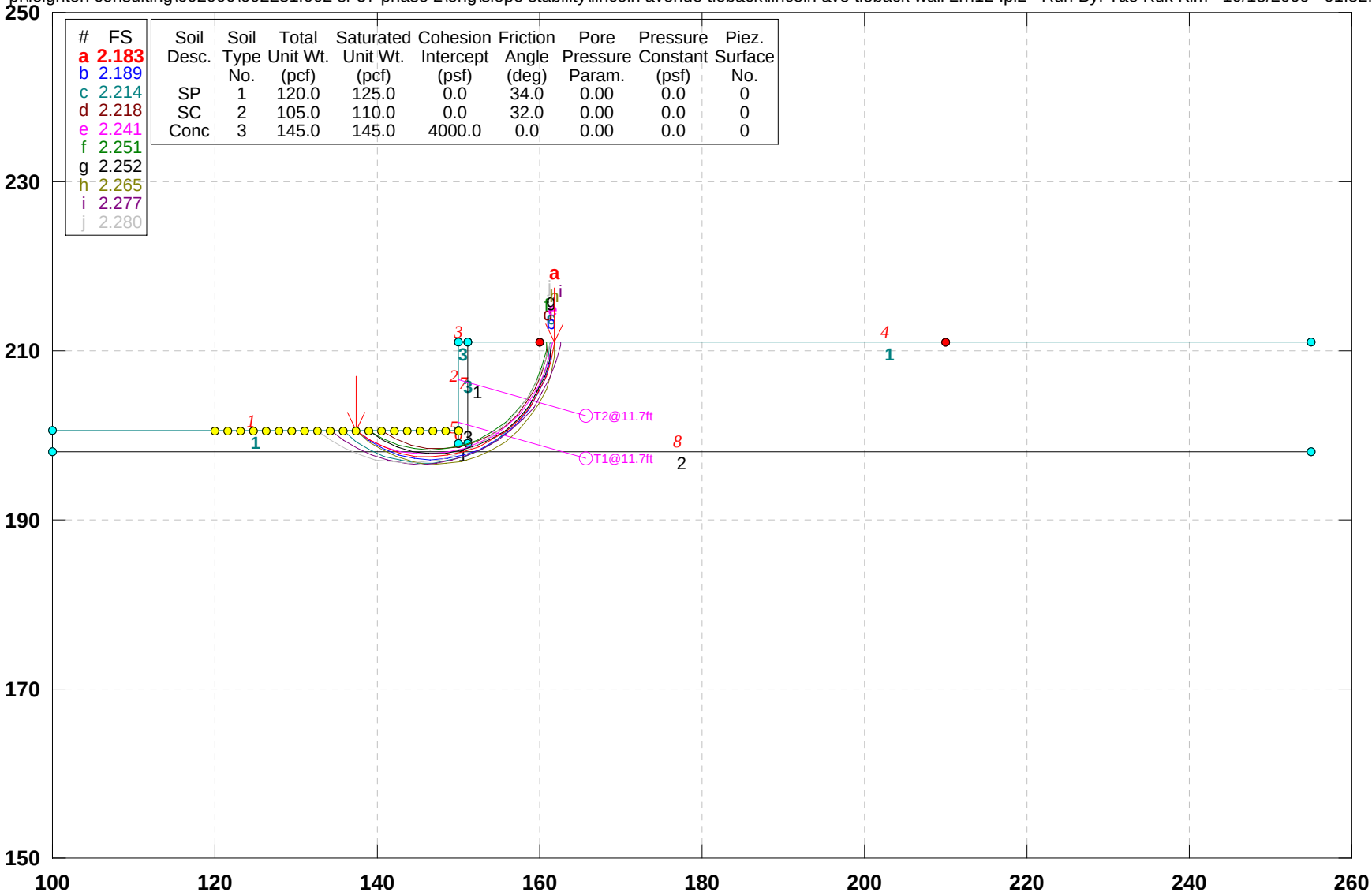


GSTABL7 v.2 FSmin=1.217

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Lincoln AveTieback Wall/2 Rows H=12ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\lincoln avenue tieback\lincoln ave tieback wall 2rh12 .pl2 Run By: Tae Kuk Kim 10/18/2009 01:52PM

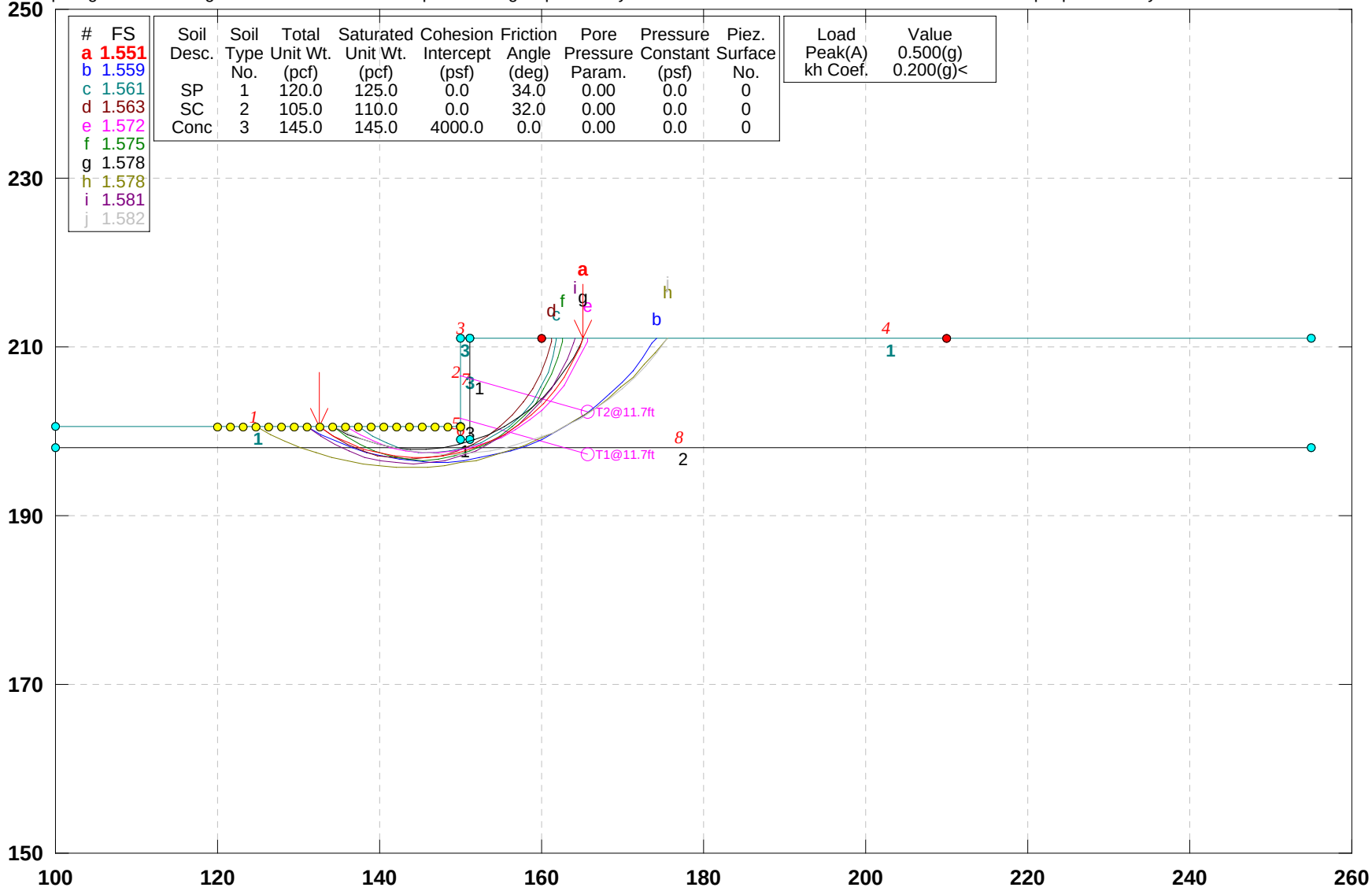


GSTABL7 v.2 FSmin=2.183

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Lincoln AveTieback Wall/Pseudo Static/2 Rows H=12ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\lincoln avenue tieback\lincoln ave tieback wall 2rh12ps .pl2 Run By: TK 2/3/2010 07:12PM

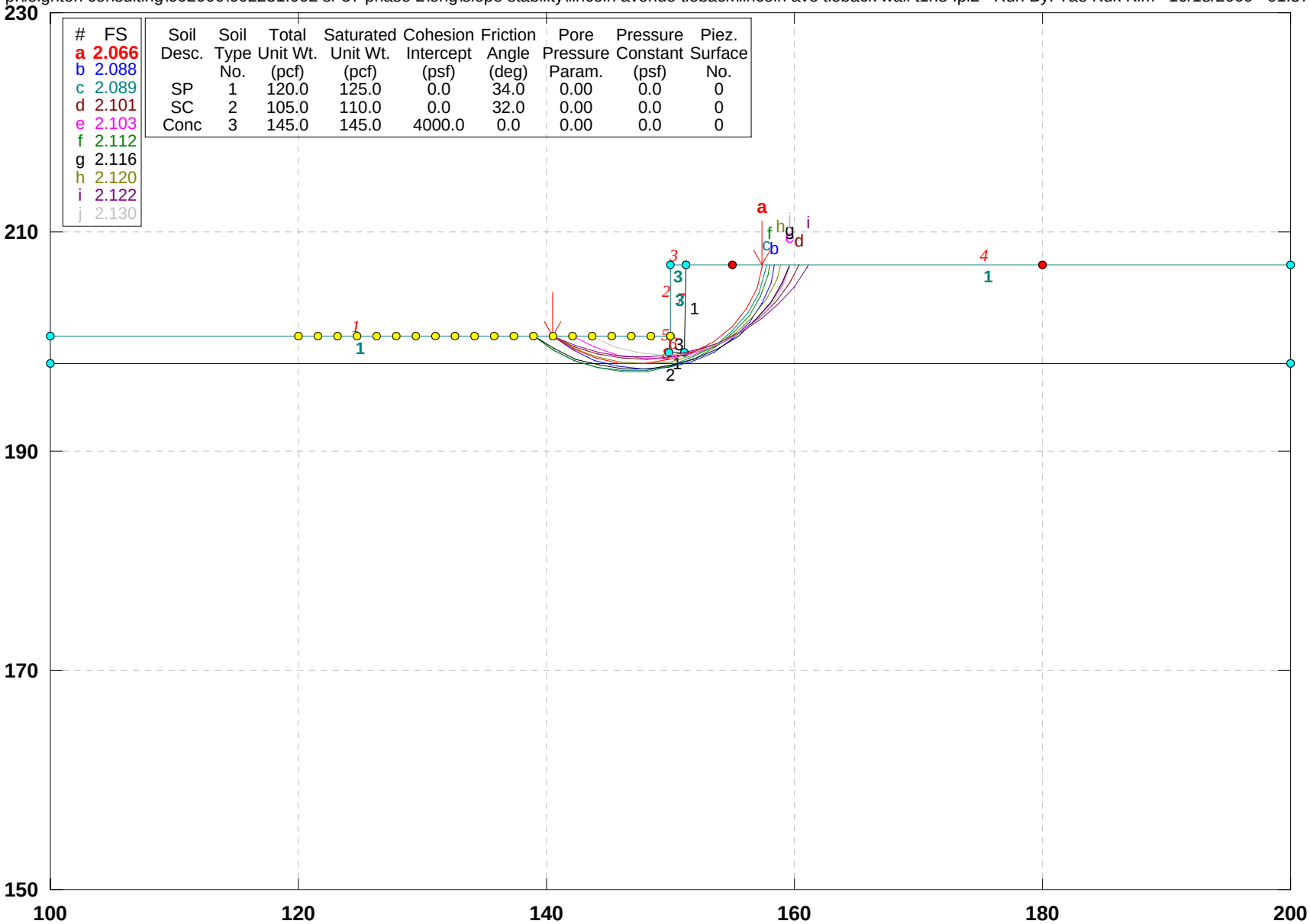


GSTABL7 v.2 FSmin=1.551

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Lincoln AveType 1 Retaining Wall/H=8ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\lincoln avenue tieback\lincoln ave tieback wall t1h8 .pl2 Run By: Tae Kuk Kim 10/18/2009 01:57PM

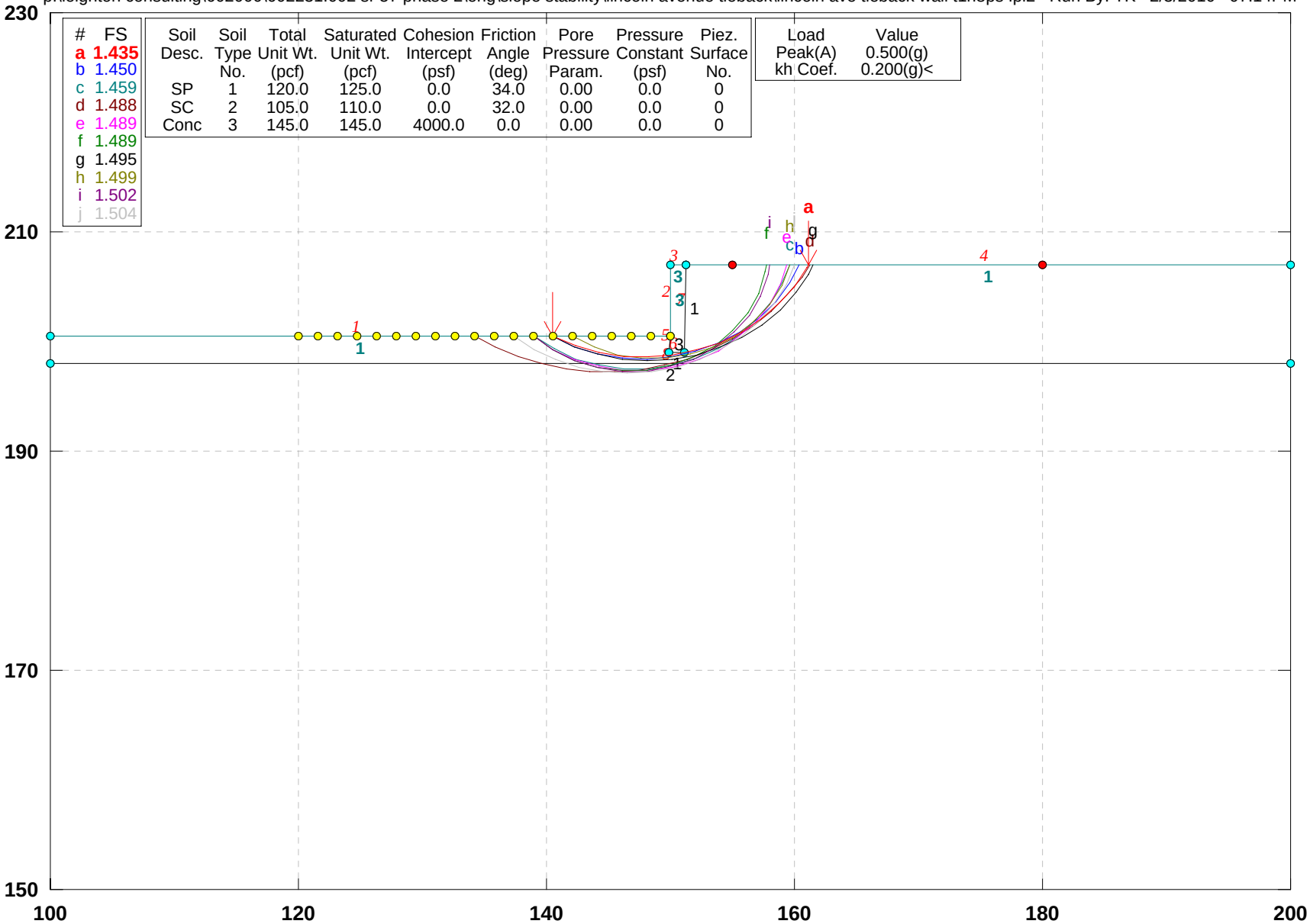


GSTABL7 v.2 FSmin=2.066

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Lincoln AveType 1 Retaining Wall/PseudoStatic/H=8ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\lincoln avenue tieback\lincoln ave tieback wall t1h8ps .pl2 Run By: TK 2/3/2010 07:14PM

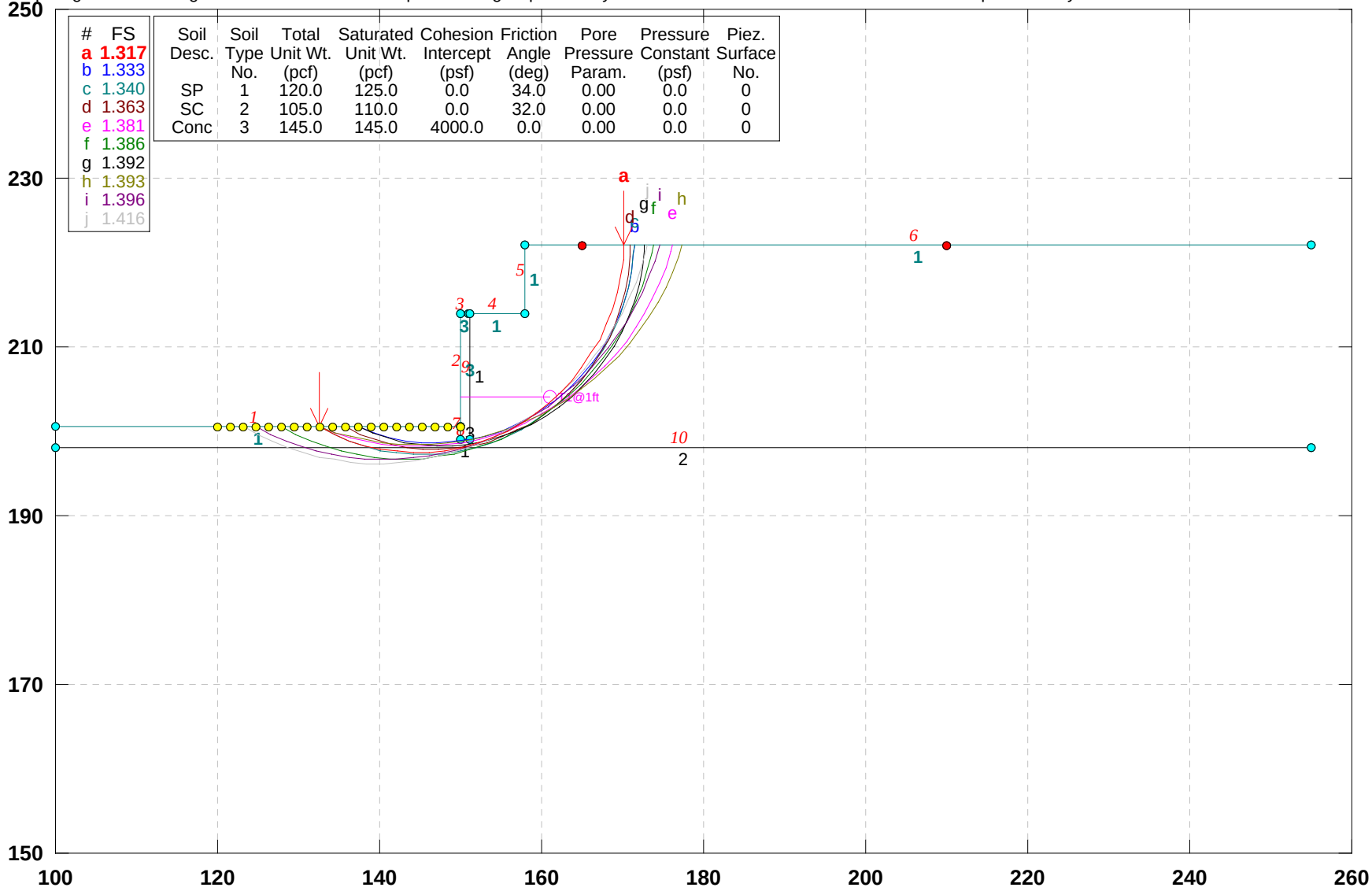


GSTABL7 v.2 FSmin=1.435

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Lincoln AveCritical Failure Surface/H=15ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\lincoln avenue tieback\lincoln ave tiebackch15 .pl2 Run By: Tae Kuk Kim 10/18/2009 02:06PM



GSTABL7 v.2 FSmin=1.317

Safety Factors Are Calculated By The Modified Bishop Method

```
VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

SR-57/ Lincoln Ave Abut 3/ 16 in Dia CIDH Pile /pile cutoff@ 14' bsg

PROPOSED DEPTH =      45.0 FT
----------------

NUMBER OF LAYERS =    4
------------------

WATER TABLE DEPTH =      65.0 FT.
-------------------

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.00
------------------------------------------------------
FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 2.00
------------------------------------------------------

SOIL INFORMATION
---------------

LAYER NO 1----SAND

  AT THE TOP

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.000E+00

  AT THE BOTTOM

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.900E+01

LAYER NO 2----SAND

  AT THE TOP

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.105E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.900E+01

  AT THE BOTTOM

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.320E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.105E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.360E+02

LAYER NO 3----SAND

  AT THE TOP

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.105E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.360E+02

  AT THE BOTTOM

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.105E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.440E+02

LAYER NO 4----SAND

  AT THE TOP

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.105E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.100E+11
  DEPTH, FT                                         = 0.440E+02

  AT THE BOTTOM

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.100E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.340E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
```

SOIL UNIT WEIGHT, LB/CU FT = 0.105E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.100E+11
DEPTH, FT = 0.650E+02

DRILLED SHAFT INFORMATION

DIAMETER OF STEM = 1.330 FT.
DIAMETER OF BASE = 1.330 FT.
END OF STEM TO BASE = 0.000 FT.
ANGLE OF BELL = 0.000 DEG.
IGNORED TOP PORTION = 9.000 FT.
IGNORED BOTTOM PORTION = 0.000 FT.
AREA OF ONE PERCENT STEEL = 2.001 SQ.IN.
ELASTIC MODULUS, Ec = 0.380E+07 LB/SQ IN
VOLUME OF UNDERREAM = 0.000 CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
10.0	0.51	1.37	6.69	8.06	4.71	4.03	15.66
11.0	0.57	2.88	7.24	10.12	6.50	5.06	17.88
12.0	0.62	4.52	7.41	11.94	8.23	5.97	19.33
13.0	0.67	6.31	7.41	13.72	10.01	6.86	20.51
14.0	0.72	8.23	7.41	15.64	11.93	7.82	21.71
15.0	0.77	10.28	7.41	17.69	13.99	8.85	22.92
16.0	0.82	12.48	7.41	19.89	16.18	9.94	24.15
17.0	0.87	14.81	7.41	22.22	18.51	11.11	25.40
18.0	0.93	17.28	7.41	24.69	20.98	12.34	26.65
19.0	0.98	19.88	7.41	27.29	23.59	13.65	27.91
20.0	1.03	22.62	7.41	30.03	26.33	15.02	29.18
21.0	1.08	25.50	7.41	32.91	29.21	16.46	30.46
22.0	1.13	28.52	7.41	35.93	32.22	17.96	31.74
23.0	1.18	31.67	7.41	39.08	35.38	19.54	33.02
24.0	1.24	34.96	7.41	42.37	38.67	21.19	34.31
25.0	1.29	38.39	7.41	45.80	42.10	22.90	35.60
26.0	1.34	41.95	7.41	49.37	45.66	24.68	36.90
27.0	1.39	45.66	7.41	53.07	49.36	26.53	38.19
28.0	1.44	49.50	7.41	56.91	53.20	28.45	39.49
29.0	1.49	53.47	7.41	60.88	57.18	30.44	40.80
30.0	1.54	57.59	7.41	65.00	61.29	32.50	42.10
31.0	1.60	61.84	7.41	69.25	65.54	34.62	43.41
32.0	1.65	66.22	7.41	73.63	69.93	36.82	44.71
33.0	1.70	70.75	7.41	78.16	74.45	39.08	46.02
34.0	1.75	75.41	7.41	82.82	79.11	41.41	47.33
35.0	1.80	80.21	14.82	95.03	87.62	47.52	52.76
36.0	1.85	85.14	14.82	99.97	92.56	49.98	53.96
37.0	1.90	90.62	14.82	105.44	98.03	52.72	55.38
38.0	1.96	96.24	14.82	111.07	103.66	55.53	56.80
39.0	2.01	102.02	14.82	116.84	109.43	58.42	58.22
40.0	2.06	107.94	14.82	122.76	115.35	61.38	59.64
41.0	2.11	114.00	14.82	128.83	121.42	64.41	61.06
42.0	2.16	120.22	14.82	135.04	127.63	67.52	62.48
43.0	2.21	126.58	14.82	141.41	134.00	70.70	63.90
44.0	2.26	133.10	14.82	147.92	140.51	73.96	65.33
45.0	2.32	139.76	14.82	154.58	147.17	77.29	66.75

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4961E+00	0.5007E-03	0.3251E-02	0.1000E-03
0.4961E+01	0.5007E-02	0.3251E-01	0.1000E-02
0.1262E+02	0.1263E-01	0.8127E-01	0.2500E-02
0.2525E+02	0.2539E-01	0.1625E+00	0.5000E-02
0.3699E+02	0.3781E-01	0.2438E+00	0.7500E-02
0.4761E+02	0.4966E-01	0.3251E+00	0.1000E-01
0.8843E+02	0.1041E+00	0.8127E+00	0.2500E-01
0.1168E+03	0.1589E+00	0.1625E+01	0.5000E-01
0.1299E+03	0.1984E+00	0.2438E+01	0.7500E-01
0.1369E+03	0.2316E+00	0.3232E+01	0.1000E+00
0.1442E+03	0.3913E+00	0.7342E+01	0.2500E+00
0.1477E+03	0.6464E+00	0.1112E+02	0.5000E+00
0.1508E+03	0.9009E+00	0.1444E+02	0.7500E+00
0.1528E+03	0.1154E+01	0.1673E+02	0.1000E+01
0.1571E+03	0.1756E+01	0.2164E+02	0.1596E+01

APPENDIX C

State of California | Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. JON HAMAGUCHI
Office of Special Funded Projects

Date: December 16, 2009
File: 12-ORA-57-PM 14.78
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
Lincoln Avenue OC.
Bridge No. 55-0525

Subject: Review of the Draft Foundation Report

On October 28, 2009, we received a draft Foundation Report for the Tieback wall at Abutment 3 of the Lincoln Avenue OC Bridge No. 55-0525. Construction of this wall is part of the Northbound widening of the SR-57 between Katella and Lincoln Avenues. The following comments are based on review of the subject report dated October 14, 2009, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

Faulting and Seismicity

- A section for Response Spectra should be added. Also Deterministic and Probabilistic Response Spectrum for each fault should be provided.
- 2008 USGS Deaggregated Hazard (Beta) Curve should be used as design curve if there is a difference of more than 10% between USGS and ARS online probabilistic data.
- QC/QA sheets should be included for all faults listed in calculated spectra.

Log of Test Borings (LOTB)

- The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets.
- The laboratory test symbols (i.e. PA at elev. 172) should be attached to the boring stick.
- Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NAVD88.
- The project name should be placed in Soil Legend sheets the same as LOTB sheet.
- Place Post Mile 14.78 in LOTB, Soil Legend, as built LOTB and design plans.

- The symbol for poorly graded sand with silt at elevation 219 should be (SP-SM).
- The word "dense" at elevation 215 should be moved to elevation 219 after (SP-SM).
- Delete the word "wet" at elevations 205 unless it is defining a perched water.
- Change relative density of "medium dense" to "dense" at elevations 207.

Design Plans

- Typical section of Type 1 wall is not shown in General Plan or any other plan sheets.
- The reason for extending shotcrete limits to Type 1 walls as shown in General Plan.
- Different soil parameters should be used for the top two rows and the bottom third row in the Foundation Plan.
- Show the label orientation on the cross sections in Retaining Wall Section Plan (i.e. vertical E-E label on Section E-E).

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by:

Date: 12/16/2009

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

c: OGDS1 - LA. File
OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of Lincoln Ave OC Bridge No. 55-0525, dated October 14, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Faulting & Seismicity	Faramarz Gerami	A section for Response Spectra should be added. Also Deterministic and Probabilistic Response Spectrum for each fault should be provided. 2008 USGS Deaggregated Hazard (Beta) Curve should be used as design curve if there is a difference of more than 10% between USGS and ARS online probabilistic data. QC/QA sheets should be included for all faults listed in calculated spectra.	ARS curve is not required for the tieback and Type 1 retaining wall design.
2	Log of Test Borings (LOTB)	Faramarz Gerami	The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets. The laboratory test symbols (i.e. P A at elev. 172) should be attached to the boring stick. Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NA VD88. The project name should be placed in Soil Legend sheets the same as LOTB sheet. Place Post Mile 14.78 in LOTB, Soil Legend, as built LOTB and design plans. The symbol for poorly graded sand with silt at elevation 219 should be (SP-SM). The word "dense" at elevation 215 should be moved to elevation 219 after (SP-SM).	We will remove the boxes. We will revise our LOTBs accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of Lincoln Ave OC Bridge No. 55-0525, dated October 14, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			Delete the word "wet" at elevations 205 unless it is defining a perched water. Change relative density of "medium dense" to "dense" at elevations 207.	
3	Design Plans	Faramarz Gerami	Typical section of Type 1 wall is not shown in General Plan or any other plan sheets. The reason for extending shotcrete limits to Type 1 walls as shown in General Plan. Different soil parameters should be used for the top two rows and the bottom third row in the Foundation Plan. Show the label orientation on the cross sections in Retaining Wall Section Plan (i.e. vertical E-E label on Section E-E).	We understand that HDR will revise the plans accordingly. We will provide the appropriate soil parameters for the third (lower) row of the tieback.

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: March 15, 2010
File: 12-ORA-57-PM 14.78
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
Lincoln Avenue OC.
Bridge No. 55-0525

Subject: 2nd Review of the Foundation Report

On February 22, 2010, we received a Foundation Report for the Tieback wall at Abutment 3 of the Lincoln Avenue OC Bridge No. 55-0525. Construction of this wall is part of the Northbound widening of the SR-57 between Katella and Lincoln Avenues. The following comments are based on review of the subject report revised February 15, 2010, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

4.1 Table 4 – As Built Foundation Data

- As Built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified.

Log of Test Borings (LOTB)

- Bottom of footing elevations (Tieback or Type 1) should not be shown on LOTB.
- Change relative density of "medium dense" to "dense" at elevations 207.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 3/15/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
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REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
No. 2669
Exp. 6-30-2010
GEOTECHNICAL
STATE OF CALIFORNIA

c: OGDS1 - LA. File
OGDS1 - Sac. File
GS - Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MARCH 15, 2010
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of Lincoln Ave OC Bridge No. 55-0525, dated February 15, 2010.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	4.1 Table 4 – As Built Foundation Data	Faramarz Gerami	As built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified.	We have revised Page 12 of our report accordingly.
2	Log of Test Borings (LOTB)	Faramarz Gerami	Bottom of footing elevations (Tieback or Type 1) should not be shown on LOTB. Change relative density of “medium dense” to “dense” at elevations 207.	We have revised our LOTB accordingly.

State of California **Business, Transportation and Housing Agency**

Memorandum

Flex your power!
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To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: June 7, 2010
File: 12-ORA-57-PM 14.78
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
Lincoln Avenue OC.
Bridge No. 55-0525

Subject: 3rd Review of the Foundation Report-Addendum

On May 26, 2010, we received an addendum to Foundation Report for the proposed Tieback wall No. 55E010 at Abutment 3 of the Lincoln Avenue OC Bridge No. 55-0525. The subject report including responses dated May 20, 2010, is prepared by Leighton Consulting, Inc.

We have no further comments after reviewing the referenced submittal and responses to our previous review comments dated March 15, 2010. Any questions should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 6/7/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
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GEOTECHNICAL
STATE OF CALIFORNIA

c: OGDS1 - LA. Electronic File
OGDS1 - Sac. Electronic File
GS – Sac. Electronic File

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

T R A N S M I T T A L

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: August 5, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail		Draft Report	X	Your Use
X	Courier/Overnight	X	Final Report		As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Foundation Report for Proposed Retaining Wall No. 55E0113 at Abutment 3 of South Street Overcrossing (Bridge No. 55-0516), Northbound State Route 57, Orange County, California

LEIGHTON CONSULTING, INC.

By: Djan Chandra

Distribution (4) Addressee

17781 Cowan ■ Irvine, CA 92614-6009
949.250.1421 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

FOUNDATION REPORT FOR
PROPOSED RETAINING WALL NO. 55E0113 AT ABUTMENT 3 OF SOUTH STREET OVERCROSSING (BRIDGE NO. 55-0516), NORTHBOUND STATE ROUTE 57, ORANGE COUNTY, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 57
PROJECT POST MILES: 12.2/15.2, EA # 0F0401

Prepared For:

HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

August 5, 2010

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

August 5, 2010

Project No. 602231-002

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Attention: Mr. Scott Bacsikin

Subject: Foundation Report for Proposed Retaining Wall No. 55E0113 at Abutment 3 of South Street Overcrossing (Bridge No. 55-0516), Northbound State Route 57, Orange County, California

In response to your request, Leighton Consulting, Inc. has performed a geotechnical exploration for the proposed Retaining Wall No. 55E0113 at the Abutment 3 of South Street overcrossing (Bridge No. 55-0516) at northbound State Route 57 (SR-57) in Orange County, California. The retaining wall will consist of a tieback wall with a Type 1 retaining wall at each end and is part of the proposed widening of northbound SR-57 from approximately 0.3 mile south of Katella Avenue to approximately 0.3 miles north of Lincoln Avenue. This project is sponsored by OCTA and Leighton Consulting has been retained as the geotechnical consultant by HDR Engineering, Inc. The purpose of our study was to evaluate the subsurface conditions at the project site and to provide geotechnical recommendations for design and construction of the proposed retaining wall. A draft version of this report was issued on October 16, 2009 and February 15, 2010 for review by Caltrans and the design team. An addendum report providing response to Caltrans final review comments was issued on May 20, 2010 and approved by Caltrans. Caltrans review comments and our responses are included in Appendix C of this report.

South Street is located approximately 24½ feet above the SR-57 grade. Based on the available borings, the subject portion of South Street is underlain by approximately 30 feet of man-made fill consisting mainly of very stiff silt and very dense sand. The fill is further underlain by alluvium consisting predominantly of medium dense to dense sand to the maximum depth of our boring of 81½ feet below the street grade. Groundwater was not encountered during our field exploration.

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Based on the provided plan, the existing Chantilly Drain is located behind Abutment 3 of the South Street overcrossing, approximately 35 feet from the proposed retaining wall. To protect the existing Chantilly Drain, design and construction of the tieback anchors for the tieback wall should consider the presence of the storm drain structure.

This report summarizes the results of our geotechnical exploration and presents geotechnical recommendations. If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Reviewed by:

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/gv

Distribution: (4) Addressee

Leighton

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1.0 INTRODUCTION

1.1 Project Overview

The California Department of Transportation (Caltrans), District 12, in cooperation with the Orange County Transportation Authority (OCTA), proposes to widen northbound State Route 57 (SR-57) between approximately 0.3 miles south of Katella Avenue (Post Mile 12.2) and 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project segment of SR-57 is approximately 3 miles long, passing through the City of Anaheim in Orange County, California. The purpose of the proposed project is to improve both existing and future mobility, reduce congestion and improve mainline merge and diverge movements.

This segment of SR-57 is relatively flat with elevations ranging from 186 feet above mean sea level (msl) at Katella Avenue to 200 feet msl at Lincoln Avenue. The southern portion of this segment is higher than the surrounding areas while the northern portion is lower. SR-57 was constructed in 1974 and currently has four general purpose lanes and a high-occupancy vehicle (HOV) lane in each direction. Six grade separations exist within this segment; namely at Katella Avenue, Douglass Road, Ball Road, Wagner Avenue, South Street and Lincoln Avenue. The project consists of widening of approximately 3 miles of northbound SR-57 by approximately 35 feet to provide standard lane widths, an additional general purpose lane (fifth lane) and a standard 10-foot wide inside shoulder.

1.2 Project Description

As part of the northbound SR-57 widening project, the existing sloped embankment at the front of Abutment 3 of South Street overcrossing will be removed and the remaining embankment will be retained by a tieback wall and a Type 1 retaining wall at each end. These walls are collectively identified as Retaining Wall No. 55E0113. The approximate location of the project site is shown in Figure 1, *Site Location Map*. Based on the provided plan and information, the proposed tieback wall has a maximum height of approximately 15 feet with two to three rows of tiebacks. The Type 1 retaining walls have a maximum height of 14 feet. The walls will be located approximately 8¾ feet from the center of the existing CIDH piles for Abutment 3. An existing storm drain box culvert, the Chantilly Drain, is located behind Abutment 3 of South Street overcrossing, approximately 35 feet from the proposed retaining wall.

Based on the as-built plan (Caltrans 1974), the existing South Street overcrossing (Bridge No. 55-0516) was constructed in 1974 and is supported on two abutments and one bent. The existing bridge is approximately 224 feet long and 80 feet wide. The as-built elevations of the bridge range from 220.34 to 220.95 feet from west to east. Datum for all elevations referenced in this report is mean sea level (msl). Additionally, the as-built plan was based on the old datum (NGVD29) and approximately 1.84 feet should be added to the as-built elevations to convert them to the current elevations (Datum NAVD88). The elevation of SR-57 freeway is approximately 195.7 feet. The *General Plan*, *Foundation Plan* and layout plan of the proposed retaining wall prepared by HDR are included at the end of the text of this report.

1.3 Purpose and Scope

The purpose of this report is to review existing geotechnical data, perform subsurface exploration, laboratory testing and geotechnical analysis to provide geotechnical design recommendations for the proposed project.

Our scope of work for this project included the following tasks:

- *Literature Review*: We reviewed various documents pertinent to the project site including the as-built Log of Test Borings (LOTBs) prepared by Caltrans for the existing Bridge No. 55-0516. The as-built LOTBs are included as Sheet 4 of 4 of the attached LOTBs. A list of references used in preparation of this report is presented in Section 6.0.

- *Site Reconnaissance:* We performed a site reconnaissance to visually evaluate the accessibility of the site for drilling equipment and locate and mark the proposed boring location.

- *Subsurface Exploration*: We performed a subsurface exploration that consisted of drilling, logging and sampling of one 8-inch diameter hollow-stem auger boring to a depth of 81½ feet below existing grade of South Street. Log of the boring is included in Sheet 1 of 4 of the attached LOTBs.

- *Laboratory Testing*: Laboratory testing was performed on selected soil samples collected from our field exploration to evaluate the engineering properties of the soils. The laboratory test results are included in Appendix A.

- *Seismic Analysis*: Based upon the encountered subsurface conditions and regional seismicity of the area, we performed ground motion analysis for the project site for use in structural analysis and design.

- *Geotechnical Design and Analysis*: Geotechnical analysis was performed on the collected data to develop recommendations for design and construction. Results of the analysis are included in Appendix B.

- *Report Preparation*: Relevant geotechnical data were compiled in this report along with our findings and recommendations for the proposed project.

2.0 GEOTECHNICAL FIELD AND LABORATORY INVESTIGATIONS

2.1 Subsurface Exploration

Our field exploration consisted of advancing one hollow-stem boring to the depth of 81½ feet below the existing grade of South Street. The boring was located within the embankment behind the existing Abutment 3 of South Street overcrossing. The approximate location of the boring is shown in LOTBs.

Standard Penetration Test (SPT) was performed within the hollow-stem boring using a 140-pound automatic hammer falling freely for 30 inches. The samplers were driven for a total penetration of 18 inches and the blow counts were recorded for the last 12 inches of penetration. Relatively undisturbed samples were collected from the boring using the Modified California Ring sampler. The field sampling procedures were conducted in accordance with ASTM Standard Specifications D 1586 and D 3550 for SPT and split-barrel sampling of soil. In addition to driven samples, representative bulk soil samples were also collected from the boring.

The test boring was logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. All samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the boring was backfilled with soil cutting mixed with cement, tamped and capped with cold mix asphalt. Geotechnical log of the boring is included in the LOTBs.

2.2 Geotechnical Laboratory Testing

Laboratory tests were performed on representative soil samples to determine the geotechnical engineering properties of subsurface materials. The following laboratory tests were performed:

- In-situ moisture content and density;
- Percent passing No. 200 sieve;
- Direct shear; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests, except corrosivity tests, were performed in general accordance with ASTM procedures. The corrosivity tests were performed in accordance with Caltrans procedures. Results of the laboratory tests are presented in Appendix A.

3.0 GEOTECHNICAL FINDINGS

3.1 Geologic Setting

The subject site is located in the Tustin Plain within the southeastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. In general, the Tustin Plain consists of approximately 1,400 feet of unconsolidated to semi-consolidated Quaternary-age alluvial sediments. Underlying the Quaternary alluvial deposits are Tertiary-age bedrock units consisting of sandstone, siltstone, shale and conglomerate on the order of 31,000 feet in thickness.

The site lies near the lower reaches of the Santa Ana River. The surface distribution of Holocene sediments, as recorded in early editions of regional soil survey maps (Eckmann et al., 1916), suggests that the Santa Ana River has recently wandered back and forth across the Orange County coastal plain from Alamitos Bay to Newport Bay. Historical accounts and documents further support the process of widespread sheet flooding being the dominant depositional process associated with the Santa Ana River prior to the construction of Prado Dam in 1941 (California Department of Water Resources, 1957). Currently, the Santa Ana River is located approximately 2,000 feet from the South Street overcrossing. Geology map of the area is presented in Figure 2.

3.2 Subsurface Earth Materials

The subsurface soils encountered in our boring consist of approximately 30 feet of embankment fill of South Street overcrossing underlain by alluvial deposits. The fill generally consists of very stiff silt and very dense sand. The alluvium below the fill consists of medium dense to dense sand to the maximum depth explored (86½ feet).

We have performed direct shear tests on representative samples collected from our boring. The cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils were found to range from 0 to 400 psf and 32 to 33 degrees, respectively. The test results are presented in Appendix A. Based on these test results, SPT blowcounts, and soil types, the shear strength parameters and unit weights selected for design are presented in Table 1.

Table 1 – Generalized Soil Profile and Design Parameters

Depth below Street Grade[1] (feet)	Elevation (feet)	Generalized Soil Type	Total Unit Weight (pcf)	Friction Angle[2] (degrees)	Undrained Cohesion, Cu[2] (psf)
0 to 25	220 to 195	**Fill**: Silt	120	28	1,000
25 to 30	195 to 190	Sand	120	34	-
30 to 81	190 to 139	**Native:** Sand	115	34	-

[1]South Street grade; cutoff elevation of the existing Abutment 3 pile is 207.5 feet; elevation of the top of retaining wall is 209.6 feet.
[2]Ultimate shear strength parameters based on SPT blow counts (NAFVAC, 1986) and laboratory test results.

3.3 Groundwater

Groundwater was not encountered during our field exploration to the maximum depth explored (elevation of 139 feet) nor in Caltrans borings in 1969 to the maximum depth explored (elevation of 137.5 feet). The historically high groundwater table is on the order of 50 feet below the freeway grade (elevation of 146 feet, CDMG, 1997). Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff.

3.4 Engineering Properties of Subsurface Materials

Engineering properties of the subsurface materials were modeled based on results of geotechnical field and laboratory tests performed during our exploration. Results of these laboratory tests that are applicable to the proposed project are presented in Appendix A. These test results are briefly discussed below:

3.4.1 Shear Strength

Based on direct shear test results, the cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils ranges from 0 to 400 psf and 32 to 33 degrees, respectively. The shear strength parameters used for design are presented in Table 1.

3.4.2 Corrosion Potential

Representative samples of the subsurface soils were subjected to analytical testing to evaluate the potential for corrosion to concrete and ferrous metals. The test results are included in Appendix A and indicate the tested soils exhibited chloride concentration of 35 parts per million (ppm), sulfate concentration of 1,431 ppm, minimum resistivity of 491 ohm-cm, and pH level of 5.31. Caltrans specifications define a corrosive soil as a material in which any of the conditions exist: a chloride content greater than 500 ppm; soluble sulfate content greater than 2,000 ppm; or a pH of 5.5 or less. Due to the relatively low pH level, the subsurface soils at the Abutment 3 location are considered corrosive. Reinforced concrete will require corrosion mitigation in accordance with Section 8.22 of *Bridge Design Specification* (Caltrans, 2004). Corrosion mitigation measure for the tieback anchors should be performed in accordance with Caltrans *Corrosion Guidelines* (Caltrans, 2003).

3.4.3 Expansion Potential

Based on our boring and previous borings, the near-surface soils on both street and freeway levels mainly consisted of silt and sand. It is our opinion that the on-site near-surface soils are considered to have low expansion potential.

3.5 Faulting and Seismicity

Our review of available in-house literature indicates that there are no known active or potentially active faults that have been mapped at the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in southern California. According to the California Geological Survey fault database, the closest active faults that could affect the site are the Puente Hills Blind Thrust, Whittier, and San

Joaquin Hills Blind Thrust faults located approximately 10.5 kilometers (km), 10.7 km and 15.7 km, respectively, from the site. Other known regional active faults that could affect the site include the Newport-Inglewood (L.A. Basin), Elsinore (Glen Ivy), Chino Central Ave (Elsinore), San Jose and Newport-Inglewood (Offshore) faults. The locations of these faults with respect to the site are shown in Figure 3.

We have performed seismic analysis for the site following the Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). Distance of faults to the site was estimated using Caltrans ARS online program and peak ground acceleration for each fault was estimated using Caltrans excel worksheet. The estimated peak ground accelerations caused by various faults near the site are summarized in the following table.

Table 2 – Peak Bedrock Accelerations

Fault	Maximum Magnitude	Distance (km)	Peak Ground Acceleration
Peralta Hills	6.2	2.9	0.41g
Puente Hills Blind Thrust	7.3	10.9	0.36g
Elsinore fault zone (Whittier section)	7.6	16.4	0.33g
Elsinore fault zone (Chino section)	7.6	16.9	0.31g

As shown in the table above, the Peralta Hills fault is the nearest fault to the site at a distance of approximately 2.9 km. A maximum earthquake magnitude of 6.2 has been estimated for this fault, resulting in a peak horizontal ground acceleration of about 0.41g at the site. This fault, however, is not included in the latest California Geological Survey fault database.

We have also performed probabilistic seismic analysis using Caltrans ARS online program. The peak ground acceleration was calculated to be 0.49g with a deaggregated moment magnitude (Mw) of 6.6. We have used this ground acceleration and earthquake magnitude in our seismic analysis.

3.6 Seismic Hazards

3.6.1 Fault Rupture

Based on available literature and reports, no known active faults are known to traverse the project site, and the site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. As such, the principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in the region as discussed in Section 3.5.

3.6.2 Liquefaction

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading.

The site is not located within an area designated as potentially liquefiable on the *California Seismic Hazard Zone Map* (CDMG, 1998). The historically high groundwater table at the site is deeper than 50 feet and, based on our boring, the subsurface soils below the historically high groundwater table consisted of dense sand with SPT N values ranging from 38 to 41. Due to the absence of shallow groundwater and the dense nature of the subsurface soils, the liquefaction potential of the site is considered low.

3.6.3 Seismically Induced Settlement

Seismically induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). This settlement occurs primarily within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event. The seismically induced settlement, including that of the embankment fill, was estimated to be on the order of ¾ inches. The magnitude of the estimated settlement is considered relatively minor.

3.6.4 Tsunami and Seiches

Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Based on the inland location of the site and the absence of enclosed bodies of water near the site and, tsunami and seiches risks at the site are considered negligible.

3.7 Slope Stability

For our slope stability analyses, we have considered three different sections of the proposed retaining wall: 1) with three rows of tiebacks, 2) with two row of tiebacks, and 3) Type 1 retaining wall without tieback. The slope stability analyses were performed using the Modified Bishop's method. The tieback spacing, location and tension force shown in the attached layout plan by HDR were incorporated in the analysis of the tieback wall. For pseudo-static analysis, a horizontal seismic coefficient of 0.20g (Caltrans, 2004) was used. Our analysis indicates that the walls have a global factor of safety higher than 1.5 and 1.1 for static and pseudo-static conditions, respectively. The results are summarized in Table 3 and computer printouts of the analyses are attached to this report.

Table 3 – Summary of Slope Stability Analyses

Retaining Wall Type	Calculated Factor of Safety	
	Static	Pseudo-Static
Retaining Wall with 3-Row of Tiebacks	2.22	1.73
Retaining Wall with 2-Row of Tiebacks	3.60	2.42
Type 1 Retaining Wall	2.68	2.14

4.0 GEOTECHNICAL AND FOUNDATION DESIGN RECOMMENDATIONS

Based upon our evaluation of the soils and geologic information, we conclude that the proposed project is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in the design and construction of the project. The recommendations in this report are considered minimum and may be superseded by more stringent requirements of the structural engineer and/or the governing agencies. Leighton should be notified, in a timely manner, of changes in the project plans that might impact recommendations in this report.

4.1 As-Built Foundation Data

Based on the as-built plan for the South Street Overcrossing (Caltrans, 1974), we have summarized the as-built foundation types and characteristics in Table 3. The nominal resistance shown in the table was calculated using the computer program *SHAFT* (O'Neill and Reese, 1999). The computer printouts are included in Appendix B. Elevations in Table 4 were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).

Table 4 – As-Built Bridge Foundation Data (Caltrans, 1974)

Structure[1]	Pile Size and Type	Pile Cutoff Elevation (feet)	Pile Tip Elevation (feet)	Nominal Resistance[2] (kips)	Allowable Capacity [3] (kips)
Abutment 3[4]	16-inch Diameter CIDH Pile	205.0	151.3	280[5]	140

[1]Elevations of freeway and South Street grade are approximately 195.7 feet and 221 feet, respectively.

[2] A minimum factor of safety of 2.0 should be applied to calculate the allowable capacity.

[3]Design load of 70 tons (140 kips) per as-built plan

[4]Abutment 3 is supported on a single row of 13 piles with minimum pile spacing of 4.75 times the pile diameter.

[5]The upper 12 feet of pile capacity within the existing fill was ignored.

4.2 Lateral Earth Pressure and Tieback Design Parameters

Based on the plan provided by the structural engineer, the proposed tieback system consists of two to three rows of tiebacks. Due to the presence of the existing Chantilly Drain in close proximity, the *General Plan* shows that the tiebacks at the bottom row will be installed at an angle of approximately 35 degrees from horizontal. The lateral loads on the retaining wall is expected to consist of the following: (a) the active earth pressure and passive earth pressure below the bottom of the excavation in accordance with Caltrans *Bridge Design Specifications* (*BDS*, September 2004), (b) the surcharge pressure from Abutment 3 backfill, (c) the surcharge pressure corresponding to traffic loading, and (d) the seismic pressure resulting from the lateral loads of the existing piles. A diagram of these lateral earth pressures are provided in Figure 4. Under service loading, the pressures of (a), (b) and (c) should be used and, under seismic loading, the pressures of (a), (b) and (d) should be used.

The active and passive pressure coefficients (Ka and Kp) of 0.28 and 3.54, respectively, and an average soil unit weight (γ) of 120 pcf may be used to estimate the active and passive earth pressures. Traffic loading may be considered as equivalent to a vertical pressure produced by 2 feet of soils. The intensity of the pressure from the existing piles shown in Figure 4 was based on a lateral load of 40 kips per pile under the seismic loading (Caltrans, 1992).

The design values indicated above are based upon drained conditions. The tieback and Type 1 retaining walls should, therefore, be provided with a subdrain system to prevent buildup of hydrostatic pressure behind the wall. The *General Plan* shows that geocomposite drain is proposed behind the walls with weep holes at the bottom of the walls. The drainage systems shown on the plan are acceptable from a geotechnical standpoint.

The anchored portion of the tieback should extend into competent material at least 5 feet beyond the critical failure surface or H/5, where H is the height of the retaining wall, whichever is longer. The critical failure surface was determined from slope stability analysis where a tieback force is applied to achieve a factor of safety of 1.3 (Caltrans, 2004). Based on the slope stability analysis and Caltrans *BDS* (2004), the tieback anchors should have a minimum unbonded length of 15 feet. The slope stability analysis to determine the critical failure surface is presented in Appendix B.

The allowable pullout resistance of anchor should be estimated by multiplying ultimate anchor bond stress, bonded length and perimeter of the drilled hole, and dividing by a

minimum factor of safety of 2.5 (Caltrans, 2004). Based on our boring, the tieback anchors are expected to be embedded in very stiff silt with sand or very dense, poorly graded sand. For the purpose of estimating the anchor bond stress, an average soil unit weight (γ) of 120 pcf, an average soil internal friction angle of 28 degrees and cohesion of 1,000 psf may be used for the upper and middle rows and an average soil unit weight (γ) of 115 pcf and an average soil internal friction angle of 34 degrees may be used for the lower row. The contractor is responsible for the final design of the bonded length of tieback anchors and the bonded length should be verified by load test of each anchor.

The tieback anchors should be installed at a minimum spacing of three times the diameter of the bond zone or 5 feet, whichever is greater. The preferred installation angle is between 5 and 20 degrees from horizontal to facilitate tendon installation and grouting, and to avoid application of excessive vertical loads that could induce downward movement of the wall. However, we understand that due to the presence of Chantilly Drain behind Abutment 3, the tiebacks at the bottom row will have an installation angle of approximately 35 degrees. Tieback anchors should be located to maximize their distance from the existing abutment piles.

4.3 Allowable Bearing Capacity

An allowable soil bearing pressure of 2,500 psf may be used for design of tieback wall footing having a minimum width of 12 inches and a minimum embedment of 18 inches below the lowest adjacent ground surface. For the Type 1 retaining wall footings, an allowable bearing pressure of 3,600 psf may be used. These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5H:1V) conditions only and may be increased by one-third for short-term loading.

The frictional resistance between the wall (concrete) and the backfill soil may be computed using a coefficient of friction of 0.4, provided that no forms are used for the concrete surfacing against the soil.

4.4 Settlement and Lateral Displacement

The tension force of each row of tiebacks is shown in the attached layout plan. The vertical component of the tension force for the bottom-row tiebacks was calculated to be a maximum of 14.0 kips (approximately 800 psf) due to the steep installation angle of tieback. The vertical components of the upper- and middle-row tiebacks were calculated

to be 9.9 kips (approximately 570 psf). Settlement of the tieback wall due to the total vertical pressure of 1,370 psf was estimated on the order of ½ inch. Settlement of the Type 1 retaining walls was estimated to be on the order of 1 inch. This magnitude of settlement is considered relatively minor for the proposed walls.

Tiebacks for the tieback wall will be installed as the excavation progresses. The tiebacks will be tensioned before additional excavation is made, providing lateral support for the wall. Lateral displacement of the tieback wall is expected to be negligible. For the Type 1 retaining walls, using the method in Caltrans *BDS* (2004), the lateral displacement is estimated to be on the order of 0.2 inches to mobilize the active earth pressure condition. Considering the relatively minor lateral displacement and that these walls will be located to the north and south of the existing abutment, the estimated lateral displacement is not expected to impact the existing abutment piles.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Tieback Installation

Due to the close proximity of the proposed tieback wall to Abutment 3 and its existing piles and the Chantilly Drain, the contractor should exercise care to minimize impact to the existing improvements from the installation of the tieback wall. We recommend that a monitoring program be implemented during the construction to monitor movement of Abutment 3. If excessive lateral and/or vertical movements are measured, construction should be suspended immediately and mitigation measurement should be implemented. The installation of the tieback anchors should be in accordance with the Caltrans *Standard Specifications*. All tieback anchors for the wall should be load tested with either a proof test, performance test or creep test. The maximum test load for an anchor should generally be 1.5 times the design force of the anchor. The tests should be performed in accordance with Caltrans specifications.

5.2 Temporary Excavations

Excavations and removal of the existing sloped embankment fill are required to construct the proposed retaining wall. The excavation and removal should be shored by either bracing or sheeting due to the close proximity of the existing Abutment 3. Design of shoring should be performed by the shoring contractor. For cantilever shoring, the active and passive pressure coefficients (Ka and Kp) of 0.28 and 3.54, respectively, and an average soil unit weight (γ) of 120 pcf may be used. For braced excavation, the lateral earth pressure is estimated as 22H pcf with a rectangular pressure distribution, where H is the depth (height) of excavation. The above lateral pressure is only appropriate for level backfill and a drained condition behind the shoring. Appropriate surcharge loads from traffic loading, heavy equipment, and stockpiles of materials should be incorporated in the shoring design. The final shoring plan should be reviewed by the geotechnical consultant.

5.3 Earthwork

Onsite soils to be used as compacted structural fill should be free of organic material and/or construction debris. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches for structural fill placement, moisture-conditioned as necessary to within two

percent above optimum, and compacted to a minimum of 95 percent of the maximum density as determined by Caltrans Test Method 216. Crushed aggregate base should be compacted to a minimum of 95 percent relative compaction. Subgrade within a depth of 30 inches below the finished grade should also be compacted to at least 95 percent relative compaction.

5.4 Additional Geotechnical Services

The proposed construction involves various activities that would require geotechnical observation and testing. These include:

- Placement of compacted fill;
- Shoring installation;
- Footing excavation for retaining wall;
- Backfill of retaining walls; and
- When any unusual surface conditions are encountered.

These and other soils related activities should be observed and tested by a qualified representative of the geotechnical engineer. Geotechnical recommendations presented in this report are based on the conditions encountered at the test boring location and information gained from review of as-built plans as well as our understanding of the current project plan. Our recommendations should be revised, as necessary, based on the actual soil condition and any modification of the current plans, and incorporated into the final design plans and specifications. Conclusions and recommendations presented in this report should be reviewed and verified by the geotechnical engineer during site construction and revised accordingly, if exposed geotechnical conditions vary from our current understanding and interpretations.

6.0 REFERENCES

The following references were used in preparation of this report:

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

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ORANGE, CA 92863

HDR ENGINEERING, INC.
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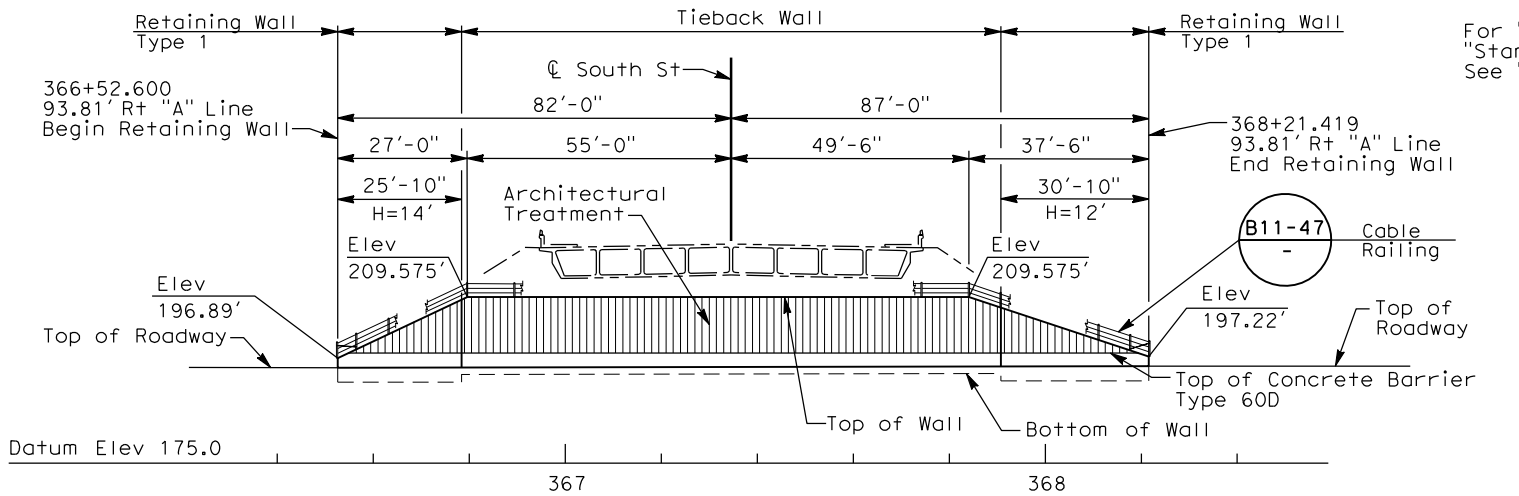
IRVINE, CA 92602-1377

NOTES:

For "General Notes" And "Standard Plans List" See "General Notes" Sheet.

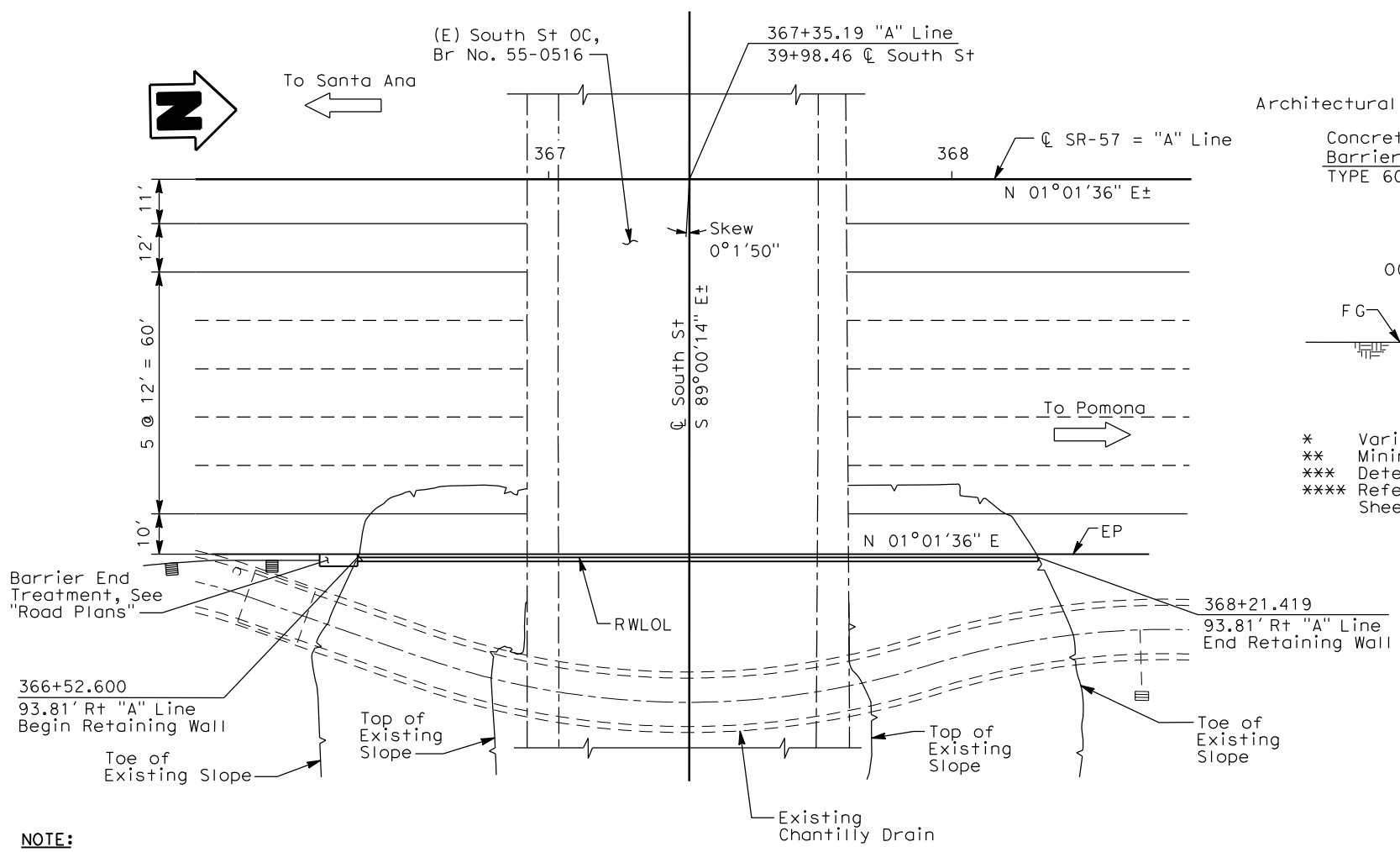
LEGEND

- Indicates Limits of Shotcrete
- Indicates New Construction
- Indicates Foundation or Hidden Lines
- Indicates Existing Structure
- RWLOL Indicates Retaining Wall Layout Line



MIRROR ELEVATION

SCALE 1"=20′

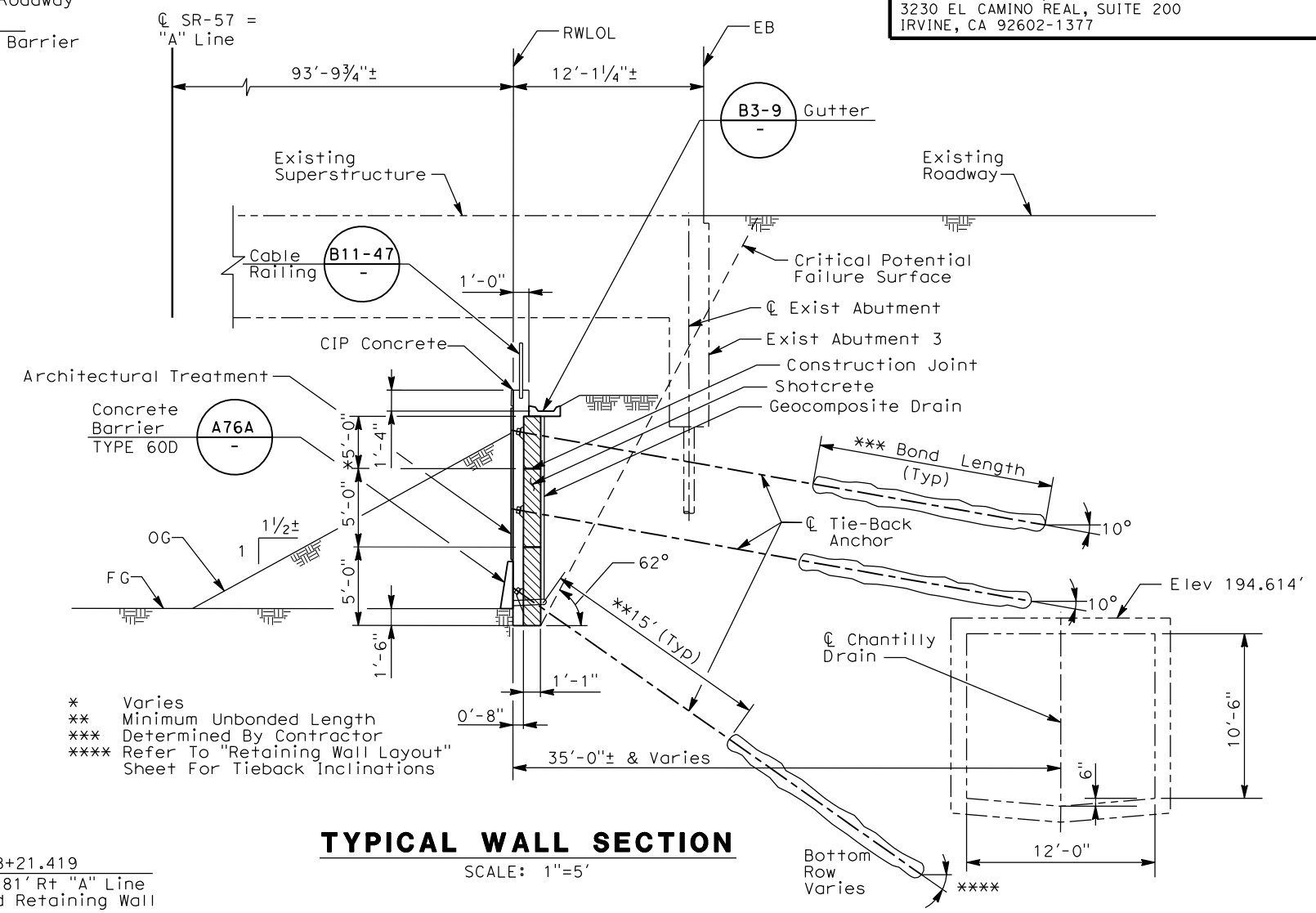


NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

PLAN

SCALE 1"=20′



* Varies
** Minimum Unbonded Length
*** Determined By Contractor
**** Refer To "Retaining Wall Layout" Sheet For Tieback Inclinations

TYPICAL WALL SECTION

SCALE: 1"=5′

DESIGN OVERSIGHT	DESIGN	BY D. Peavey	CHECKED E. Johnson	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE
	DETAILS	BY E. Gray	CHECKED E. Johnson	LAYOUT: BY D. Peavey	CHECKED W. Chu
SIGN OFF DATE	QUANTITIES	BY D. Peavey	CHECKED E. Johnson	SPECIFICATIONS: BY E. Johnson	PLANS AND SPECS COMPARED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0113
POST MILES 14.4

SOUTH ST OC - RET WALL
GENERAL PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 1 OF 12

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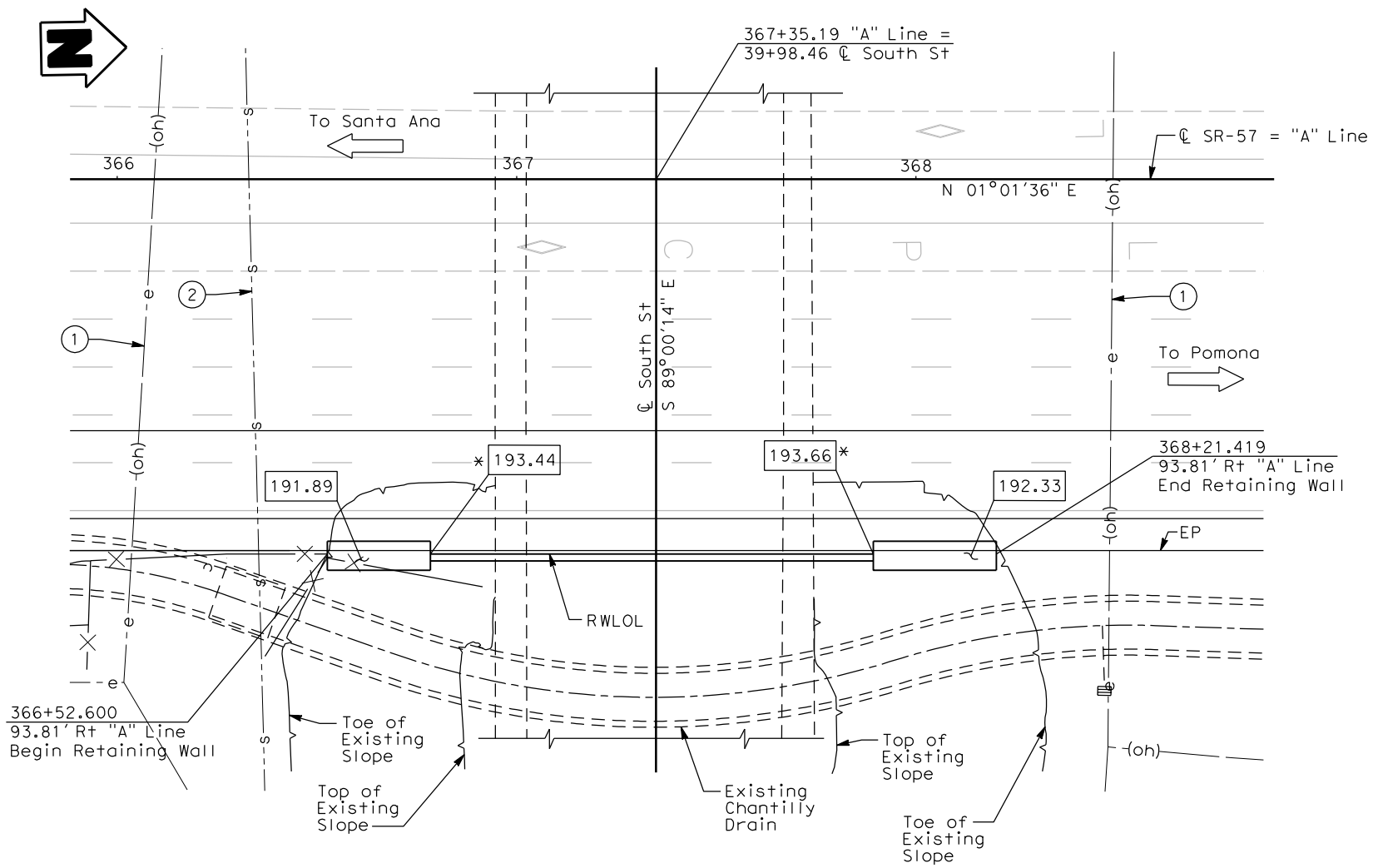

PLAN

SCALE 1"=20'

Note: Tiebacks Not Shown For Clarity.

EXISTING UTILITY LINES TABLE

(BASED ON AS-BUILT DATA)

NO.	UTILITY	OWNER	ACTION
1	12 Kv OH	City Of Anaheim	Overhead - Protect In Place
2	8" VCP	City Of Anaheim	Protect In Place

LEGEND

Indicates New Construction

Indicates Existing

xxx.xx — Denotes Bottom of Footing Elevation @ Type 1 Retaining Wall

* xxx.xx — Denotes Bottom of Wall Elevation @ Tieback Wall

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

DESIGN OVERSIGHT

SIGN OFF DATE

SCALE: 1"=20'	VERT.DATUM	HORZ.DATUM
PHOTOGRAMMETRY AS OF:	ALIGNMENT TIES	
SURVEYED BY E. Martinez	DRAFTED BY	
FIELD CHECKED BY D. Williams	CHECKED BY	

	BY	CHECKED
DESIGN	D. Peavey	E. Johnson
DETAILS	E. Gray	E. Johnson
QUANTITIES	D. Peavey	E. Johnson

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0113
POST MILE 14.4

SOUTH ST OC - RET WALL
FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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EA 0F0401

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SHEET 3 OF 12

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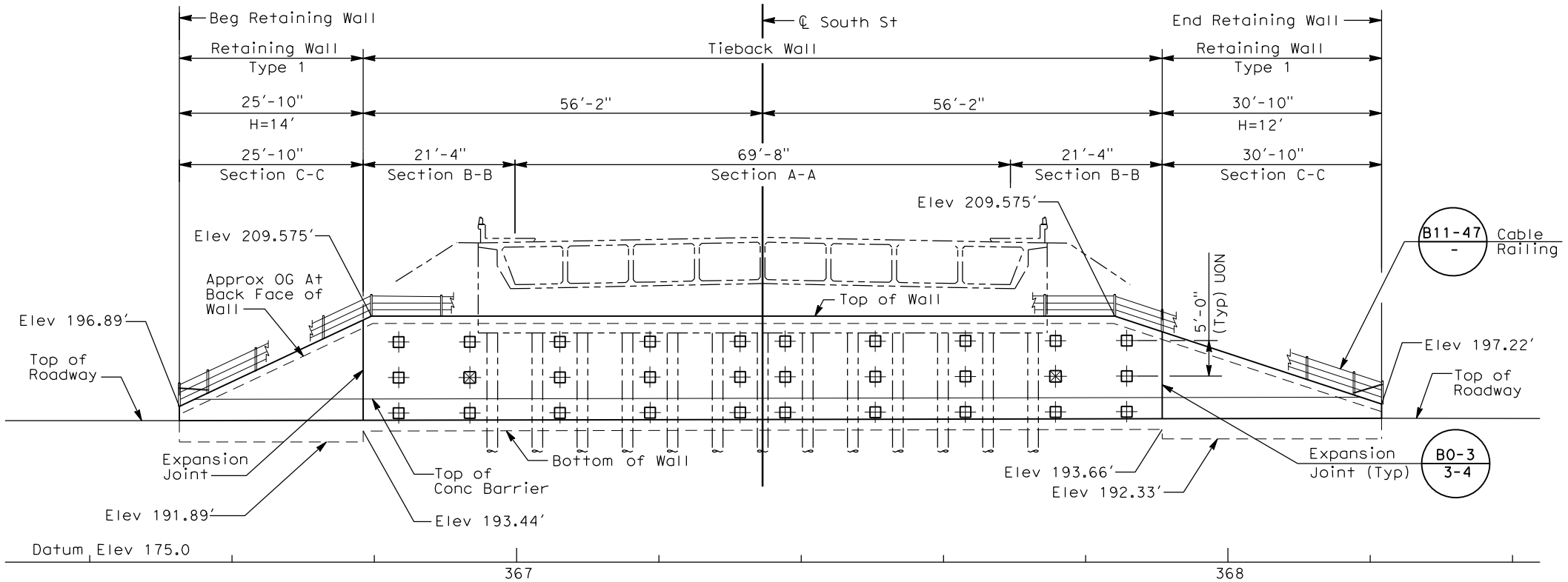
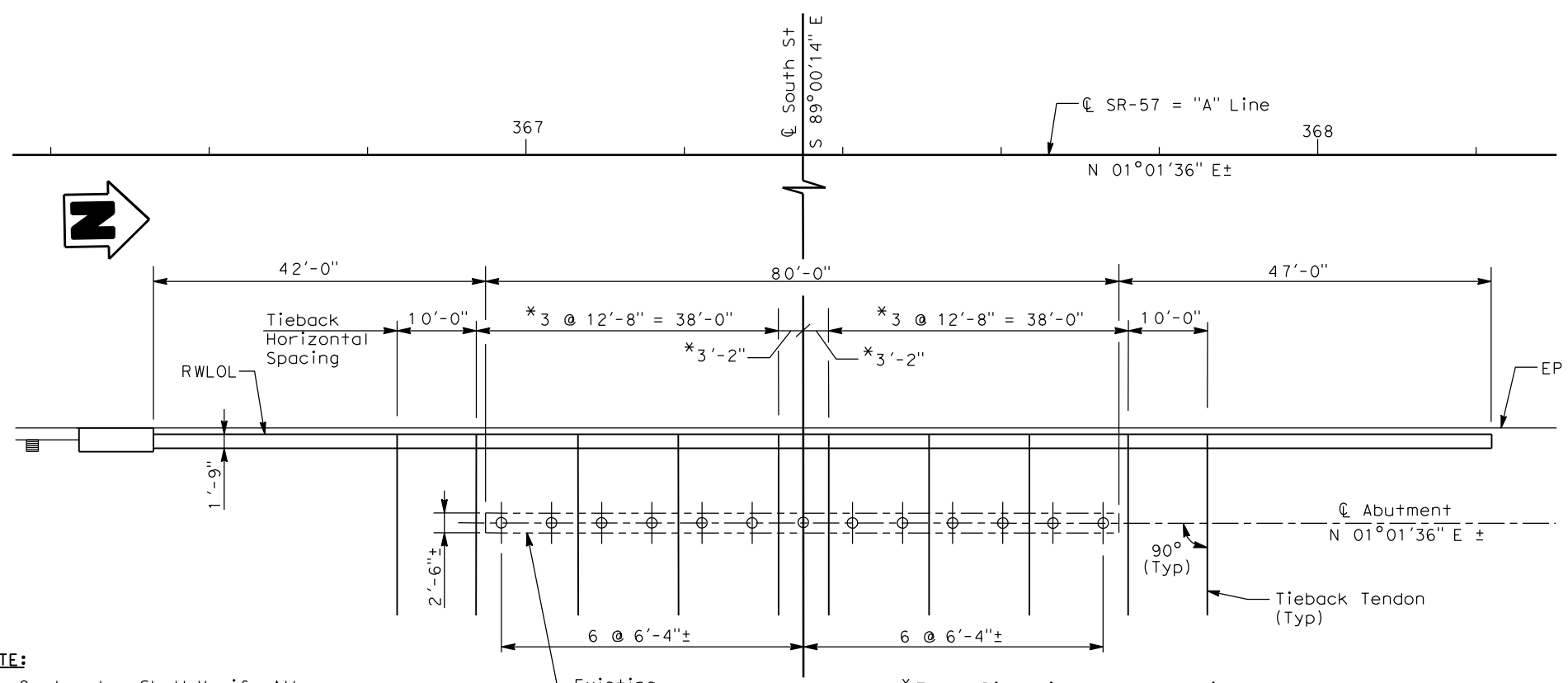


ELEVATION

SCALE 1"=10'

Note: For Sections A-A, B-B, And C-C, See "Retaining Wall Section" Sheet



PLAN

SCALE 1"=10'

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

*These Dimensions Are Approximate. After Contractor Verification Of Existing Pile Locations, The Tieback Shall Be Placed Centered Between The Adjacent Piles.

LEGEND

Indicates Existing 16" CIDH Piles.

Indicates Location Of Tieback Assembly Or As Directed By The Engineer.

Tiebacks # 1-10 Top Row (10° Inclination)
Tiebacks # 11-20 Middle Row (10° Inclination)
Tiebacks # 21-30 Bottom Row
Tiebacks # 21, 22, 29, 30 Drilled At 45°
Tiebacks # 23-28 Drilled At 35°

Indicates Location Of Tieback Assembly Requiring Performance Test Or As Directed By The Engineer.

NOTES:

1. Prior To Installing Tiebacks, Contractor Shall Verify The Existing Footing And Pile Locations By Exposing, By Hand, One Pile At Each End Of Each Abutment.

TIEBACK DESIGN FORCE TABLE

Tieback Wall Name	Tieback Wall Section	Tieback Location (Station)	Lift Ht (Ft) / T (Kip) Upper	Lift Ht (Ft) / T (Kip) Middle	Lift Ht (Ft) / T (Kip) Lower
55E0113	A-A	366+99.75 To 367+69.42	4.7 / 47.7	5 / 25.8	5 / 25.9
	B-B	366+78.42 To 366+99.75	4.7 / 16.2	5 / 20.4	5 / 23.7
	B-B	367+69.42 To 367+90.75	4.7 / 16.2	5 / 20.4	5 / 23.7

DESIGN OVERSIGHT

SIGN OFF DATE

	BY	CHECKED
DESIGN	D. Peavey	E. Johnson
DETAILS	E. Gray	E. Johnson
QUANTITIES	D. Peavey	E. Johnson

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0113
POST MILE 14.4

SOUTH ST OC - RET WALL
RETAINING WALL LAYOUT

DESIGN DETAIL SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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SHEET 4 OF 12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
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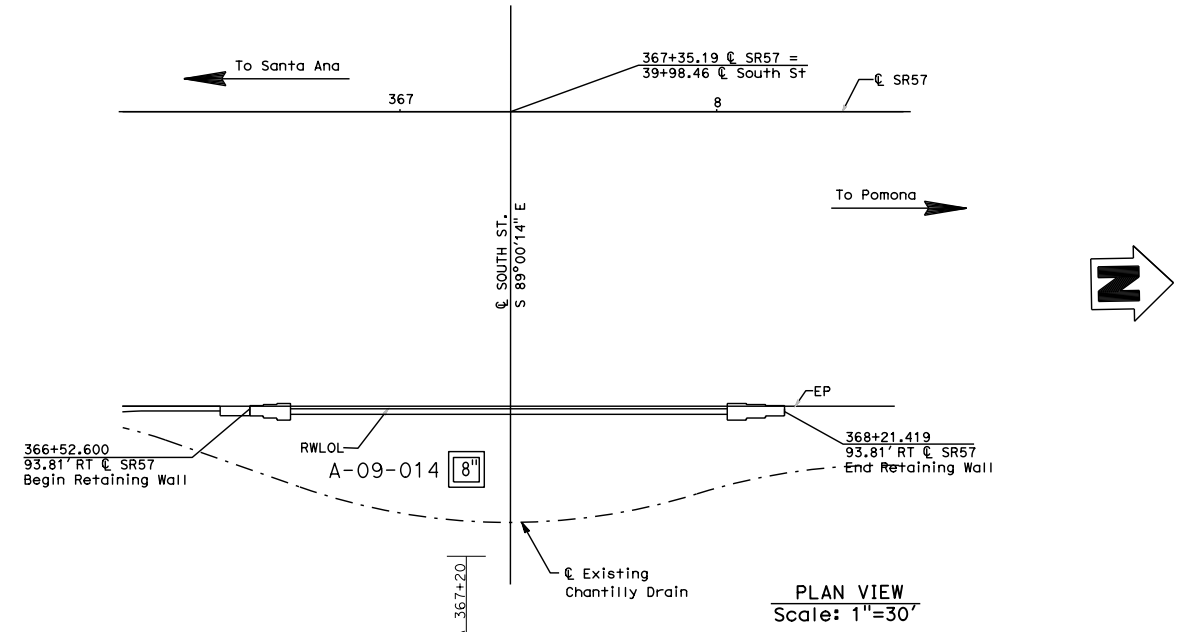
LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

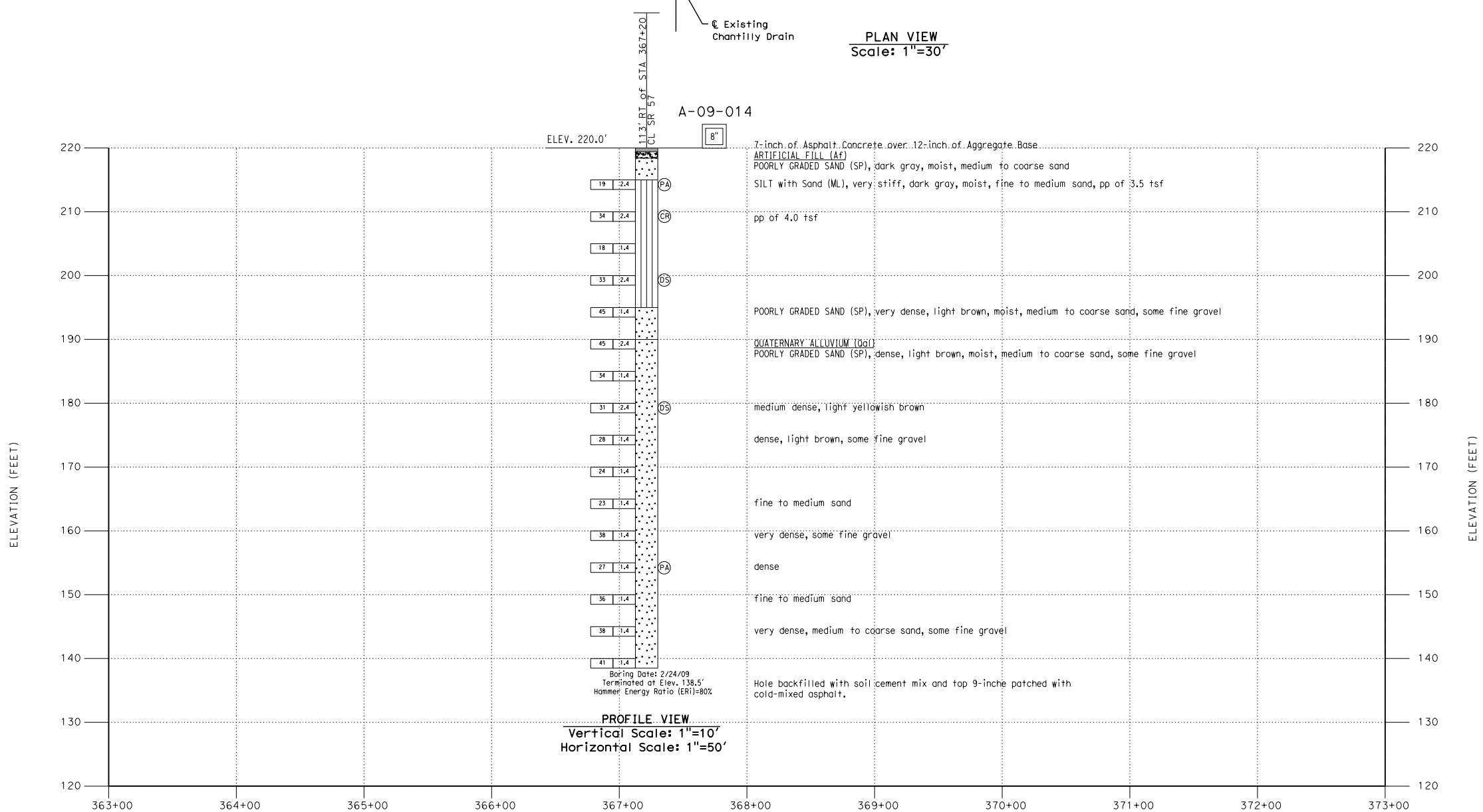
This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.



PLAN VIEW
Scale: 1"=30'



PROFILE VIEW
Vertical Scale: 1"=10'
Horizontal Scale: 1"=50'

Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.

DESIGN OVERSIGHT	DRAWN BY Buu Tran	Amit Bakane FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55E0113
SIGN OFF DATE	CHECKED BY Taekuk Kim	DATE: 2/24/09			POST MILES 14.42

SOUTH ST OC-RET WALL
LOG OF TEST BORINGS 1 OF 4

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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EA 0F0401

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REVISION DATES: ~~10/09~~ ~~2/10~~ 5/10

SHEET 9 OF 12

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USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 14:25

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

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550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

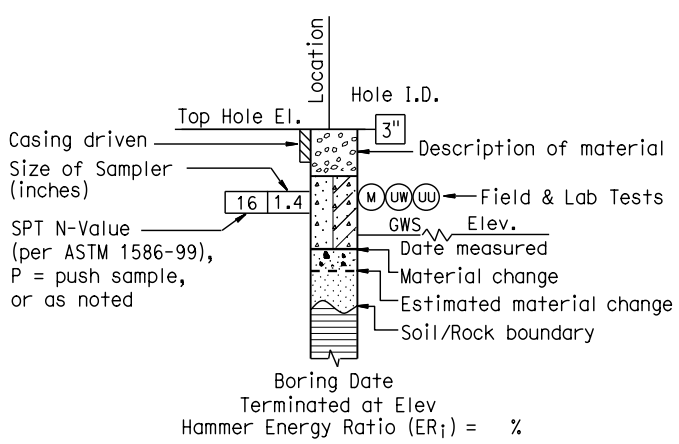
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
[ ]	O	Other

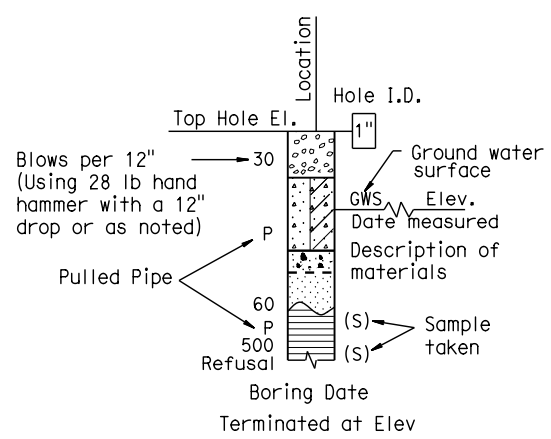
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

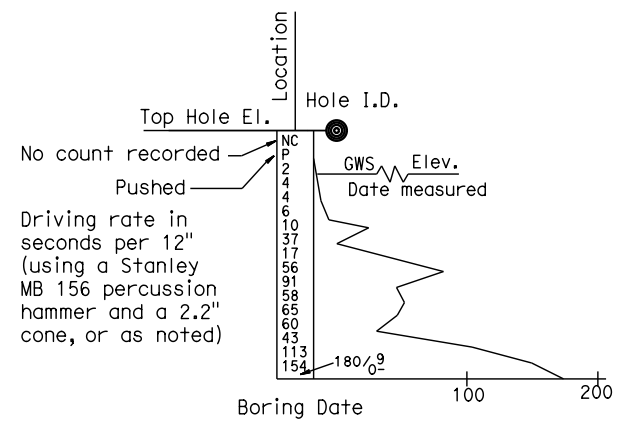
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



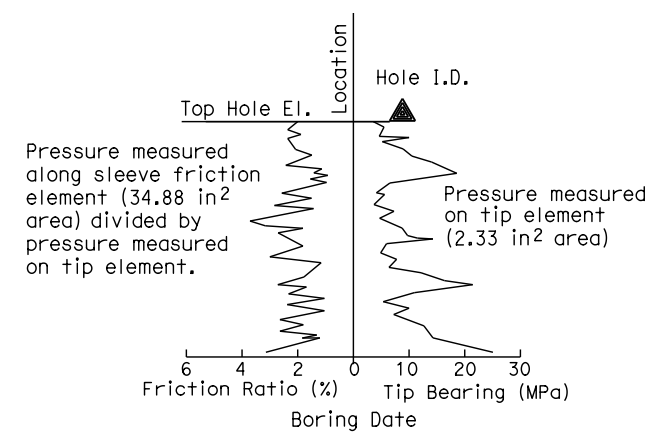
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT	DRAWN BY Buu Tran	Amit Bakane FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55E0113
SIGN OFF DATE	CHECKED BY Taekuk Kim	DATE: 2/24/09			POST MILES 14.42

SOUTH STE OC-RET WALL
LOG OF TEST BORINGS 2 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10

REVISION DATES

SHEET 10 OF 12

FILE => FIGURE-2-South-Street_2of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 14:26

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of scanned copies of this plan sheet.

ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY Buu Tran

CHECKED BY Taekuk Kim

Amit Bakane
FIELD INVESTIGATION BY:
DATE: 2/24/09

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Djan Chandra
PROJECT ENGINEER

BRIDGE NO. 55E0113
POST MILES 14.42

SOUTH ST OC-RET WALL
LOG OF TEST BORINGS 3 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10

REVISION DATES

SHEET 11 OF 12

FILE => FIGURE-2-South-Street_3of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 14:27

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	ORA	57, 91	12.2/16.0 · 5.3/7.0	333	443

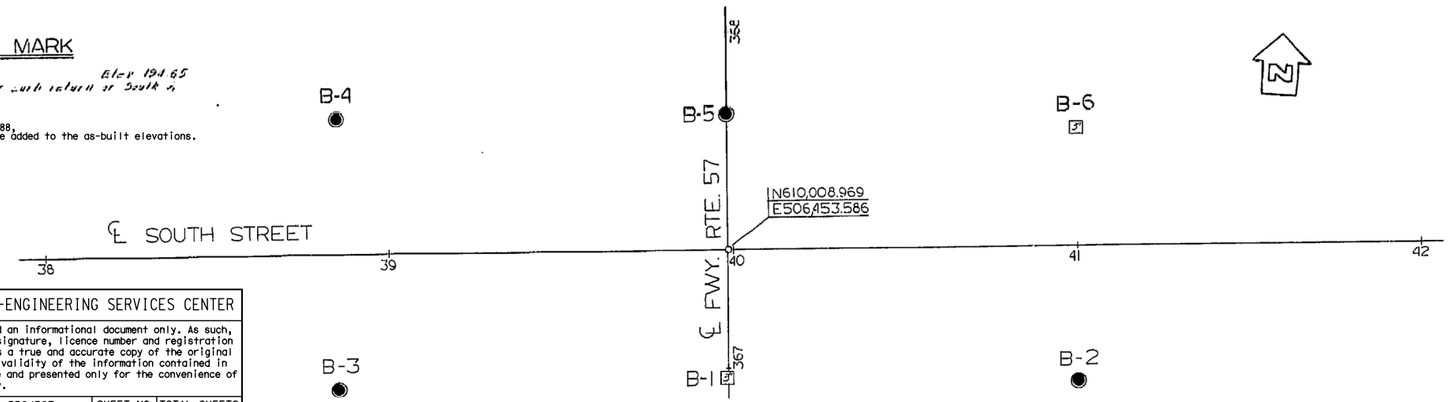
U. E. Bachu
REGISTERED PROFESSIONAL ENGINEER REGISTERED CIVIL ENGINEER NO. 8808
DATE APPROVED December 18, 1972

BENCH MARK

B.M. # LY-5 Elev 194.65
Brass cap in S.W. M.P.C. at curb return at South & Rio Vista Sts.

To convert to current datum NAVD88, approximately 1.84 feet should be added to the as-built elevations.

REGISTERED PROFESSIONAL ENGINEER DHAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA



PLAN

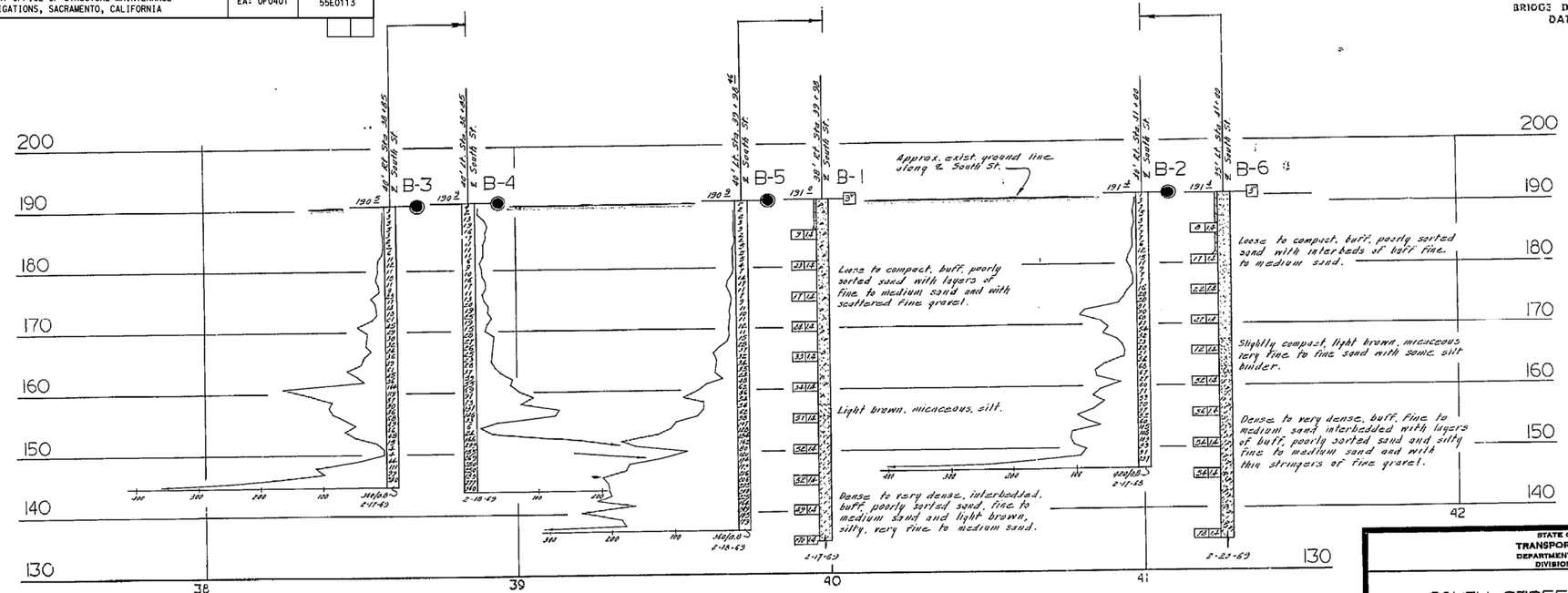
Scale 1" = 20'

PROFILE

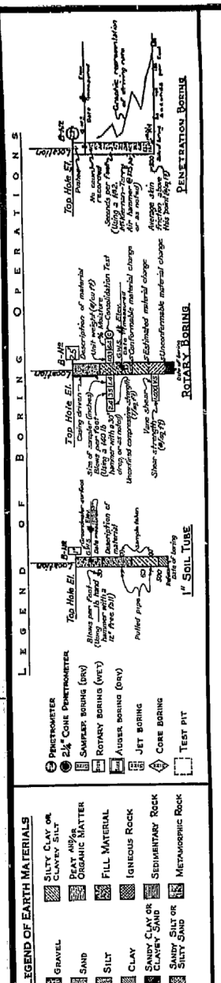
Scale: Vert 1" = 10'
Horiz. 1" = 20'

NO AS BUILT changes
CORRECTIONS BY R. Strungs
CONTRACT NO. 032021
DATE 10-11-74

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE February 1969



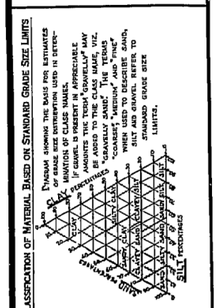
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat Humus Organic Matter
- Fill Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS



NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

FIELD STUDY	By H. C. Cain	2-20-69
DRAWN	By J. Clary	2-28-69
CHECKED	By R. Cochlay	3-28-69

Approval Recommended by [signature] Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	12.2/15.2	12	12
REGISTERED ENGINEER-GEOTECHNICAL					
SOUTH ST OC - RET WALL					
LOG OF TEST BORINGS 4 OF 4					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU: 12231 EA: 0F0401	BRIDGE NO. 55E0113	

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000 6373

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

SOUTH STREET OVERCROSSING

LOG OF TEST BORINGS

BRIDGE NO.	POST MILE	DRAWING NO.	SHEET	OF
55-516	11.4		11	11

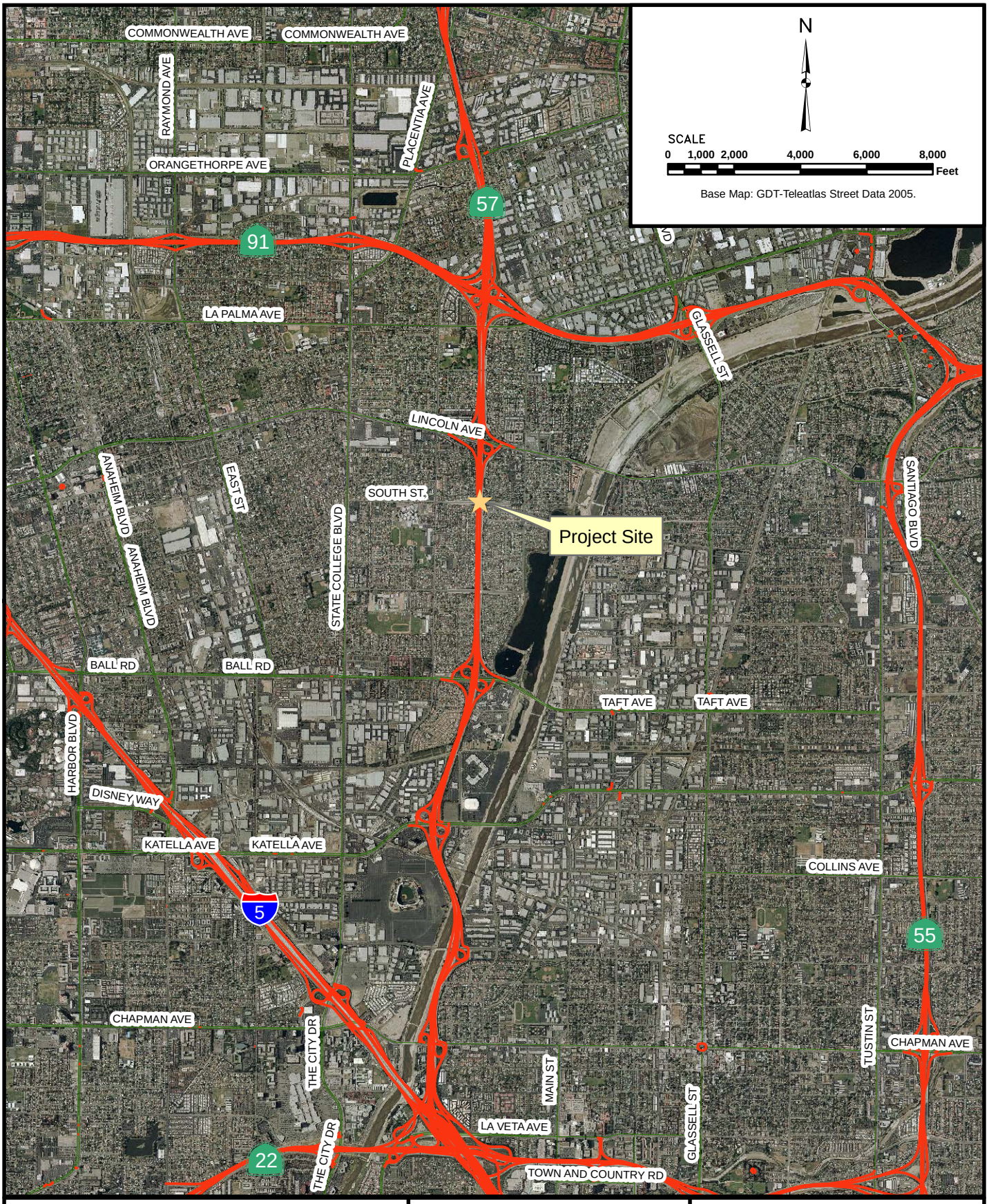
REVISION DATES (PRELIMINARY STAGE ONLY)

WO 032021
CU 07200

Disregard prints bearing earlier revision dates

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 1/29/75 SIGNATURE [signature] TITLE Micrographic Supervisor



Retaining Wall
at South Street Overcrossing
Northbound SR-57 Widening
Orange County, California

SITE LOCATION MAP

Project No.

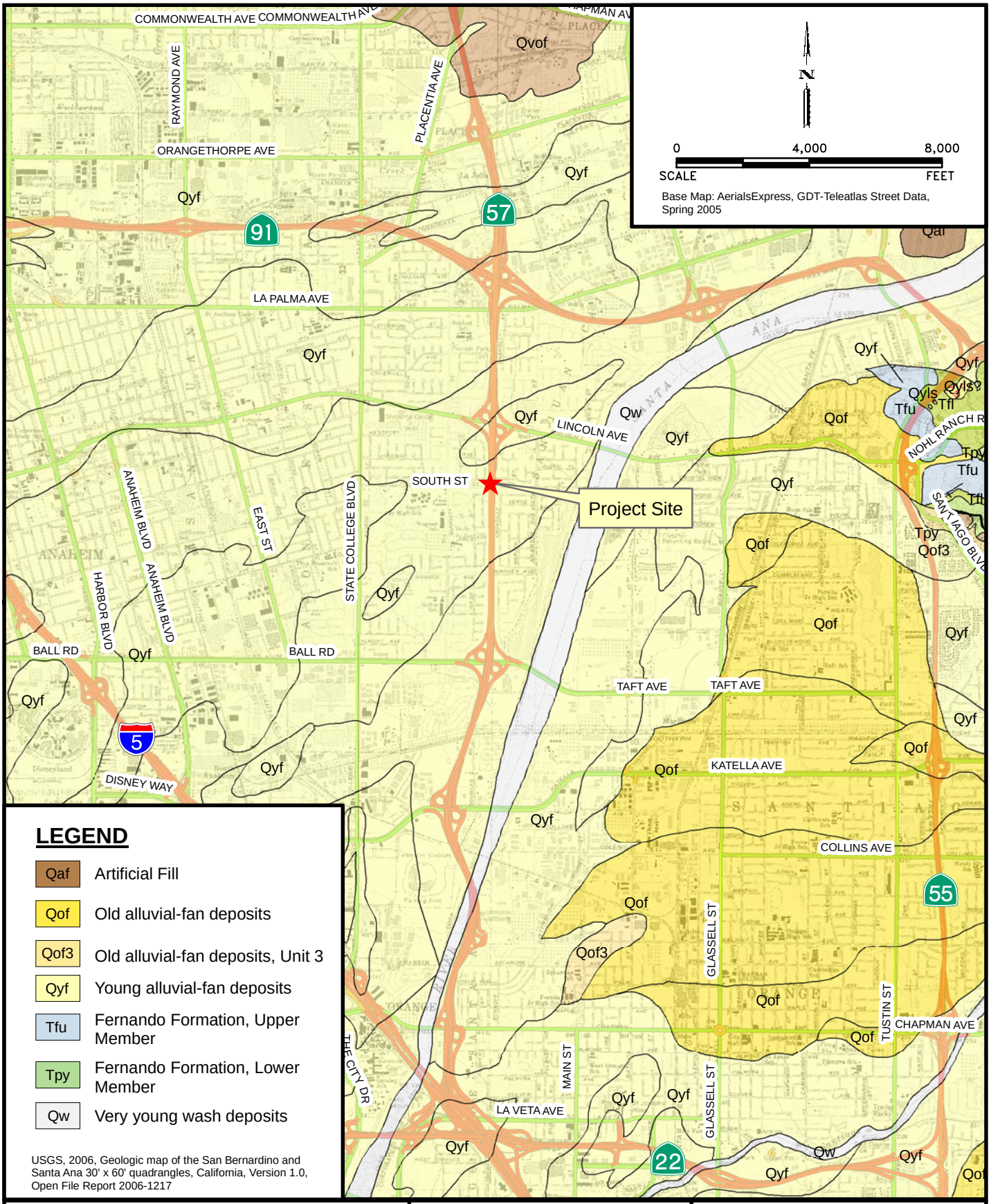
602231-002

Date

February 2010

Figure 1

P:\Drafting\602231\002\GIS\602231002_SiteLocationMap_DouglsRd.mxd



LEGEND

Qaf	Artificial Fill
Qof	Old alluvial-fan deposits
Qof3	Old alluvial-fan deposits, Unit 3
Qyf	Young alluvial-fan deposits
Tfu	Fernando Formation, Upper Member
Tpy	Fernando Formation, Lower Member
Qw	Very young wash deposits

USGS, 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, Version 1.0, Open File Report 2006-1217

Retaining Wall
at South Street Overcrossing
Northbound SR-57 Widening
Orange County, California

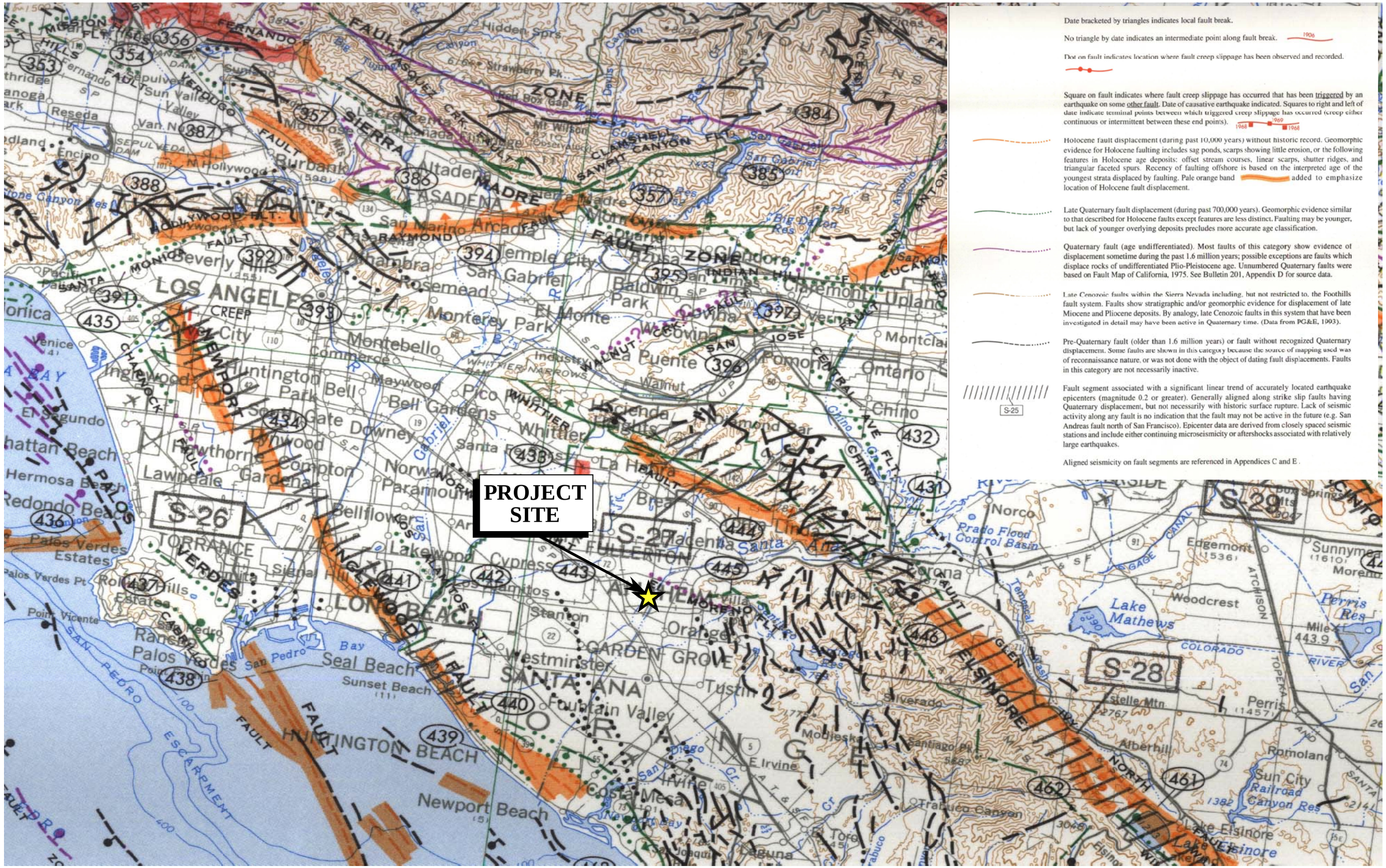
REGIONAL GEOLOGIC MAP

Project No.
602231-002

Date
February 2010

Figure 2

\\geomatics\data2\Drafting\602231\002\GIS\Figure3-GeologyMap-SouthSt.mxd



Base Map: Fault Activity Map of California and Adjacent Areas with Location and Ages of Recent Volcanic Eruptions; CDMG 1994

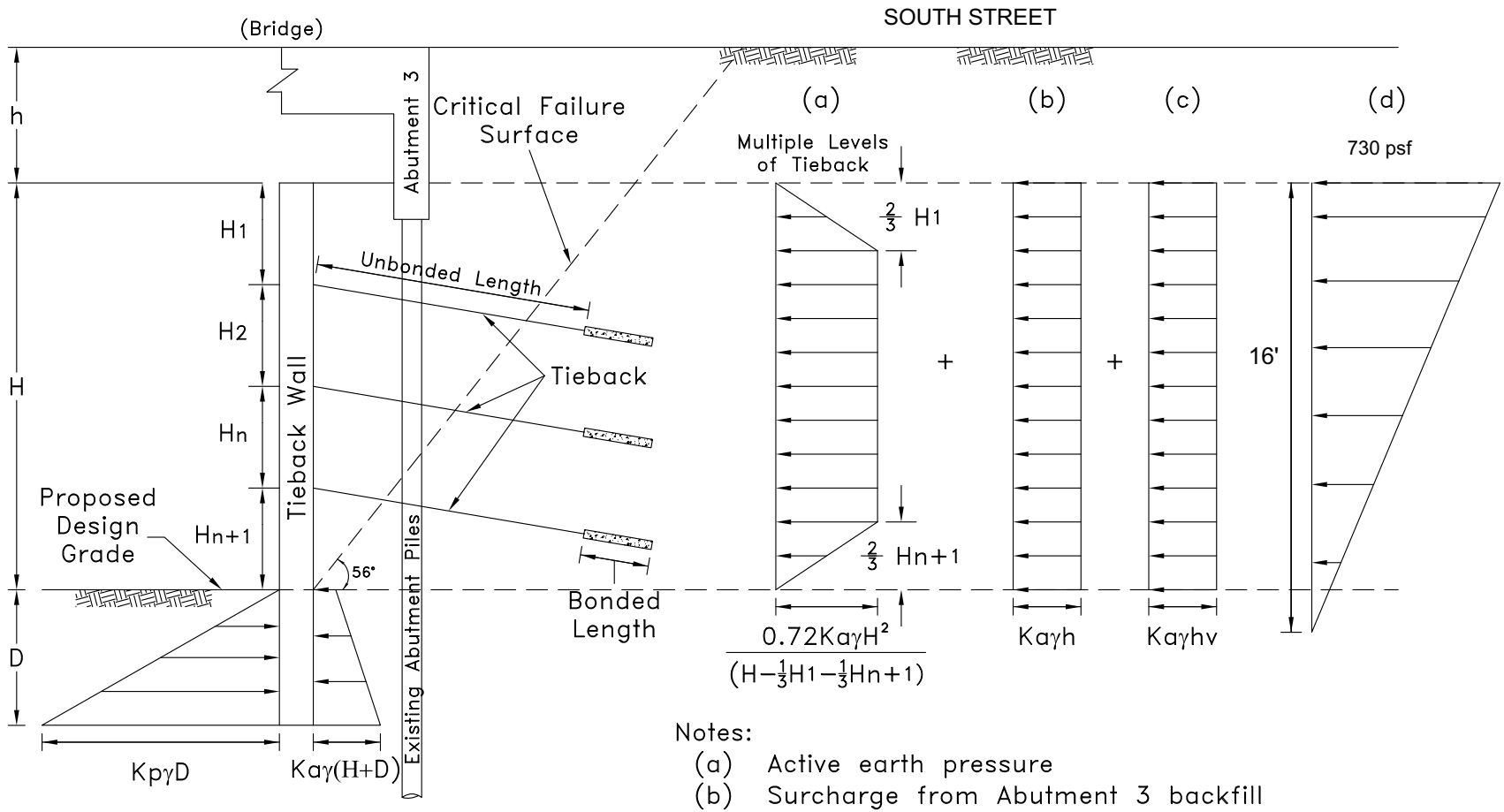
FAULT ACTIVITY MAP

Retaining Wall at South Street Overcrossing
Northbound SR 57 Widening
Anaheim, California

Project No.	602231-002
Scale (Approx)	1:750,000
Engr./Geol.	DJC / ELB
Drafted By	BQT
Date	5/09

Leighton

Figure 3



Notes:

(a) Active earth pressure
(b) Surcharge from Abutment 3 backfill
(c) Surcharge from traffic loading
(d) Seismic pressure resulting from lateral load of the existing piles

hv –Equivalent soil height for traffic surcharge (min. 2 feet)
ka –Active earth pressure coefficient
kp –Passive earth pressure coefficient
γ –Soil unit weight

Reference: Caltrans Bridge Design Specification (2004)

Figure 4

LATERAL EARTH PRESSURE ON TIEBACK WALL SOUTH STREET OVERCROSSING	Leighton	Proj: 602231-002 Eng./Geol. DJC	Scale: As-Shown Drafted By: VMN	Date: 6/09 CP By: BQT

P:\DRAFTING\602231\002\OF_2009-05-04-BORING-LOGS\LINCOLN-AVENUE\FIGURE5.DWG (06-17-09 11:15:27AM) Plotted by: btran

APPENDIX A

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

				Gradation				Atterberg Limits		Maximum Density		Shear Strength Peak		Shear Strength Ultimate		Chemical Analyses					
Boring No.	Sample Type	Top of Sample (ft)	Bottom of Sample (ft)	Gravel (%)	Sand (%)	Silt (%)	Clay <5μm (%)	LL:PL:PI	Sand Equivalent	Max Dry Density (pcf)	Optimum Moisture Content (%)	ϕ' (deg)	C' (psf)	ϕ' (deg)	C' (psf)	pH	Sulfate (ppm)	Chloride (ppm)	Resistivity (Ω-cm)	Expansion Index of Soil	R-Value
A-09-014	RING	5.0	6.5	29		71															
	R/SPT	10.0	20.0													5.3	1431	35	491		
	RING	20.0	21.5									24	1000	33	400						
	RING	40.0	41.5									36	0	32	0						
	SPT	65.0	66.5	95		5															

NOTE: The laboratory tests were performed in general accordance with the following standards:

Sieve Analysis - ASTM D422

Direct Shear Test - ASTM D3080

Corrosivity Tests - DOT CA 532/643 - pH, DOT CA 417 - soluble sulfates, DOT CA 422 - chlorides, DOT CA 643- minimum resistivity

Leighton Consulting, Inc.

SR-57 Widening

Project No: 602231-002

Boring No.	A-09-014	A-09-014	A-09-014					
Sample No.	R-1	R-2	R-4					
Depth (ft.)	5.0	10.0	30.0					
Sample Type	Drive	Drive	Drive					
Soil Identification	Dark gray silt with sand (ML)	Dark gray silt with sand (ML)	Light brown poorly-graded sand (SP)					
Pocket Penetrometer (tons/ft^2)	3.50	4.00						
Weight Soil + Rings / Tube (g)	1111.00	1102.46	1139.95					
Weight of Rings / Tube (g)	266.40	266.40	266.40					
Average Length (in.)	6.00	6.00	6.00					
Average Diameter (in.)	2.416	2.416	2.416					
Wet. Wt. of Soil + Cont. (g)	574.14	171.81	191.20					
Dry Wt. of Soil + Cont. (g)	480.10	144.28	181.01					
Weight of Container (g)	154.71	38.86	39.50					
Container No.								
Wet Density	117.0	115.8	121.0					
Moisture Content (%)	**29**	**26**	**7**					
Dry Density (pcf)	**91**	**92**	**113**					
Degree of Saturation (%)	91.0	84.4	39.4					

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

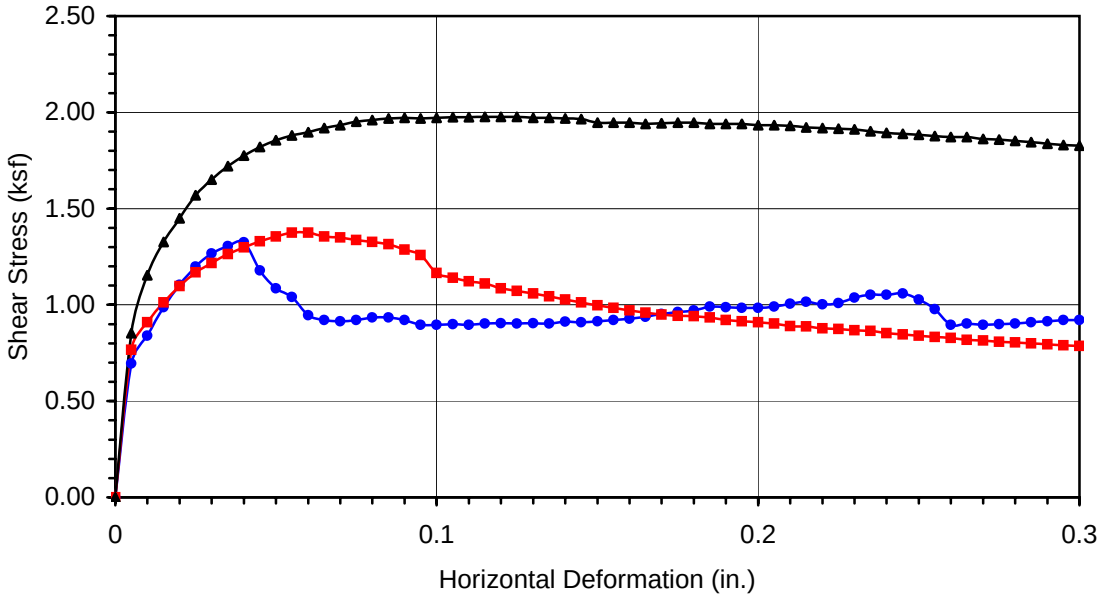
Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/06/09

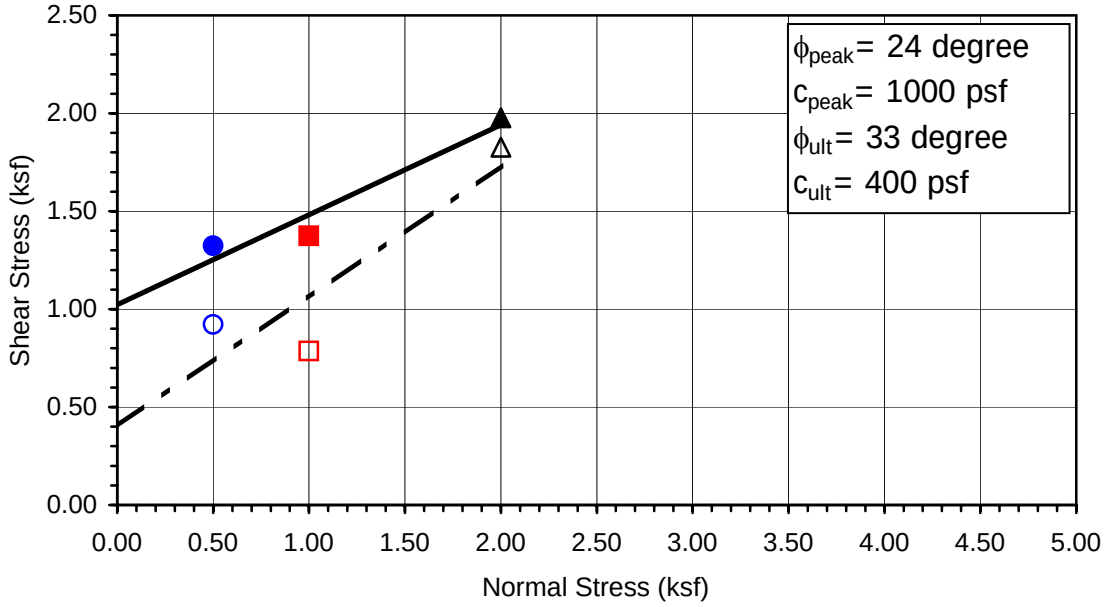
Boring No.	A-09-014	A-09-014						
Sample No.	R-1	S-8						
Depth (ft.)	5	65						
Sample Type	Drive	SPT						
Soil Identification	Dark gray silt with sand (ML)	Light brown poorly graded sand (SP)						
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00						
Dry Weight of Soil + Container (g)	0.00	0.00						
Weight of Container (g)	1.00	1.00						
Moisture Content (%)	0.00	0.00						
Sample Dry Weight Determination								
Weight of Sample + Container (g)	479.60	524.98						
Weight of Container (g)	154.71	138.60						
Weight of Dry Sample (g)	324.89	386.38						
Container No.:								
After Wash								
Method (A or B)	B	B						
Dry Weight of Sample + Cont. (g)	249.61	506.90						
Weight of Container (g)	154.71	138.60						
Dry Weight of Sample (g)	94.90	368.30						
% Passing No. 200 Sieve	**70.8**	**4.7**						
% Retained No. 200 Sieve	29.2	95.3						

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/05/09





Boring No.	**A-09-014**
Sample No.	**R-3**
Depth (ft)	**20**

Sample Type:

Drive

Soil Identification:
Dark gray silt with sand (ML)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 1.324	■ 1.374	▲ 1.977
Shear Stress @ End of Test (ksf)	○ 0.921	□ 0.786	△ 1.827
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	26.00	26.00	26.00
Dry Density (pcf)	98.9	98.9	99.2
Saturation (%)	99.6	99.5	100.4
Soil Height Before Shearing (in.)	0.9994	0.9947	0.9904
Final Moisture Content (%)	32.2	29.7	29.3

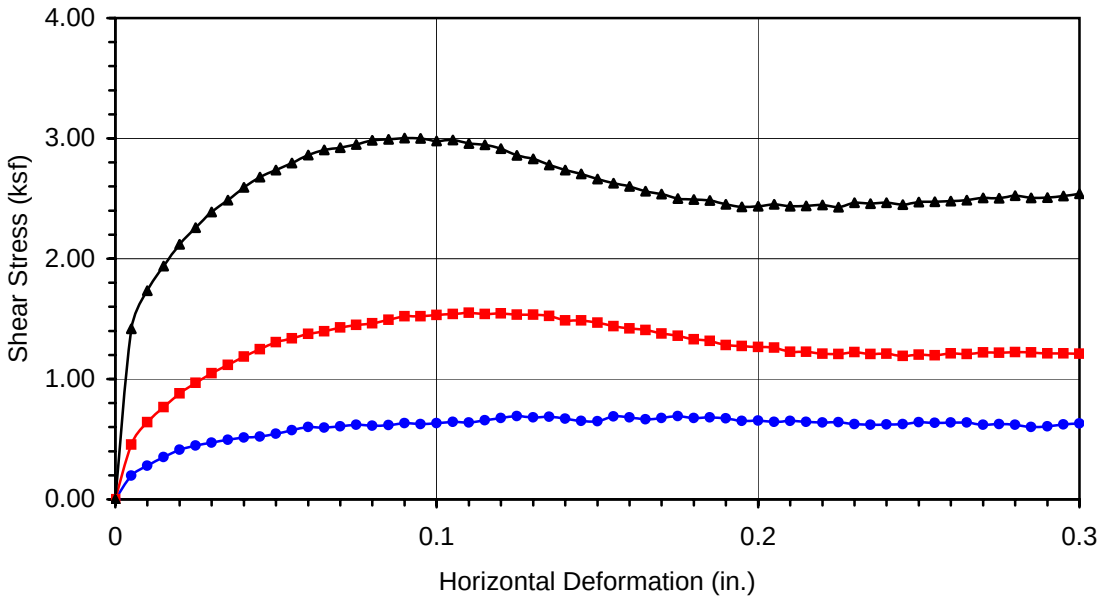
Leighton

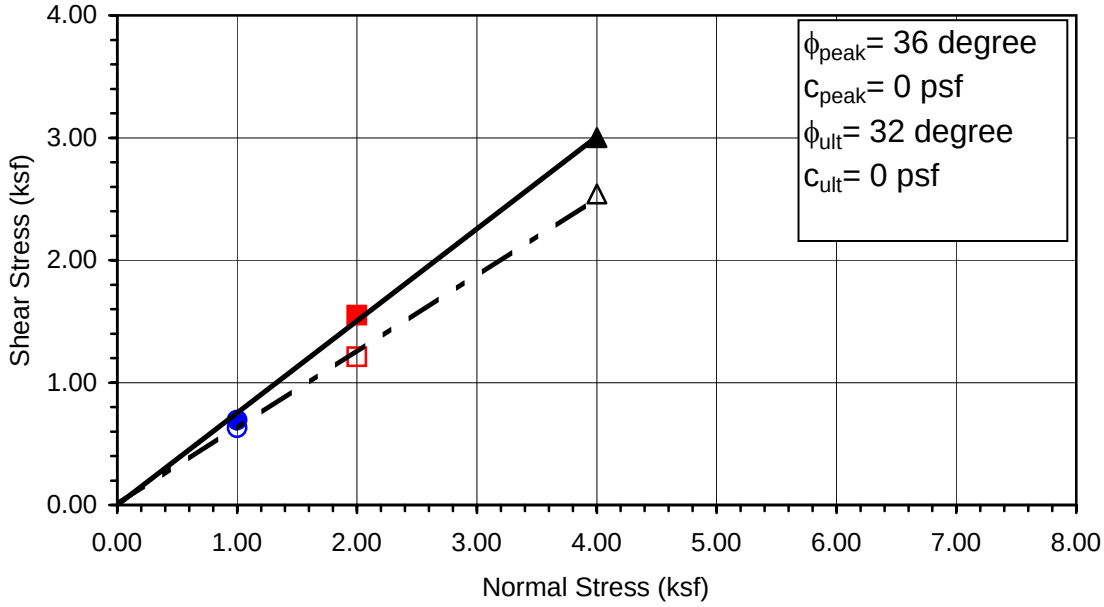
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09





Boring No.	**A-09-014**
Sample No.	**R-5**
Depth (ft)	**40**

Sample Type:

Drive

Soil Identification:
Light yellowish brown poorly graded sand (SP)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.692	■ 1.550	▲ 3.002
Shear Stress @ End of Test (ksf)	○ 0.629	□ 1.210	△ 2.540
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	8.31	8.31	8.31
Dry Density (pcf)	95.6	94.1	97.6
Saturation (%)	29.4	28.3	30.9
Soil Height Before Shearing (in.)	0.9953	0.9888	0.9811
Final Moisture Content (%)	23.5	22.3	22.6

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09

Leighton

SOIL RESISTIVITY TEST

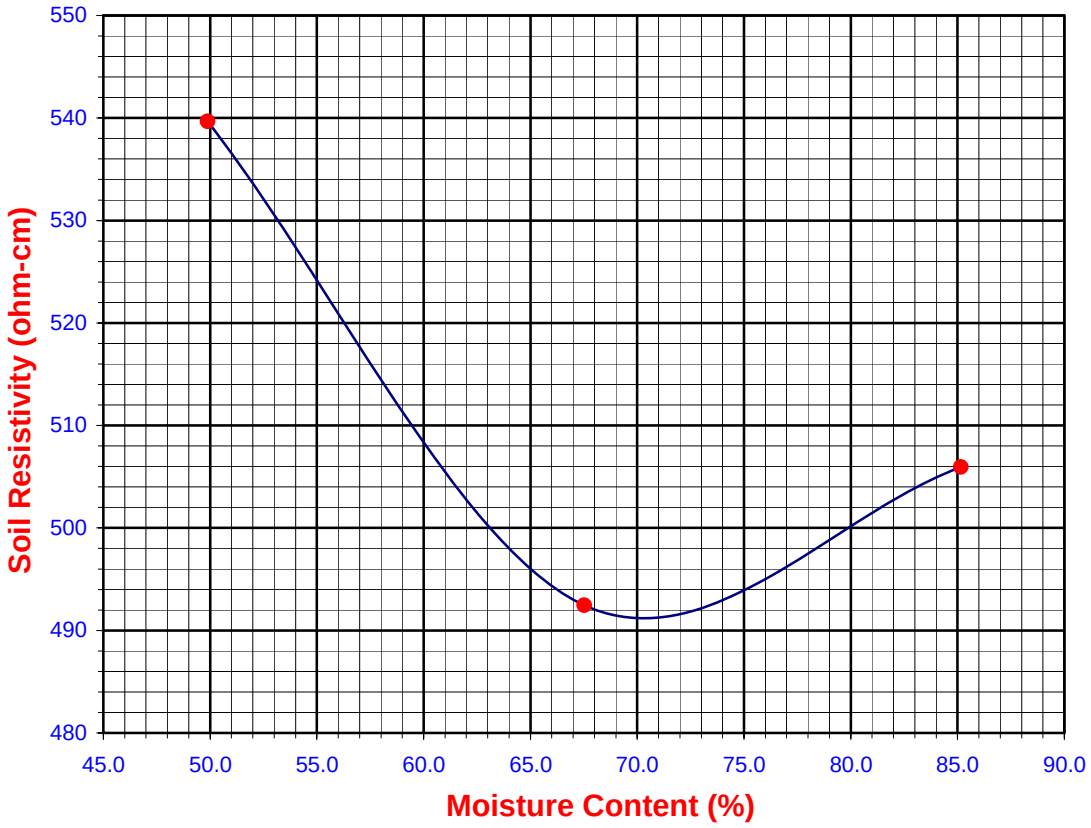
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/17/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/19/09
Boring No.:	A-09-014	Depth (ft.) :	10-20		
Sample No. :	R-2, S-1, R-3				
Soil Identification:	Dark gray (ML)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	400	49.89	80	540
2	600	67.52	73	492
3	800	85.15	75	506
4				
5				

Moisture Content (%) (MCi)	14.62
Wet Wt. of Soil + Cont. (g)	200.40
Dry Wt. of Soil + Cont. (g)	182.20
Wt. of Container (g)	57.70
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
491	**70.2**	**1431**	**35**	**5.31**	**19.2**



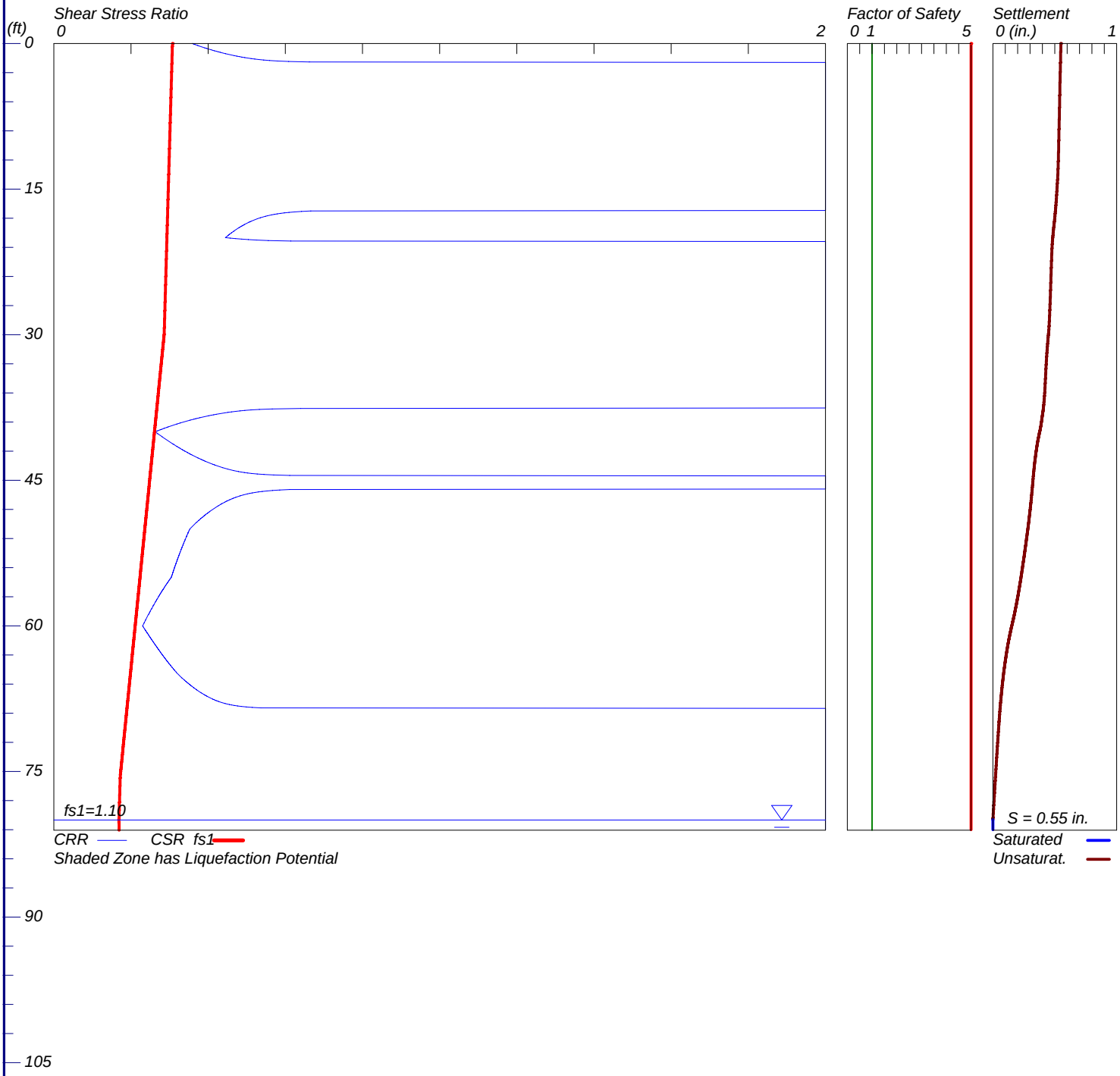
APPENDIX B

SEISMIC SETTLEMENT ANALYSIS

SR 57 Widening South St Retaining Wall

Hole No.=A-09-014 Water Depth=80 ft Surface Elev.=220.0

Magnitude=6.6
Acceleration=0.43g



LiquefyPro CivilTech Software USA www.civiltech.com

****

LIQUEFACTION ANALYSIS SUMMARY
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Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 2/4/2010 12:30:47 PM

Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\B-14.liq
Title: SR 57 Widening Tieback Wall at South St OC
Subtitle: 602231-002

Surface Elev.=220.0
Hole No.=A-09-014
Depth of Hole= 81.05 ft
Water Table during Earthquake= 80.00 ft
Water Table during In-Situ Testing= 82.00 ft
Max. Acceleration= 0.49 g
Earthquake Magnitude= 6.60

Input Data:
Surface Elev.=220.0
Hole No.=A-09-014
Depth of Hole=81.05 ft
Water Table during Earthquake= 80.00 ft
Water Table during In-Situ Testing= 82.00 ft
Max. Acceleration=0.49 g
Earthquake Magnitude=6.60

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.333
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	10.00	120.00	0.00
10.00	25.00	120.00	0.00
15.00	18.00	120.00	0.00
20.00	17.00	120.00	0.00
25.00	45.00	120.00	0.00
30.00	23.00	120.00	0.00
35.00	34.00	120.00	0.00
40.00	16.00	120.00	0.00
45.00	28.00	120.00	0.00
50.00	24.00	120.00	0.00
55.00	23.00	120.00	0.00
60.00	19.00	120.00	0.00
65.00	27.00	120.00	0.00
70.00	36.00	120.00	0.00
75.00	38.00	120.00	0.00
80.00	41.00	120.00	0.00

Output Results:
Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.72 in.
Total Settlement of Saturated and Unsaturated Sands=0.72 in.
Differential Settlement=0.360 to 0.475 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.36	0.35	5.00	0.00	0.72	0.72
5.00	2.77	0.35	5.00	0.00	0.71	0.71
10.00	2.77	0.34	5.00	0.00	0.70	0.70
15.00	2.77	0.34	5.00	0.00	0.68	0.68
20.00	0.45	0.33	5.00	0.00	0.63	0.63
25.00	2.77	0.33	5.00	0.00	0.61	0.61
30.00	2.72	0.33	5.00	0.00	0.59	0.59
35.00	2.64	0.31	5.00	0.00	0.55	0.55
40.00	0.26	0.30	5.00	0.00	0.49	0.49
45.00	2.50	0.28	5.00	0.00	0.42	0.42
50.00	0.35	0.27	5.00	0.00	0.37	0.37
55.00	0.31	0.25	5.00	0.00	0.29	0.29
60.00	0.23	0.24	5.00	0.00	0.20	0.20
65.00	0.32	0.23	5.00	0.00	0.11	0.11
70.00	2.22	0.21	5.00	0.00	0.06	0.06
75.00	2.18	0.20	5.00	0.00	0.03	0.03
80.00	2.14	0.19	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Lateral load Calculation

ϕ (degree)	28
c (psf)	1000
ϕ (degree)	34
γ (pcf)	120.0
Individual Pile	No
Factor of Safety	1.0

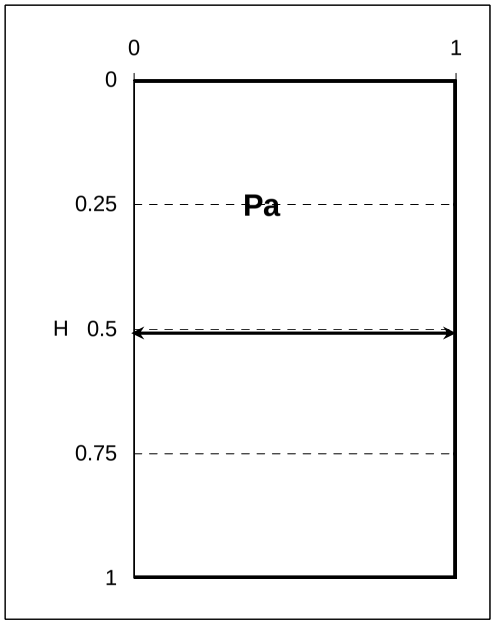
Temporary Excavation - Braced Cut

1	2	3	
Sand	Soft & Medium Clay	Stiff Clay	

Soil Type: 1

Soil Pressure (psf): **22.1**

	Level Backfill
Friction resistance	0.45
K_p	3.54
K_0	0.44
K_a	0.28
P_p (pcf)	**424.5**
P_0 (pcf)	**52.9**
P_a (pcf)	**33.9**



Assumption: Wall friction (δ) assumed to be 0.
Passive Pressure: Rankine Theory
Active Pressure: Rankine Theory for Level Backfill, slope backfill from NAVFAC DM 7.02 Ch3.
At rest condition: empirical relationship by Jaky 1944

Jaky, J., 1944, The Coefficient of Earth Pressure at Rest," Journal of the Society of Hungarian Architects and Engineers, Vol 7, 355-358

NAVFAC Figure 33, Passive pressure distribution for solider piles, p7.2-112

LATERAL EARTH PRESSURES-STATIC CONDITION
SR-57 RETAINING WALL
AT SOUTH STREET OVERCROSSING
ANAHEIM, CALIFORNIA

PROJECT NAME : SR-57/South Retaining Wall
PROJECT NO: 602231-002
DESIGNED BY: TK
CHECKED BY: DJC
DATE: 6/9/2009

Figure B2

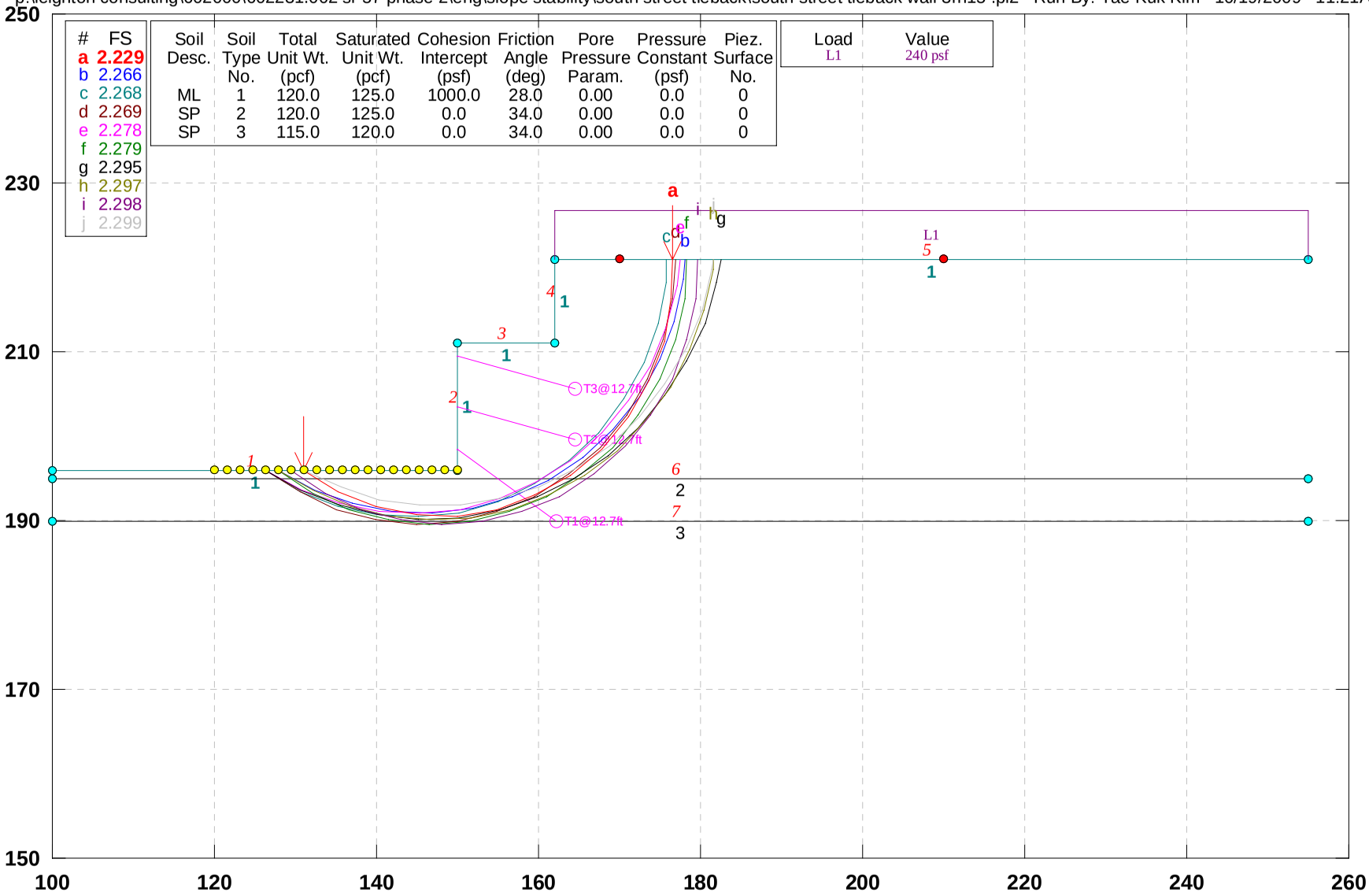
602231-002/SR 57 N Widening/South StreetTieback Wall/3 Rows/ H=15ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\south street tieback\south street tieback wall 3rh15 .pl2 Run By: Tae Kuk Kim 10/19/2009 11:21AM

#	FS
a	2.229
b	2.266
c	2.268
d	2.269
e	2.278
f	2.279
g	2.295
h	2.297
i	2.298
j	2.299

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
ML	1	120.0	125.0	1000.0	28.0	0.00	0.0	0
SP	2	120.0	125.0	0.0	34.0	0.00	0.0	0
SP	3	115.0	120.0	0.0	34.0	0.00	0.0	0

Load	Value
L1	240 psf

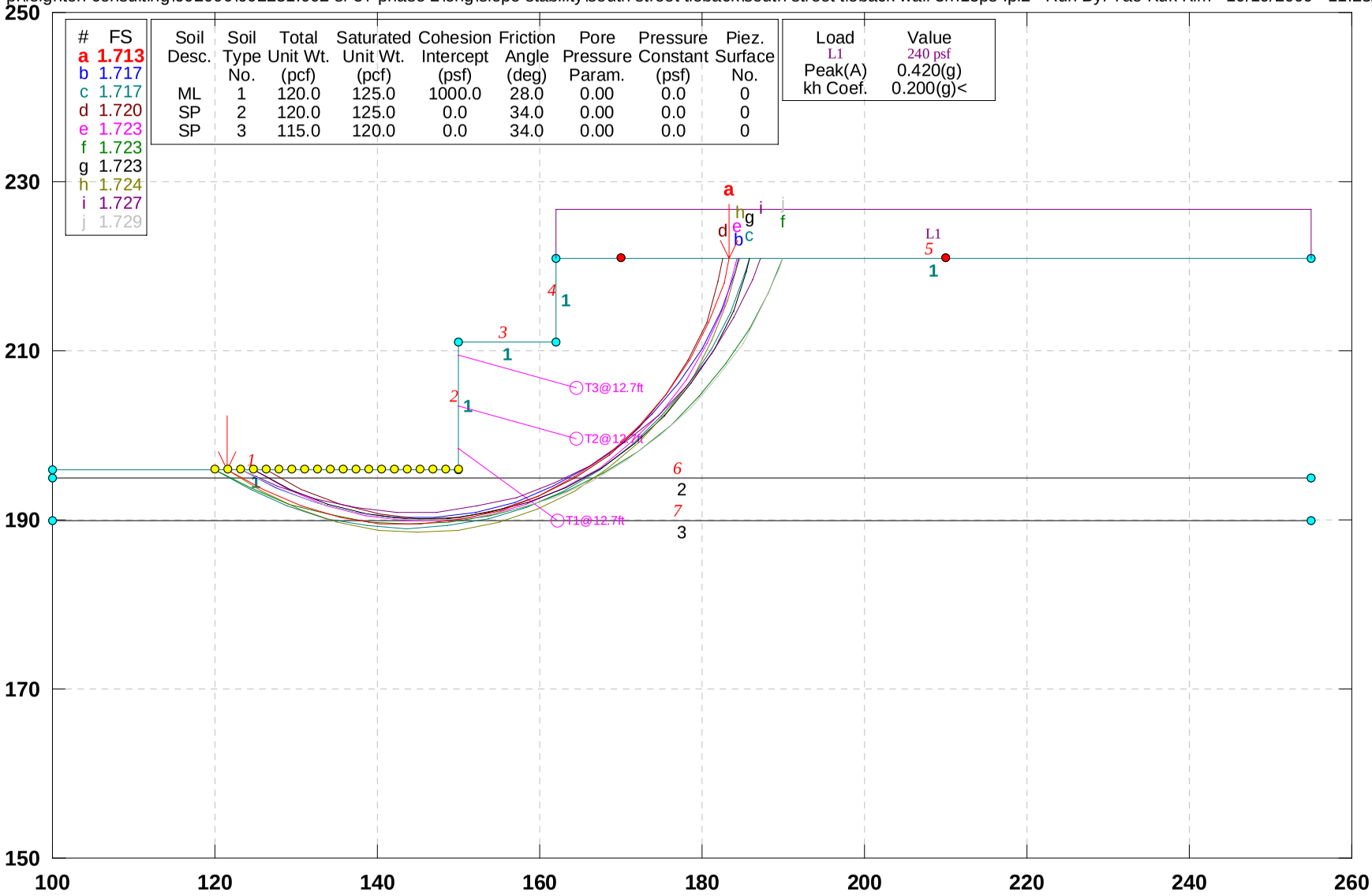


GSTABL7 v.2 FSmin=2.229

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/SR 57 N Widening/South StreetTieback Wall/3 Rows/Pseudo Static/H=15ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\south street tieback\south street tieback wall 3rh15ps .pl2 Run By: Tae Kuk Kim 10/19/2009 11:23AM

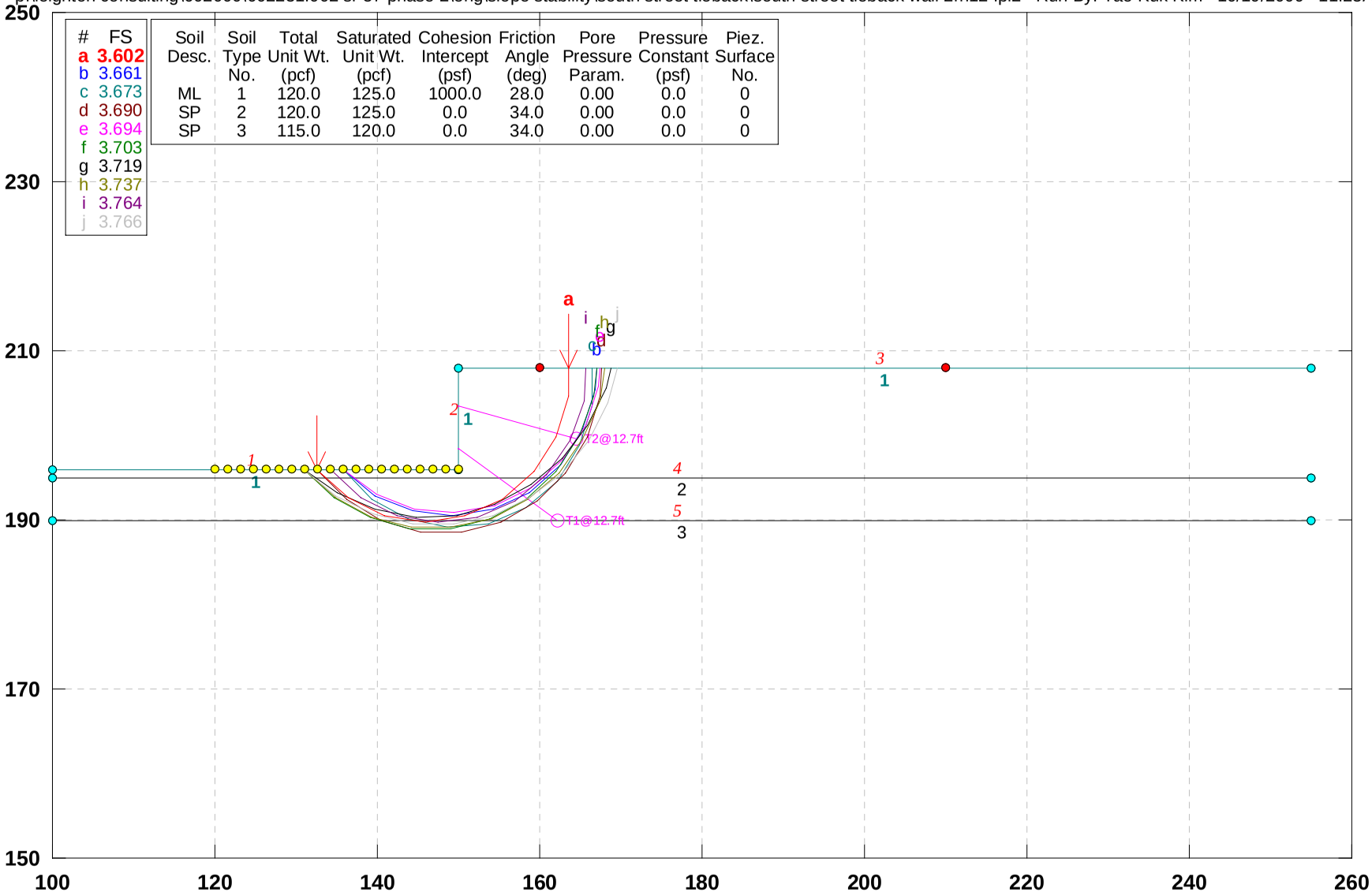


GSTABL7 v.2 FSmin=1.713

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/SR 57 N Widening/South StreetTieback Wall/2 Rows H=12ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\south street tieback\south street tieback wall 2rh12 .pl2 Run By: Tae Kuk Kim 10/19/2009 11:23AM



GSTABL7 v.2 FSmin=3.602

Safety Factors Are Calculated By The Modified Bishop Method

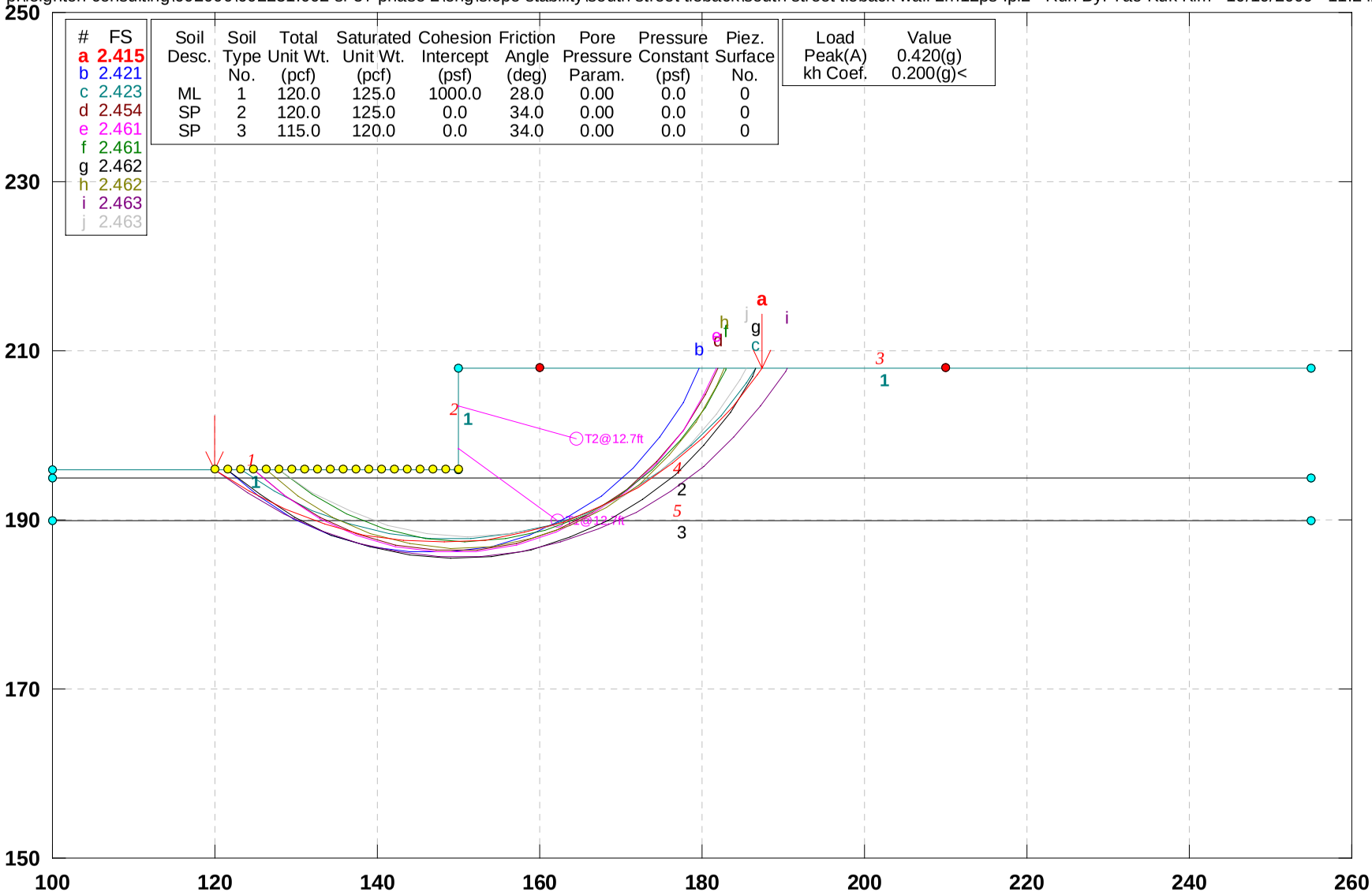
602231-002/SR 57 N Widening/South StreetTieback Wall/2 Rows/Pseudo Static/H=12ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\south street tieback\south street tieback wall 2rh12ps .pl2 Run By: Tae Kuk Kim 10/19/2009 11:24AM

#	FS
a	2.415
b	2.421
c	2.423
d	2.454
e	2.461
f	2.461
g	2.462
h	2.462
i	2.463
j	2.463

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
ML	1	120.0	125.0	1000.0	28.0	0.00	0.0	0
SP	2	120.0	125.0	0.0	34.0	0.00	0.0	0
SP	3	115.0	120.0	0.0	34.0	0.00	0.0	0

Load	Value
Peak(A)	0.420(g)
kh Coef.	0.200(g)<

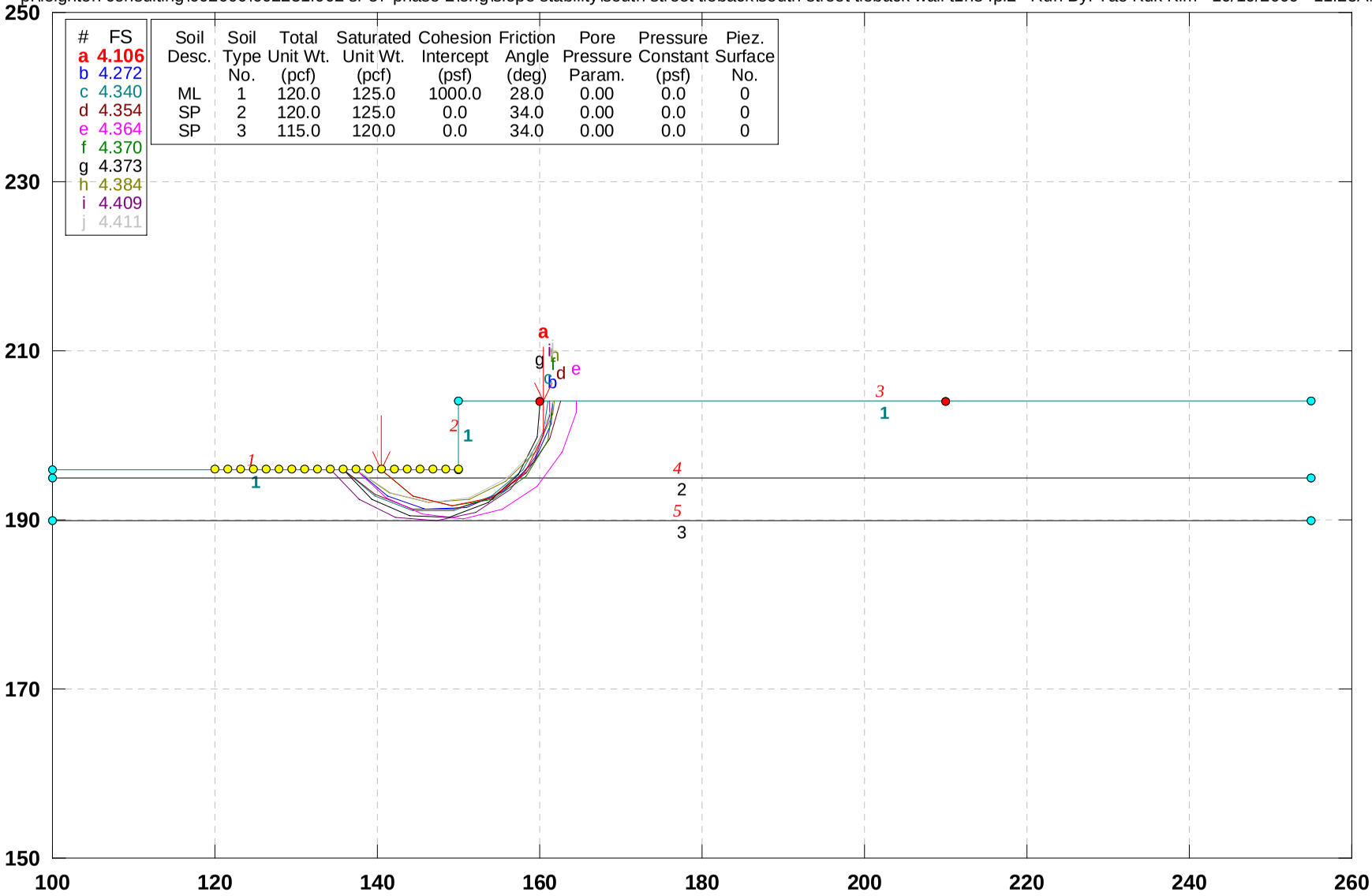


GSTABL7 v.2 FSmin=2.415

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/SR 57 N Widening/South StreetType 1 Retaining Wall /H= 8ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\south street tieback\south street tieback wall t1h8 .pl2 Run By: Tae Kuk Kim 10/19/2009 11:25AM

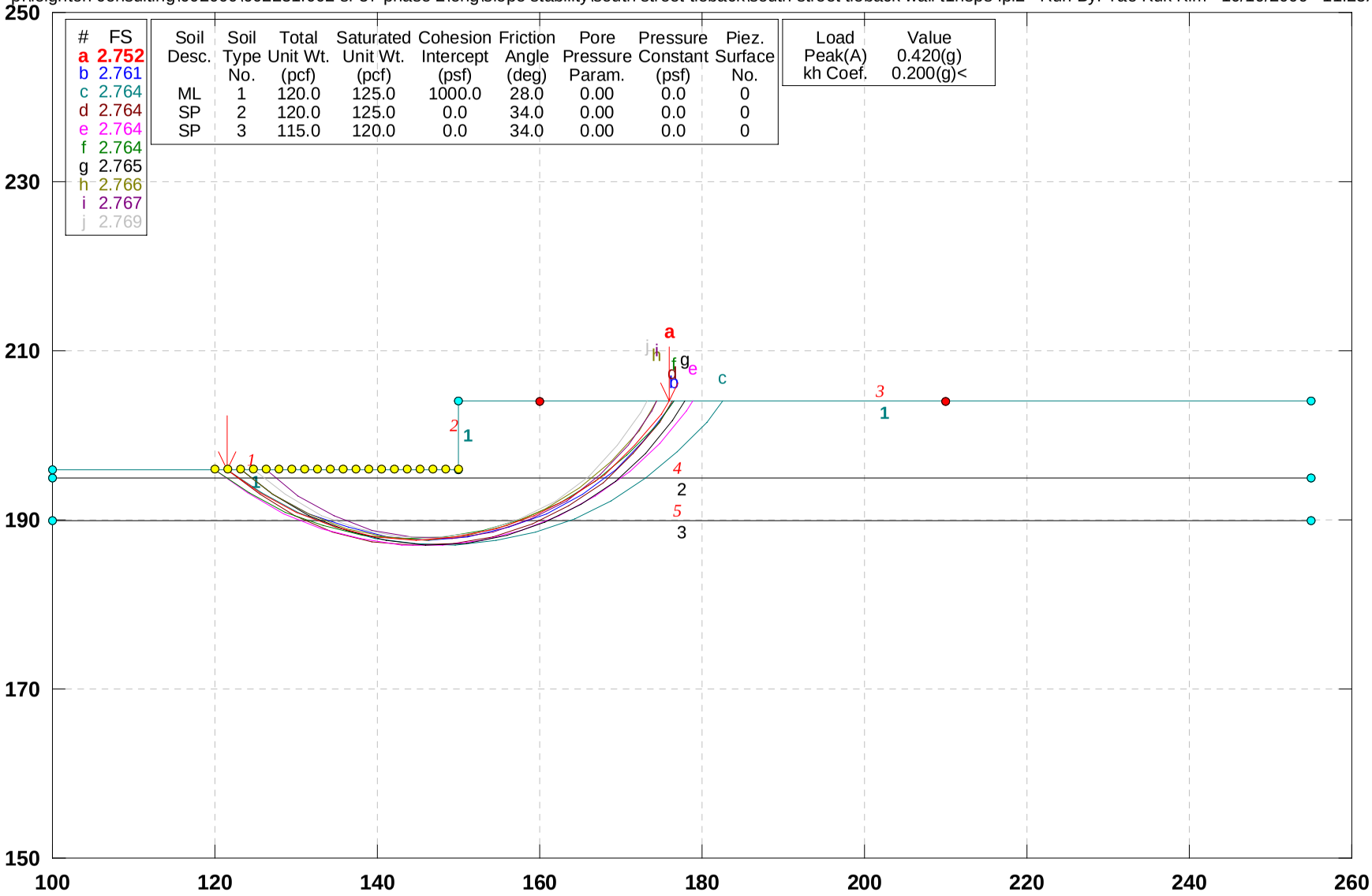


GSTABL7 v.2 FSmin=4.106

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/SR 57 N Widening/South StreetType 1 RW/Pseudo Static/ H= 8ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\south street tieback\south street tieback wall t1h8ps .pl2 Run By: Tae Kuk Kim 10/19/2009 11:25AM

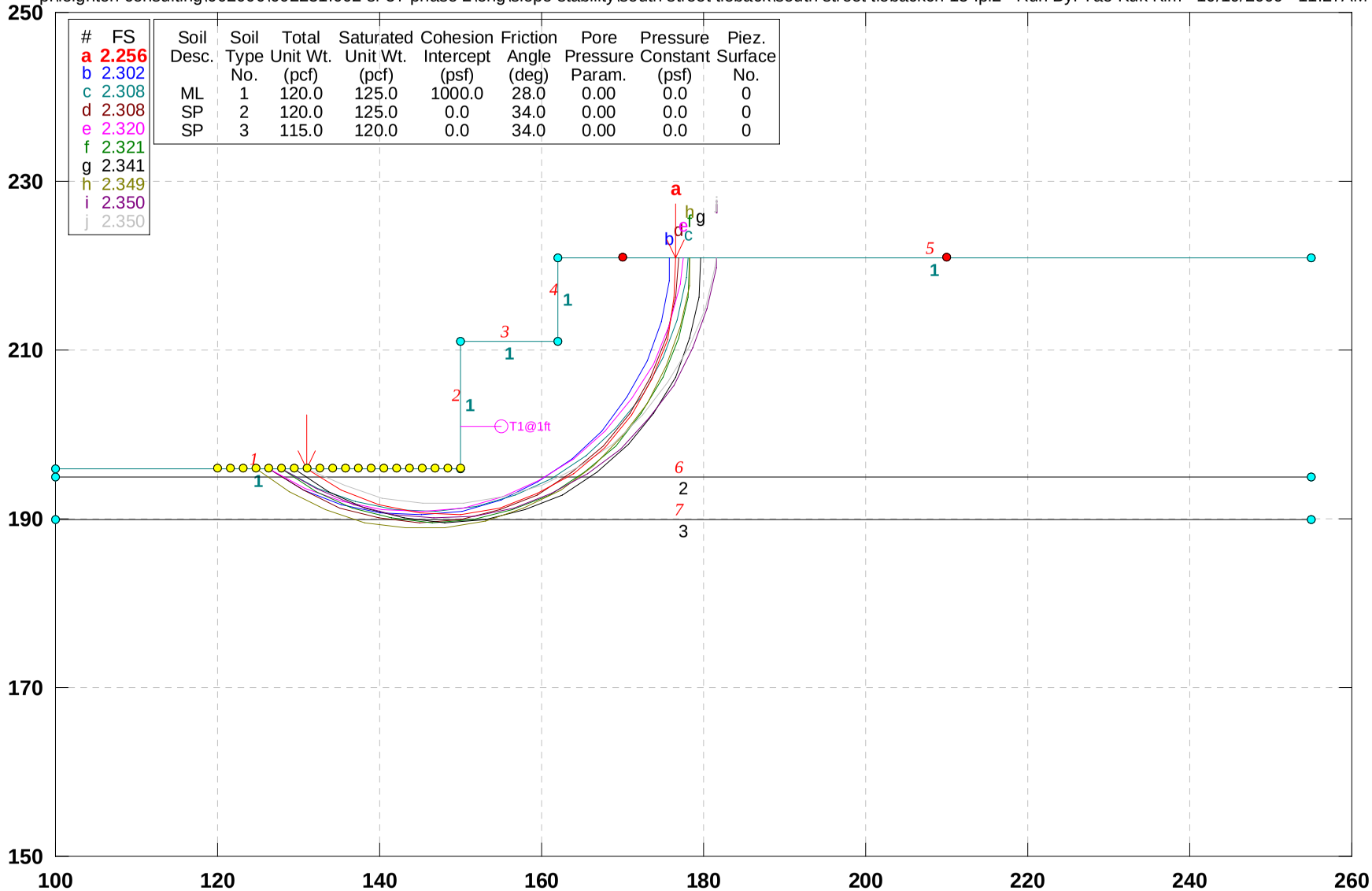


GSTABL7 v.2 FSmin=2.752

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/SR 57 N Widening/South StreetTieback Wall Critical Failure H=15ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\south street tieback\south street tiebackch 15 .pl2 Run By: Tae Kuk Kim 10/19/2009 11:27AM



GSTABL7 v.2 FSmin=2.256

Safety Factors Are Calculated By The Modified Bishop Method

```
VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

    SR57 Widening South Street Abutment 3 - Existing 16-inch Dia CIDH Pile

    PROPOSED DEPTH =      54.0 FT
    ----------------

    NUMBER OF LAYERS =    3
    ------------------

    WATER TABLE DEPTH =      81.0 FT.
    -------------------

    FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.00
    ------------------------------------------------------
    FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 2.00
    -------------------------------------------------------

    SOIL INFORMATION
    ---------------

    LAYER NO 1----CLAY

      AT THE TOP

      STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
      END BEARING COEFFICIENT-Nc                       = 0.600E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.100E+04
      INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.120E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
      DEPTH, FT                                        = 0.000E+00

      AT THE BOTTOM

      STRENGTH REDUCTION FACTOR-ALPHA                  = 0.550E+00
      END BEARING COEFFICIENT-Nc                       = 0.900E+01
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.100E+04
      INTERNAL FRICTION ANGLE, DEG.                    = 0.000E+00
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.120E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
      DEPTH, FT                                        = 0.250E+02

    LAYER NO 2----SAND

      AT THE TOP

      SKIN FRICTION COEFFICIENT- BETA                  = 0.825E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                    = 0.340E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.120E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
      DEPTH, FT                                        = 0.250E+02

      AT THE BOTTOM

      SKIN FRICTION COEFFICIENT- BETA                  = 0.761E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                    = 0.340E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.120E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
      DEPTH, FT                                        = 0.300E+02

    LAYER NO 3----SAND

      AT THE TOP

      SKIN FRICTION COEFFICIENT- BETA                  = 0.761E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                    = 0.340E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.115E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
      DEPTH, FT                                        = 0.300E+02

      AT THE BOTTOM

      SKIN FRICTION COEFFICIENT- BETA                  = 0.285E+00
      UNDRAINED SHEAR STRENGTH, LB/SQ FT               = 0.000E+00
      INTERNAL FRICTION ANGLE, DEG.                    = 0.340E+02
      BLOWS PER FOOT FROM STANDARD PENETRATION TEST    = 0.000E+00
      SOIL UNIT WEIGHT, LB/CU FT                       = 0.115E+03
      MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT         = 0.100E+11
      DEPTH, FT                                        = 0.810E+02

    DRILLED SHAFT INFORMATION
    -------------------------

     DIAMETER OF STEM          =    1.330  FT.
     DIAMETER OF BASE          =    1.330  FT.
     END OF STEM TO BASE       =    0.000  FT.
     ANGLE OF BELL             =    0.000  DEG.
     IGNORED TOP PORTION       =   12.000  FT.
     IGNORED BOTTOM PORTION    =    0.000  FT.
     AREA OF ONE PERCENT STEEL =    2.001  SQ.IN.
     ELASTIC MODULUS, Ec       = 0.380E+07 LB/SQ IN
     VOLUME OF UNDERREAM       =    0.000  CU.YDS.
```

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
13.0	0.67	1.15	5.42	6.57	3.86	3.28	9.82
14.0	0.72	2.30	5.50	7.80	5.05	3.90	10.83
15.0	0.77	3.45	5.59	9.03	6.24	4.52	11.70
16.0	0.82	4.60	5.67	10.27	7.43	5.13	12.47
17.0	0.87	5.75	5.75	11.50	8.62	5.75	13.14
18.0	0.93	6.90	5.84	12.73	9.81	6.37	13.74
19.0	0.98	8.04	5.92	13.96	11.00	6.98	14.28
20.0	1.03	9.19	6.00	15.20	12.19	7.60	14.76
21.0	1.08	10.34	6.09	16.43	13.39	8.21	15.20
22.0	1.13	11.49	6.17	17.66	14.58	8.83	15.60
23.0	1.18	12.64	6.25	18.89	15.77	9.45	15.96
24.0	1.24	13.79	14.82	28.61	21.20	14.31	23.17
25.0	1.29	14.94	14.82	29.76	22.35	14.88	23.13
26.0	1.34	20.23	14.82	35.05	27.64	17.53	26.20
27.0	1.39	25.64	14.82	40.46	33.05	20.23	29.12
28.0	1.44	31.15	14.82	45.97	38.56	22.99	31.91
29.0	1.49	36.77	14.82	51.60	44.18	25.80	34.57
30.0	1.54	42.49	14.82	57.32	49.90	28.66	37.13
31.0	1.60	48.30	14.82	63.13	55.71	31.56	39.57
32.0	1.65	54.19	14.82	69.02	61.61	34.51	41.91
33.0	1.70	60.17	14.82	74.99	67.58	37.49	44.16
34.0	1.75	66.21	14.82	81.04	73.63	40.52	46.31
35.0	1.80	72.33	14.82	87.15	79.74	43.58	48.39
36.0	1.85	78.52	14.82	93.34	85.93	46.67	50.38
37.0	1.90	84.76	14.82	99.59	92.18	49.79	52.30
38.0	1.96	91.07	14.82	105.89	98.48	52.95	54.15
39.0	2.01	97.43	14.82	112.26	104.84	56.13	55.93
40.0	2.06	103.85	14.82	118.67	111.26	59.33	57.65
41.0	2.11	110.31	14.82	125.13	117.72	62.57	59.31
42.0	2.16	116.81	14.82	131.63	124.22	65.82	60.90
43.0	2.21	123.36	14.82	138.18	130.77	69.09	62.44
44.0	2.26	129.94	14.82	144.76	137.35	72.38	63.93
45.0	2.32	136.55	14.82	151.37	143.96	75.69	65.37
46.0	2.37	143.19	14.82	158.02	150.60	79.01	66.75
47.0	2.42	149.86	14.82	164.68	157.27	82.34	68.09
48.0	2.47	156.55	14.82	171.37	163.96	85.69	69.38
49.0	2.52	163.26	14.82	178.08	170.67	89.04	70.62
50.0	2.57	169.98	14.82	184.81	177.39	92.40	71.82
51.0	2.62	176.72	14.82	191.54	184.13	95.77	72.98
52.0	2.68	183.46	14.82	198.28	190.87	99.14	74.10
53.0	2.73	190.21	14.82	205.03	197.62	102.52	75.17
54.0	2.78	196.96	14.82	211.78	204.37	105.89	76.21

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.9717E+00	0.9746E-03	0.3251E-02	0.1000E-03
0.9874E+01	0.9831E-02	0.3251E-01	0.1000E-02
0.2479E+02	0.2490E-01	0.8127E-01	0.2500E-02
0.4551E+02	0.4838E-01	0.1625E+00	0.5000E-02
0.6310E+02	0.6988E-01	0.2438E+00	0.7500E-02
0.7811E+02	0.8966E-01	0.3251E+00	0.1000E-01
0.1309E+03	0.1709E+00	0.8127E+00	0.2500E-01
0.1656E+03	0.2426E+00	0.1625E+01	0.5000E-01
0.1813E+03	0.2895E+00	0.2438E+01	0.7500E-01
0.1890E+03	0.3261E+00	0.3232E+01	0.1000E+00
0.1955E+03	0.4879E+00	0.7342E+01	0.2500E+00
0.1989E+03	0.7439E+00	0.1112E+02	0.5000E+00
0.2019E+03	0.9991E+00	0.1444E+02	0.7500E+00
0.2039E+03	0.1253E+01	0.1673E+02	0.1000E+01
0.2080E+03	0.1856E+01	0.2164E+02	0.1596E+01

APPENDIX C

State of California | Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. JON HAMAGUCHI
Office of Special Funded Projects

Date: December 16, 2009
File: 12-ORA-57-PM 14.42
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
South St. Overcrossing
Bridge No. 55-0516

Subject: Review of the Draft Foundation Report

On October 28, 2009, we received a draft Foundation Report for the Tieback wall at Abutment 3 of the South Street OC Bridge No. 55-0516. Construction of this wall is part of the Northbound widening of the SR-57 between Katella and Lincoln Avenues. The following comments are based on review of the subject report dated October 16, 2009, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

Table 1

- Effective ultimate shear strength should be used for design of permanent anchors.

Faulting and Seismicity

- A section for Response Spectra should be added. Also Deterministic and Probabilistic Response Spectrum for each fault should be provided.
- 2008 USGS Deaggregated Hazard (Beta) Curve should be used as design curve if there is a difference of more than 10% between USGS and ARS online probabilistic data.
- QC/QA sheets should be included for all faults listed in calculated spectra.

Log of Test Borings (LOTB)

- The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets.
- The laboratory test symbols should be attached to the boring stick (i.e. PA at elev. 155).
- Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NAVD88.

- The project name in title block of as built LOTB should be the same as current LOTB (sheet 1 of 4) and Soil Legend (sheets 2 of 4 and 3 of 4). The project name should read "South Street OC – Retaining Wall".

- Place Post Mile 14.42 in LOTB including Soil Legend sheets and design plans.

- There is not such a term as "clayey silt with sand". It is suggested to use elastic silt with sand, silty clay with sand or another acceptable cohesive soil group name.

- Delete the word "wet" at elevations 214 and 217 unless it is defining a perched water.

- Change the term "medium dense" to "very stiff" at elevation 214.

- Draw a solid line in boring stick at elevation 190 to separate the fill from alluvium.

- Add the terms "very dense" at elevations 160 and 145 and "dense" at elevation 155.

Design Plans

- Typical section of Type 1 wall is not shown in General Plan or other plan sheets.

- The reason for extending shotcrete limits to Type 1 walls as shown in General Plan.

- Soil parameters in the report's Foundation Plan are different than those in Foundation Plan submitted separately. Cohesive soil parameters with ultimate shear strength should be used for the top two rows and granular soil parameters for the third row.

- Show the label orientation on the cross sections in Retaining Wall Section Plan (i.e. vertical E-E label on Section E-E).

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by:

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

Date: 12/16/2009

Exp. 6-30-2010

c: OGDS1 - LA. File OGDS1 - Sac. File GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of South Street OC Bridge No. 55-0516, dated October 16, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Table 1	Faramarz Gerami	Effective ultimate shear strength should be used for design of permanent anchors.	Soil strength parameters shown in Table 1 are ultimate shear strength parameters.
2	Faulting & Seismicity	Faramarz Gerami	A section for Response Spectra should be added. Also Deterministic and Probabilistic Response Spectrum for each fault should be provided. 2008 USGS Deaggregated Hazard (Beta) Curve should be used as design curve if there is a difference of more than 10% between USGS and ARS online probabilistic data. QC/QA sheets should be included for all faults listed in calculated spectra.	ARS curve is not required for the tieback and Type 1 retaining wall design.
3	Lot of Test Borings (LOTB)	Faramarz Gerami	The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets. The laboratory test symbols should be attached to the boring stick (i.e. PA at elev. 155). Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NA VD88. The project name in title block of as built LOTB should be the same as current LOTB (sheet 1 of 4) and Soil Legend (sheets 2 of 4 and 3 of 4). The project name should read "South Street OC - Retaining Wall". Place Post Mile 14.42 in LOTB including Soil Legend sheets and design plans.	We will remove the boxes. We will revise our LOTBs accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of South Street OC Bridge No. 55-0516, dated October 16, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			There is not such a term as "clayey silt with sand". It is suggested to use elastic silt with sand, silty clay with sand or another acceptable cohesive soil group name. Delete the word "wet" at elevations 214 and 217 unless it is defining a perched water. Change the term "medium dense" to "very stiff' at elevation 214. Draw a solid line in boring stick at elevation 190 to separate the fill from alluvium. Add the terms "very dense" at elevations 160 and 145 and "dense" at elevation 155.	
4	Design Plans	Faramarz Gerami	Typical section of Type 1 wall is not shown in General Plan or other plan sheets. The reason for extending shotcrete limits to Type 1 walls as shown in General Plan. Soil parameters in the report's Foundation Plan are different than those in Foundation Plan submitted separately. Cohesive soil parameters with ultimate shear strength should be used for the top two rows and granular soil parameters for the third row. Show the label orientation on the cross sections in Retaining Wall Section Plan (i.e. vertical E-E label on Section E-E).	We understand that HDR will revise the plans accordingly. We will provide the appropriate soil parameters for the third (lower) row of the tieback.

State of California | Business, Transportation and Housing Agency

Memorandum

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To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: March 15, 2010
File: 12-ORA-57-PM 14.42
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
South St. Overcrossing
Bridge No. 55-0516

Subject: 2nd Review of the Foundation Report

On February 22, 2010, we received a Foundation Report for the Tieback wall at Abutment 3 of the South Street OC Bridge No. 55-0516. Construction of this wall is part of the Northbound widening of the SR-57 between Katella and Lincoln Avenues. The following comments are based on review of the subject report revised February 15, 2010, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

4.1 Table 4 – As Built Foundation Data

- As Built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified.

- Please explain the reason Nominal Resistance is exceeding 2 x Allowable Capacity.

Log of Test Borings (LOTB)

- Bottom of footing elevations (Tieback or Type 1) should not be shown on LOTB.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 3/15/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
No. 2669
Exp. 6-30-2010
GEOTECHNICAL
STATE OF CALIFORNIA

c: OGDS1 - LA. File
OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MARCH 15, 2010
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of South Street OC Bridge No. 55-0516, dated February 15, 2010.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Table 4 – As Built Foundation Data	Faramarz Gerami	As built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified. Please explain the reason Nominal Resistance is exceeding 2X Allowable Capacity.	We have revised Page 12 of our report accordingly. We have revised Page 12 of our report to indicate nominal resistance as 2 times the allowable pile capacity.
2	Log of Test Borings (LOTB)	Faramarz Gerami	Bottom of footing elevations (Tieback or Type 1) should not be shown on LOTB.	We have revised our LOTB accordingly.

State of California **Business, Transportation and Housing Agency**

Memorandum

Flex your power!
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To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: June 7, 2010
File: 12-ORA-57-PM 14.42
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
South St. Overcrossing
Bridge No. 55-0516

Subject: 3rd Review of the Foundation Report-Addendum

On May 26, 2010, we received an addendum to Foundation Report for the proposed Tieback wall No. 55E0113 at Abutment 3 of the South Street OC Bridge No. 55-0516. The subject addendum report including responses dated May 20, 2010, is prepared by Leighton Consulting, Inc.

We have no further comments after reviewing the referenced submittal and responses to our previous review comments dated March 15, 2010. Any questions should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 6/7/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
No. 2669
Exp. 6/30/2010
GEOTECHNICAL
STATE OF CALIFORNIA

c: OGDS1 - LA. Electronic File
OGDS1 - Sac. Electronic File
GS – Sac. ElectroFile

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

TRANSMITTAL

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: August 5, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail	X	Draft Report	X	Your Use
X	Courier/Overnight		Final Report		As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Foundation Report for Proposed Retaining Wall No 55E0112 at Abutment 3 of Wagner Avenue Overcrossing (Bridge No. 55-0515), Northbound State Route 57, Orange County, California

LEIGHTON CONSULTING, INC.

By: Djan Chandra

Distribution (4) Addressee

17781 Cowan ■ Irvine, CA 92614-6009
949.253.9836 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

FOUNDATION REPORT FOR
PROPOSED RETAINING WALL NO. 55E0112 AT ABUTMENT 3 OF WAGNER AVENUE OVERCROSSING (BRIDGE NO. 55-0515), NORTHBOUND STATE ROUTE 57, ORANGE COUNTY, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 57
PROJECT POST MILES: 12.2/15.2, EA # 0F0401

Prepared For:

HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

August 5, 2010

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

August 5, 2010

Project No. 602231-002

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Attention: Mr. Scott Bacsikin

Subject: Foundation Report for Proposed Retaining Wall No. 55E0112 at Abutment 3 of Wagner Avenue Overcrossing (Bridge No. 55-0515), Northbound State Route 57, Orange County, California

In response to your request, Leighton Consulting, Inc. has performed a geotechnical exploration for the proposed Retaining Wall No. 55E0112 at the Abutment 3 of Wagner Avenue overcrossing (Bridge No. 55-0515) at northbound State Route 57 (SR-57) in Orange County, California. The retaining wall will consist of a tieback wall with a Type 1 retaining wall at each end and is part of the proposed widening of northbound SR-57 from approximately 0.3 mile south of Katella Avenue to approximately 0.3 miles north of Lincoln Avenue. This project is sponsored by OCTA and Leighton Consulting has been retained as the geotechnical consultant by HDR Engineering, Inc. The purpose of our study was to evaluate the subsurface conditions at the project site and to provide geotechnical recommendations for design and construction of the proposed retaining wall. A draft version of this report was issued on October 19, 2009 and February 15, 2010 for review by Caltrans and the design team. An addendum report providing response to Caltrans final review comments was issued on May 20, 2010 and approved by Caltrans. Caltrans review comments and our response are included in Appendix C of this report.

Wagner Avenue is located approximately 24 feet above the SR-57 grade. Based on the available borings, the subject portion of Wagner Avenue is underlain by approximately 30 feet of man-made embankment fill consisting mainly of loose sand and stiff to very stiff silt. The fill is further underlain by alluvium consisting predominantly of medium dense to dense sand and very stiff silt to the maximum depth of our boring of 86½ feet below the street grade. Groundwater was not encountered during our field exploration.

17781 Cowan ■ Irvine, CA 92614-6009
949.253.9836 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

Based on the provided plan, the existing Chantilly Drain is located behind Abutment 3 of the Wagner Avenue overcrossing, approximately 36 feet from the proposed retaining wall. To protect the existing Chantilly Drain, design and construction of the tieback anchors for the tieback wall should consider the presence of the storm drain structure.

This report summarizes the results of our geotechnical exploration and presents geotechnical recommendations for the proposed retaining wall. If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Reviewed by:

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/lr

Distribution: (4) Addressee

Leighton

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1.0 INTRODUCTION

1.1 Project Overview

The California Department of Transportation (Caltrans), District 12, in cooperation with the Orange County Transportation Authority (OCTA), proposes to widen northbound State Route 57 (SR-57) between approximately 0.3 miles south of Katella Avenue (Post Mile 12.2) and 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project segment of SR-57 is approximately 3 miles long, passing through the City of Anaheim in Orange County, California. The purpose of the proposed project is to improve both existing and future mobility, reduce congestion and improve mainline merge and diverge movements.

This segment of SR-57 is relatively flat with elevations ranging from 186 feet above mean sea level (msl) at Katella Avenue to 200 feet msl at Lincoln Avenue. The southern portion of this segment is higher than the surrounding areas while the northern portion is lower. SR-57 was constructed in 1974 and currently has four general purpose lanes and a high-occupancy vehicle (HOV) lane in each direction. Six grade separations exist within this segment; namely at Katella Avenue, Douglass Road, Ball Road, Wagner Avenue, South Street and Lincoln Avenue. The project consists of widening of approximately 3 miles of northbound SR-57 by approximately 35 feet to provide standard lane widths, an additional general purpose lane (fifth lane) and a standard 10-foot wide inside shoulder.

1.2 Project Description

As part of the northbound SR-57 widening project, the existing sloped embankment at the front of Abutment 3 of Wagner Avenue overcrossing will be removed and the remaining embankment will be retained by a tieback wall with a Type 1 retaining wall at each end. These walls are collectively identified as Retaining Wall No. 55E0112. The approximate location of the project site is shown in Figure 1, *Site Location Map*. Based on the provided plan and information, the proposed tieback wall has a maximum height of approximately 15 feet with two to three rows of tiebacks. The Type 1 retaining walls have a maximum height of 14 feet. The walls will be located approximately 10 feet from the center of the existing CIDH piles for Abutment 3. An existing storm drain box culvert, the Chantilly Drain, is located behind the Abutment 3 of the Wagner Avenue overcrossing, approximately 36 feet from the proposed retaining wall.

Based on the as-built plan (Caltrans 1974), the existing Wagner Avenue overcrossing (Bridge No. 55-0515) was constructed in 1974 and is supported on two abutments and one bent. The existing bridge is approximately 212 feet long and 80 feet wide. The as-built elevations of the bridge range from 215.95 to 216.68 feet from west to east. Datum for all elevations referenced in this report is mean sea level (msl). Additionally, the as-built plan was based on the old datum (NGVD29) and approximately 1.84 feet should be added to the as-built elevations to convert them to the current elevations (Datum NAVD88). The elevation of SR-57 freeway is approximately 192 feet. The *General Plan*, *Foundation Plan* and layout plan of the proposed retaining wall prepared by HDR are included at the end of the text of this report.

1.3 Purpose and Scope

The purpose of this report is to review existing geotechnical data, perform subsurface exploration, laboratory testing and geotechnical analysis to provide geotechnical design recommendations for the proposed project.

Our scope of work for this project included the following tasks:

- *Literature Review*: We reviewed various documents pertinent to the project site including the as-built Log of Test Borings (LOTBs) prepared by Caltrans for the existing Bridge No. 55-0515. The as-built LOTBs are included as Sheet 4 of 4 of the attached LOTBs. A list of references used in preparation of this report is presented in Section 6.0.

- *Site Reconnaissance:* We performed a site reconnaissance to visually evaluate the accessibility of the site for drilling equipment and locate and mark the proposed boring location.

- *Subsurface Exploration*: We performed a subsurface exploration that consisted of drilling, logging and sampling of one 8-inch diameter hollow-stem auger boring to a depth of 86½ feet below existing grade of Wagner Avenue. Log of the boring is included in Sheet 1 of 4 of the attached LOTBs.

- *Laboratory Testing*: Laboratory testing was performed on selected soil samples collected from our field exploration to evaluate the engineering properties of the soils. The laboratory test results are included in Appendix A.

- *Seismic Analysis*: Based upon the encountered subsurface conditions and regional seismicity of the area, we performed ground motion analysis for the project site for use in structural analysis and design.

- *Geotechnical Design and Analysis*: Geotechnical analysis was performed on the collected data to develop recommendations for design and construction. Results of the analysis are included in Appendix B.

- *Report Preparation*: Relevant geotechnical data were compiled in this report along with our findings and recommendations for the proposed project.

2.0 GEOTECHNICAL FIELD AND LABORATORY INVESTIGATIONS

2.1 Subsurface Exploration

Our field exploration consisted of advancing one hollow-stem boring to the depth of 86½ feet below the existing grade of Wagner Avenue. The boring was located within the embankment behind the existing Abutment 3 of Wagner Avenue overcrossing. The approximate location of the boring is shown in LOTBs.

Standard Penetration Test (SPT) was performed within the hollow-stem boring using a 140-pound automatic hammer falling freely for 30 inches. The samplers were driven for a total penetration of 18 inches and the blow counts were recorded for the last 12 inches of penetration. Relatively undisturbed samples were collected from the boring using the Modified California Ring sampler. The field sampling procedures were conducted in accordance with ASTM Standard Specifications D 1586 and D 3550 for SPT and split-barrel sampling of soil. In addition to driven samples, representative bulk soil samples were also collected from the boring.

The test boring was logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. All samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the boring was backfilled with soil cutting mixed with cement, tamped and capped with cold mix asphalt. Geotechnical log of the boring is included in the LOTBs.

2.2 Geotechnical Laboratory Testing

Laboratory tests were performed on representative soil samples to determine the geotechnical engineering properties of subsurface materials. The following laboratory tests were performed:

- In-situ moisture content and density;
- Percent passing No. 200 sieve;
- Direct shear; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests, except corrosivity tests, were performed in general accordance with ASTM procedures. The corrosivity tests were performed in accordance with Caltrans procedures. Results of the laboratory tests are presented in Appendix A.

3.0 GEOTECHNICAL FINDINGS

3.1 Geologic Setting

The subject site is located in the Tustin Plain within the southeastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. In general, the Tustin Plain consists of approximately 1,400 feet of unconsolidated to semi-consolidated Quaternary-age alluvial sediments. Underlying the Quaternary alluvial deposits are Tertiary-age bedrock units consisting of sandstone, siltstone, shale and conglomerate on the order of 31,000 feet in thickness.

The site lies near the lower reaches of the Santa Ana River. The surface distribution of Holocene sediments, as recorded in early editions of regional soil survey maps (Eckmann et al., 1916), suggests that the Santa Ana River has recently wandered back and forth across the Orange County coastal plain from Alamitos Bay to Newport Bay. Historical accounts and documents further support the process of widespread sheet flooding being the dominant depositional process associated with the Santa Ana River prior to the construction of Prado Dam in 1941 (California Department of Water Resources, 1957). Currently, the Santa Ana River is located approximately 1,200 feet from the Wagner Avenue overcrossing. Geology map of the area is presented in Figure 2.

3.2 Subsurface Earth Materials

The subsurface soils encountered in our boring consist of approximately 30 feet of embankment fills of Wagner Avenue overcrossing underlain by alluvial deposits. The upper 10 feet of the fills mainly consists of loose sand and the fills below 10 feet to 30 feet consist of stiff to very stiff silt. The alluvium below the fill generally consists of medium dense to dense sand to the depth of 80 feet below the street level, underlain by very stiff silt to the maximum depth explored (86½ feet).

We have performed direct shear tests on representative samples collected from our boring. The cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils were found to range from 0 to 300 psf and 28 to 32 degrees, respectively. The test results are presented in Appendix A. Based on these test results, SPT blowcounts, and soil types, the shear strength parameters and unit weights selected for design are presented in Table 1.

Table 1 – Generalized Soil Profile and Design Parameters

Depth below Street Grade[1] (feet)	Elevation (feet)	Generalized Soil Type	Total Unit Weight (pcf)	Friction Angle[2] (degrees)	Undrained Cohesion, Cu[2] (psf)
0 to 10	216 to 206	**Fill**: Sand	120	32	-
10 to 30	206 to 186	Silt	120	28	500
30 to 80	186 to 136	**Native:** Sand	115	32	-
80 to 86	136 to 130	Silt	115	28	500

[1]Wagner Avenue street grade; cutoff elevation of the existing Abutment 3 pile is 203.9 feet; elevation of the top of retaining wall is 205.7 feet.

[2]Ultimate shear strength parameters based on SPT blow counts (NAFVAC, 1986) and laboratory test results.

3.3 Groundwater

Groundwater was not encountered during our field exploration to the maximum depth explored (elevation of 129.5 feet) nor in Caltrans borings in 1969 to the maximum depth explored (elevation of 107.5 feet). The historically high groundwater table is on the order of 50 feet below the freeway grade (elevation of 142 feet, CDMG, 1997). Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff.

3.4 Engineering Properties of Subsurface Materials

Engineering properties of the subsurface materials were modeled based on results of geotechnical field and laboratory tests performed during our exploration. Results of these laboratory tests that are applicable to the proposed project are presented in Appendix A. These test results are briefly discussed below:

3.4.1 Shear Strength

Based on direct shear test results, the cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils ranges from 0 to 300 psf and 28 to 32 degrees, respectively. The shear strength parameters used for design are presented in Table 1.

3.4.2 Corrosion Potential

Representative samples of the subsurface soils were subjected to analytical testing to evaluate the potential for corrosion to concrete and ferrous metals. The test results are included in Appendix A and indicate the tested soils exhibited chloride concentration of 60 parts per million (ppm), sulfate concentration of 928 ppm, minimum resistivity of 625 ohm-cm, and pH level of 6.98. Caltrans specifications define a corrosive soil as a material in which any of the conditions exist: a chloride content greater than 500 ppm; soluble sulfate content greater than 2,000 ppm; or a pH of 5.5 or less. Based on the laboratory test results, the subsurface soils at the Abutment 3 location are considered non-corrosive and, therefore, no special measures are required for corrosion protection of structural concrete and reinforcing steel for structural concrete. Corrosion mitigation measure for the tieback anchors, however, should be performed in accordance with Caltrans *Corrosion Guidelines* (Caltrans, 2003)

3.4.3 Expansion Potential

Based on our boring and previous borings, the near-surface soils on both street and freeway levels mainly consisted of sand. It is our opinion that the on-site near-surface soils are considered to have low expansion potential.

3.5 Faulting and Seismicity

Our review of available in-house literature indicates that there are no known active or potentially active faults that have been mapped at the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in southern California. According to the California Geological Survey fault database, the closest active faults that could affect the site are the Puente Hills Blind Thrust, Whittier, and San

Joaquin Hills Blind Thrust faults located approximately 11.3 kilometers (km), 11.4 km and 14.8 km, respectively, from the site. Other known regional active faults that could affect the site include the Newport-Inglewood (L.A. Basin), Elsinore (Glen Ivy), Chino Central Ave (Elsinore), San Jose and Newport-Inglewood (Offshore) faults. The locations of these faults with respect to the site are shown in Figure 3.

We have performed seismic analysis for the site following the Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). Distance of faults to the site was estimated using Caltrans ARS online program and peak ground acceleration for each fault was estimated using Caltrans excel worksheet. The estimated peak ground accelerations caused by various faults near the site are summarized in the following table.

Table 2 – Peak Bedrock Accelerations

Fault	Maximum Magnitude	Distance (km)	Peak Ground Acceleration
Peralta Hills	6.2	3.2	0.39g
Puente Hills Blind Thrust	7.3	11.7	0.35g
Elsinore fault zone (Whittier section)	7.6	11.7	0.30g
Elsinore fault zone (Chino section)	7.6	16.4	0.34g

As shown in the table above, the Peralta Hills fault is the nearest fault to the site at a distance of approximately 3.2 km. A maximum earthquake magnitude of 6.2 has been estimated for this fault, resulting in a peak horizontal ground acceleration of about 0.39g at the site. This fault, however, is not included in the latest California Geological Survey fault database.

We have also performed probabilistic seismic analysis using Caltrans ARS online program. The peak ground acceleration was calculated to be 0.49g with a deaggregated moment magnitude (Mw) of 6.6. We have used this ground acceleration and earthquake magnitude in our seismic analysis.

3.6 Seismic Hazards

3.6.1 Fault Rupture

Based on available literature and reports, no known active faults are known to traverse the project site, and the site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. As such, the principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in the region as discussed in Section 3.5.

3.6.2 Liquefaction

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading.

The site is located within an area designated as potentially liquefiable on the *California Seismic Hazard Zone Map* (CDMG, 1998). Based on our boring, the subsurface soils below the historically high groundwater table of 50 feet below the freeway grade (72 feet below the street grade) consisted of medium dense to dense sand and very stiff silt with SPT N values ranging from 12 to 32.

Liquefaction analysis was performed using procedures outlined by Youd et al. (2001) and in accordance with the guidelines provided in the Special Publication 117. The historically high groundwater level and a peak ground acceleration of 0.49g with a moment magnitude (Mw) of 6.6 were used in the analysis. The results of our evaluation for the boring indicated that the subsurface soils below the historically high groundwater table are not susceptible to liquefaction. The results of the analysis are included in Appendix B.

3.6.3 Seismically Induced Settlement

Seismically induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). This settlement occurs primarily within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event. The seismically

induced settlement, including that of the embankment fill, was estimated to be less than 1½ inches. The magnitude of the estimated settlement is considered relatively minor.

3.6.4 Tsunami and Seiches

Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Based on the inland location of the site and the absence of enclosed bodies of water near the site and, tsunami and seiches risks at the site are considered negligible.

3.7 Slope Stability

For our slope stability analyses, we have considered three different sections of the proposed retaining wall: 1) with three rows of tiebacks, 2) with two row of tiebacks, and 3) Type 1 retaining wall without tieback. The slope stability analyses were performed using the Modified Bishop's method. The tieback spacing, location and tension force shown in the attached layout plan by HDR were incorporated in the analysis of the tieback wall. For pseudo-static analysis, a horizontal seismic coefficient of 0.20g (Caltrans, 2004) was used. Our analysis indicates that the walls have a global factor of safety higher than 1.5 and 1.1 for static and pseudo-static conditions, respectively. The results are summarized in Table 3 and computer printouts of the analyses are attached to this report.

Table 3 – Summary of Slope Stability Analyses

Retaining Wall Type	Calculated Factor of Safety	
	Static	Pseudo-Static
Retaining Wall with 3-Row of Tiebacks	1.63	1.16
Retaining Wall with 2-Row of Tiebacks	2.54	1.99
Type 1 Retaining Wall	2.65	2.04

4.0 GEOTECHNICAL AND FOUNDATION DESIGN RECOMMENDATIONS

Based upon our evaluation of the soils and geologic information, we conclude that the proposed project is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in the design and construction of the project. The recommendations in this report are considered minimum and may be superseded by more stringent requirements of the structural engineer and/or the governing agencies. Leighton should be notified, in a timely manner, of changes in the project plans that might impact recommendations in this report.

4.1 As-Built Foundation Data

Based on the as-built plan for the Wagner Avenue Overcrossing (Caltrans, 1974), we have summarized the as-built foundation types and characteristics in Table 3. The nominal resistance shown in the table was calculated using the computer program *SHAFT* (O'Neill and Reese, 1999). The computer printouts are included in Appendix B. Elevations in Table 4 were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).

Table 4 – As-Built Bridge Foundation Data (Caltrans, 1974)

Structure(1)	Pile Size and Type	Pile Cutoff Elevation (feet)	Pile Tip Elevation (feet)	Nominal Resistance(2) (kips)	Allowable Capacity (3) (kips)
Abutment 3(4)	16-inch Diameter CIDH Pile	201.4	149.5	280(5)	140

(1)Elevations of freeway and Wagner Avenue grade are approximately 192 feet and 216 feet , respectively.
(2)A minimum factor of safety of 2.0 should be applied to calculate the allowable capacity.
(3)Design load of 70 tons (140 kips) per as-built plan
(4)Abutment 3 is supported on a single row of 12 piles with minimum pile spacing of 5 times the pile diameter.
(5)The upper 16 feet of pile capacity within the existing fill was ignored.

4.2 Lateral Earth Pressure and Tieback Design Parameters

Based on the plan provided by the structural engineer, the proposed tieback system consists of two to three rows of tiebacks. Due to the presence of the existing Chantilly Drain in close proximity, the *General Plan* shows that the tiebacks at the bottom row will be installed at an angle of approximately 35 degrees from horizontal. The lateral loads on the retaining wall is expected to consist of the following: (a) the active earth pressure and passive earth pressure below the bottom of the excavation in accordance with Caltrans *Bridge Design Specifications* (*BDS*, September 2004), (b) the surcharge pressure from Abutment 3 backfill, (c) the surcharge pressure corresponding to traffic loading, and (d) the seismic pressure resulting from the lateral loads of the existing piles. A diagram of these lateral earth pressures are provided in Figure 4. Under service loading, the pressures of (a), (b) and (c) should be used and, under seismic loading, the pressures of (a), (b) and (d) should be used.

The active and passive pressure coefficients (Ka and Kp) of 0.31 and 3.25, respectively, and an average soil unit weight (γ) of 120 pcf may be used to estimate the active and passive earth pressures. Traffic loading may be considered as equivalent to a vertical pressure produced by 2 feet of soils. The intensity of the pressure from the existing piles shown in Figure 4 was based on a lateral load of 40 kips per pile under the seismic loading (Caltrans, 1992).

The design values indicated above are based upon drained conditions. The tieback and Type 1 retaining walls should, therefore, be provided with a subdrain system to prevent buildup of hydrostatic pressure behind the wall. The *General Plan* shows that geocomposite drain is proposed behind the walls with weep holes at the bottom of the walls. The drainage systems shown on the plan are acceptable from a geotechnical standpoint.

The anchored portion of the tieback should extend into competent material at least 5 feet beyond the critical failure surface or H/5, where H is the height of the retaining wall, whichever is longer. The critical failure surface was determined from slope stability analysis where a tieback force is applied to achieve a factor of safety of 1.3 (Caltrans, 2004). Based on the slope stability analysis and Caltrans *BDS* (2004), the tieback anchors should have a minimum unbonded length of 15 feet. The slope stability analysis to determine the critical failure surface is presented in Appendix B.

The allowable pullout resistance of anchor should be estimated by multiplying ultimate anchor bond stress, bonded length and perimeter of the drilled hole, and dividing by a minimum factor of safety of 2.5 (Caltrans, 2004). Based on our boring, the tieback anchors are expected to be embedded in stiff to very stiff silt and/or dense sand. For the purpose of estimating the anchor bond stress, an average soil unit weight (γ) of 120 pcf, an average soil internal friction angle of 28 degrees and cohesion of 500 psf may be used for the upper and middle rows and an average soil unit weight (γ) of 120 pcf and an average soil internal friction angle of 32 degrees may be used for the lower row. The contractor is responsible for the final design of the bonded length of tieback anchors and the bonded length should be verified by load test of each anchor.

The tieback anchors should be installed at a minimum spacing of three times the diameter of the bond zone or 5 feet, whichever is greater. The preferred installation angle is between 5 and 20 degrees from horizontal to facilitate tendon installation and grouting, and to avoid application of excessive vertical loads that could induce downward movement of the wall. However, due to the presence of Chantilly Drain in close proximity, tiebacks at the bottom row have an installation angle of approximately 35 degrees. Tieback anchors should be located to maximize their distance from the existing abutment piles.

4.3 Allowable Bearing Capacity

An allowable soil bearing pressure of 2,500 psf may be used for design of tieback wall footing having a minimum width of 12 inches and a minimum embedment of 18 inches below the lowest adjacent ground surface. For the Type 1 retaining wall footings, an allowable bearing pressure of 3,600 psf may be used. These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5H:1V) conditions only and may be increased by one-third for short-term loading.

The frictional resistance between the wall (concrete) and the backfill soil may be computed using a coefficient of friction of 0.4, provided that no forms are used for the concrete surfacing against the soil.

4.4 Settlement and Lateral Displacement

The tension force of each row of tiebacks is shown in the attached layout plan. The vertical component of the tension force for the bottom-row tiebacks was calculated to be a maximum of 16.8 kips (approximately 960 psf) due to the steep installation angle of tieback. The vertical components of the upper- and middle-row tiebacks were calculated to be 11.2 kips (approximately 640 psf). Settlement of the tieback wall due to the total vertical pressure of 1,600 psf was estimated to be on the order of ½ inch. Settlement of the Type 1 retaining walls also estimated to be on the order of 1 inch. This magnitude of settlement is considered relatively minor for the proposed walls.

Tiebacks for the tieback wall will be installed as the excavation progresses. The tiebacks will be tensioned before additional excavation is made, providing lateral support for the wall. Lateral displacement of the tieback wall is expected to be negligible. For the Type 1 retaining walls, using the method in Caltrans *BDS* (2004), the lateral displacement is estimated to be on the order of 0.2 inches to mobilize the active earth pressure condition. Considering the relatively minor lateral displacement and that these walls will be located to the north and south of the existing abutment, the estimated lateral displacement is not expected to impact the existing abutment piles.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Tieback Installation

Due to the close proximity of the proposed tieback wall to Abutment 3 and its existing piles and the Chantilly Drain, the contractor should exercise care to minimize impact to the existing improvements from the installation of the tieback wall. We recommend that a monitoring program be implemented during the construction to monitor movement of Abutment 3. If excessive lateral and/or vertical movements are measured, construction should be suspended immediately and mitigation measurement should be implemented. The installation of the tieback anchors should be in accordance with the Caltrans *Standard Specifications*. All tieback anchors for the wall should be load tested with either a proof test, performance test or creep test. The maximum test load for an anchor should generally be 1.5 times the design force of the anchor. The tests should be performed in accordance with Caltrans specifications.

5.2 Temporary Excavations

Excavations and removal of the existing sloped embankment fill are required to construct the proposed retaining wall. The excavation and removal should be shored by either bracing or sheeting due to the close proximity of the existing Abutment 3. Design of shoring should be performed by the shoring contractor. For cantilever shoring, the active and passive pressure coefficients (Ka and Kp) of 0.31 and 3.25, respectively, and an average soil unit weight (γ) of 120 pcf may be used. For braced excavation, the lateral earth pressure is estimated as 24H pcf with a rectangular pressure distribution, where H is the depth (height) of excavation. The above lateral pressure is only appropriate for level backfill and a drained condition behind the shoring. Appropriate surcharge loads from traffic loading, heavy equipment, and stockpiles of materials should be incorporated in the shoring design. The final shoring plan should be reviewed by the geotechnical consultant.

5.3 Earthwork

Onsite soils to be used as compacted structural fill should be free of organic material and/or construction debris. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches for structural fill placement, moisture-conditioned as necessary to within two

percent above optimum, and compacted to a minimum of 95 percent of the maximum density as determined by Caltrans Test Method 216. Crushed aggregate base should be compacted to a minimum of 95 percent relative compaction. Subgrade within a depth of 30 inches below the finished grade should also be compacted to at least 95 percent relative compaction.

5.4 Additional Geotechnical Services

The proposed construction involves various activities that would require geotechnical observation and testing. These include:

- Placement of compacted fill;
- Shoring installation;
- Footing excavation for retaining wall;
- Backfill of retaining walls; and
- When any unusual surface conditions are encountered.

These and other soils related activities should be observed and tested by a qualified representative of the geotechnical engineer. Geotechnical recommendations presented in this report are based on the conditions encountered at the test boring location and information gained from review of as-built plans as well as our understanding of the current project plan. Our recommendations should be revised, as necessary, based on the actual soil condition and any modification of the current plans, and incorporated into the final design plans and specifications. Conclusions and recommendations presented in this report should be reviewed and verified by the geotechnical engineer during site construction and revised accordingly, if exposed geotechnical conditions vary from our current understanding and interpretations.

6.0 REFERENCES

The following references were used in preparation of this report:

Bryant, W.A., and Hart, E.W, Interim Revision 2007, Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps: California Geological Survey, Special Publications 42.

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ERIC A. JOHNSON No. C57355 Exp. 12/31/11 CIVIL STATE OF CALIFORNIA

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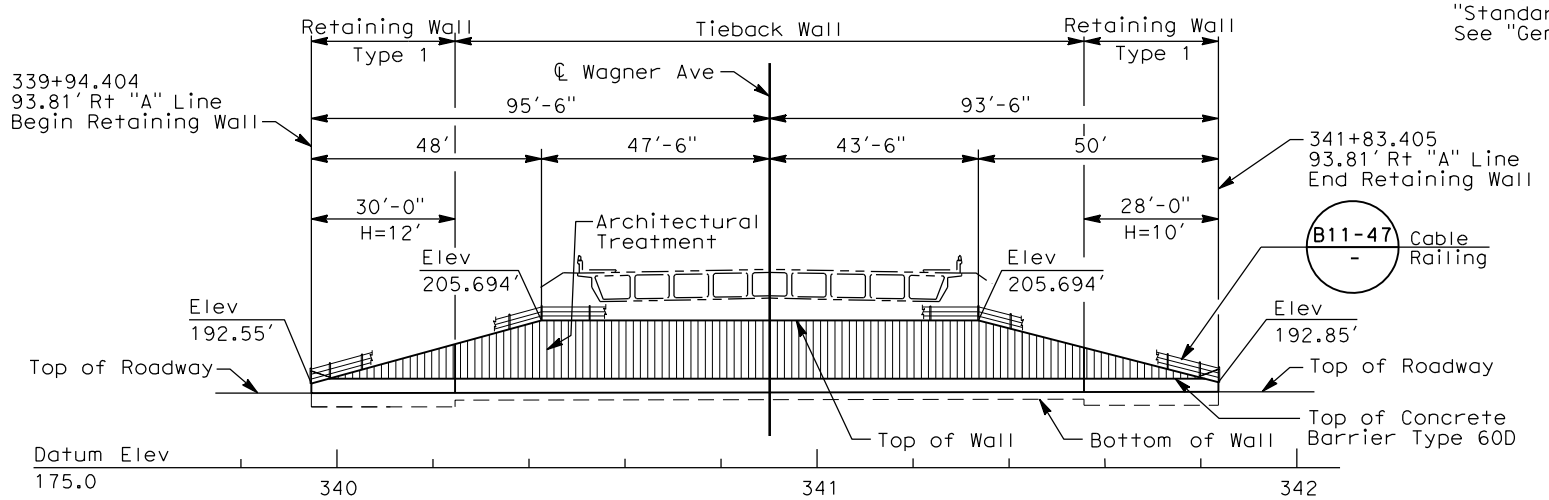
3230 EL CAMINO REAL, SUITE 200
IRVINE, CA 92602-1377

NOTES:

For "General Notes" And "Standard Plans List" See "General Notes" Sheet.

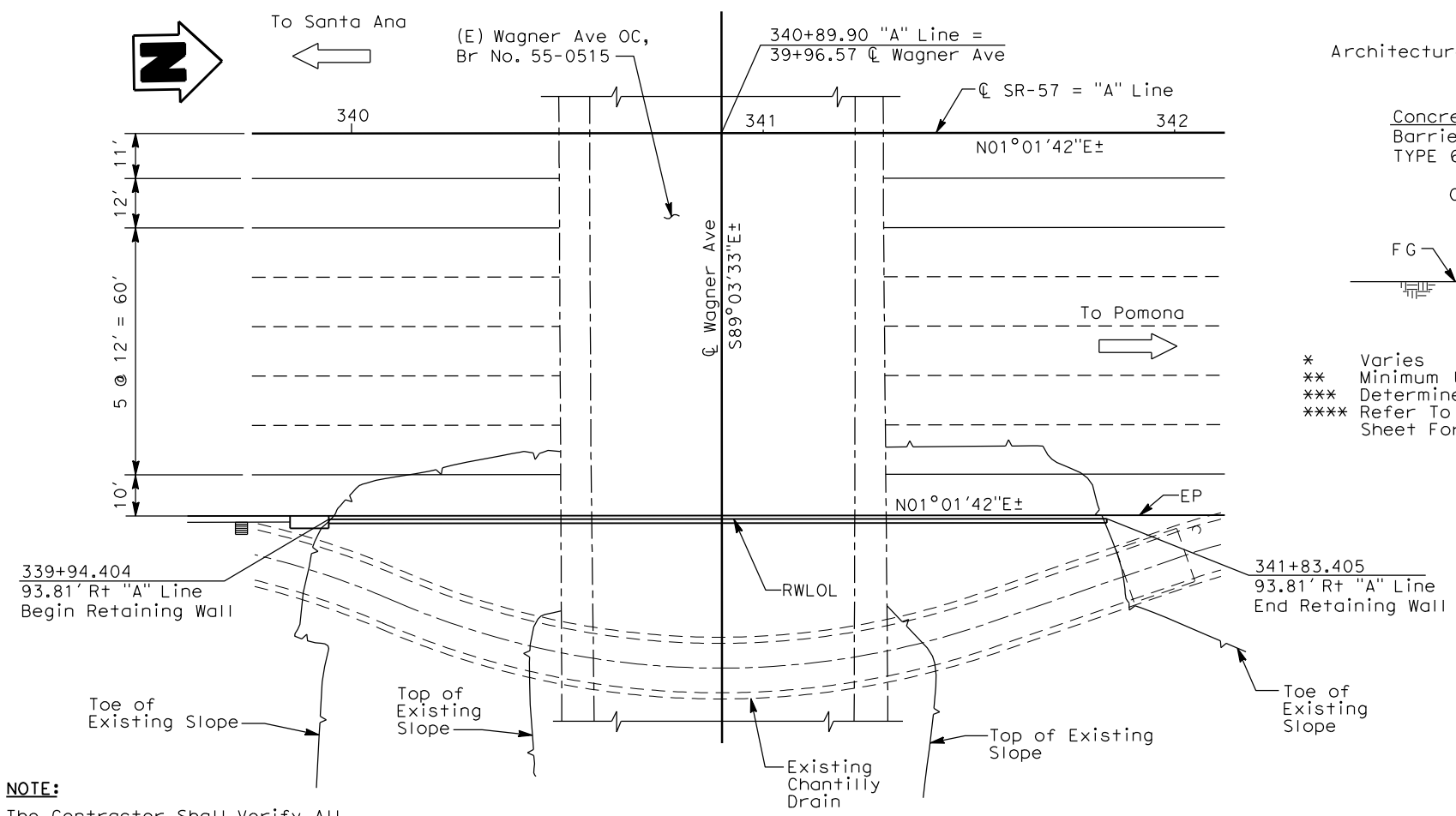
LEGEND

- Indicates Limits of Shotcrete
- Indicates New Construction
- Indicates Foundation or Hidden Lines
- Indicates Existing Structure
- RWLOL Indicates Retaining Wall Layout Line



MIRROR ELEVATION

SCALE 1"=20'

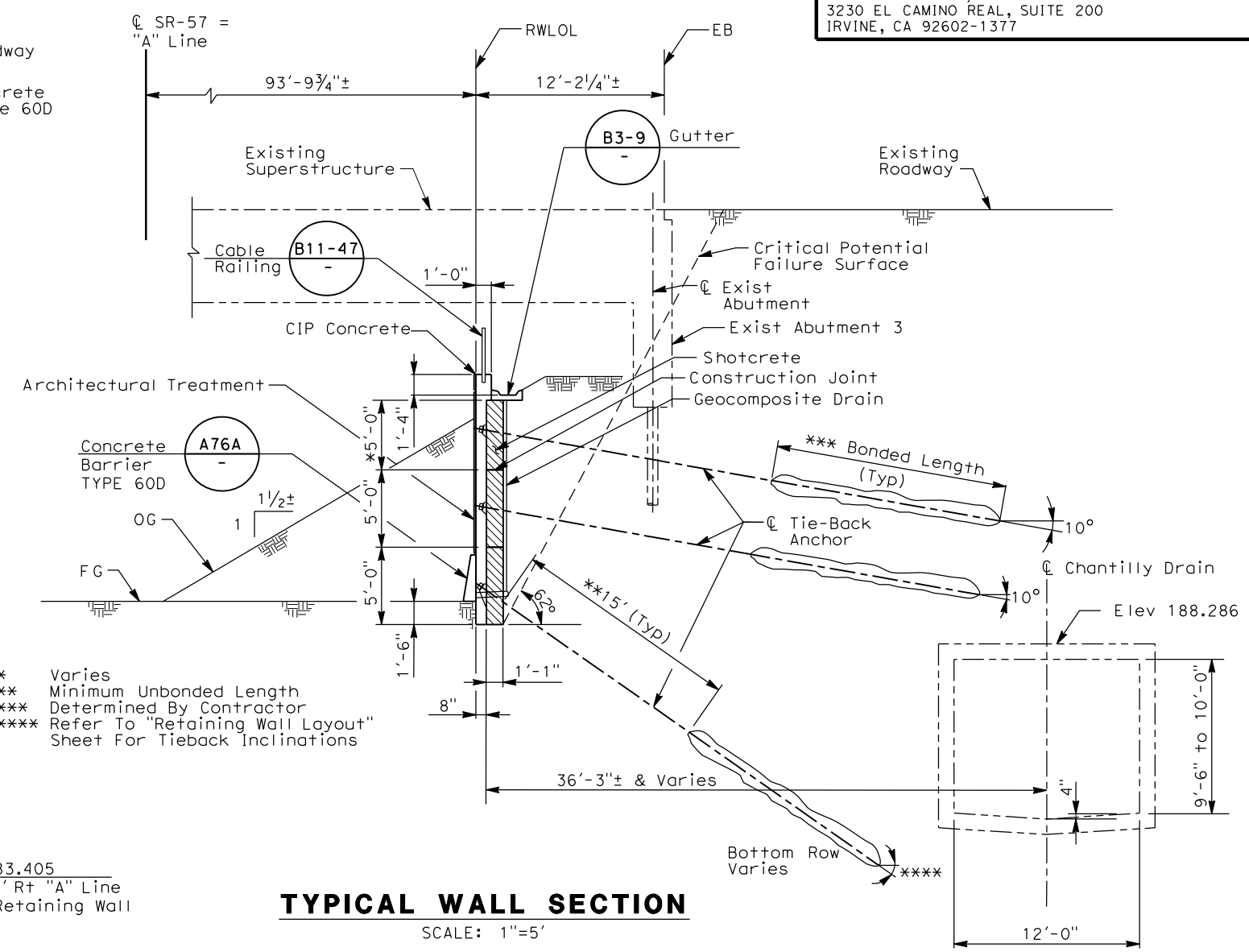


PLAN

SCALE 1"=20'

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.



* Varies
** Minimum Unbonded Length
*** Determined By Contractor
**** Refer To "Retaining Wall Layout" Sheet For Tieback Inclinations

TYPICAL WALL SECTION

SCALE: 1"=5'

DESIGN OVERSIGHT	DESIGN	BY D. Peavey	CHECKED E. Johnson	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE
	DETAILS	BY E. Gray	CHECKED E. Johnson	LAYOUT: BY D. Peavey	CHECKED W. Chu
SIGN OFF DATE	QUANTITIES	BY D. Peavey	CHECKED E. Johnson	SPECIFICATIONS: BY E. Johnson	PLANS AND SPECS COMPARED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0112
POST MILES 13.9

WAGNER AVE OC - RET WALL
GENERAL PLAN

DESIGN GENERAL PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/09 2/10 5/10 6/10

SHEET 1 OF 12

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USERNAME => egray DATE PLOTTED => 08\02\10 TIME PLOTTED => 10:04:49 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ERIC A. JOHNSON No. C57355 Exp. 12/31/11 CIVIL STATE OF CALIFORNIA

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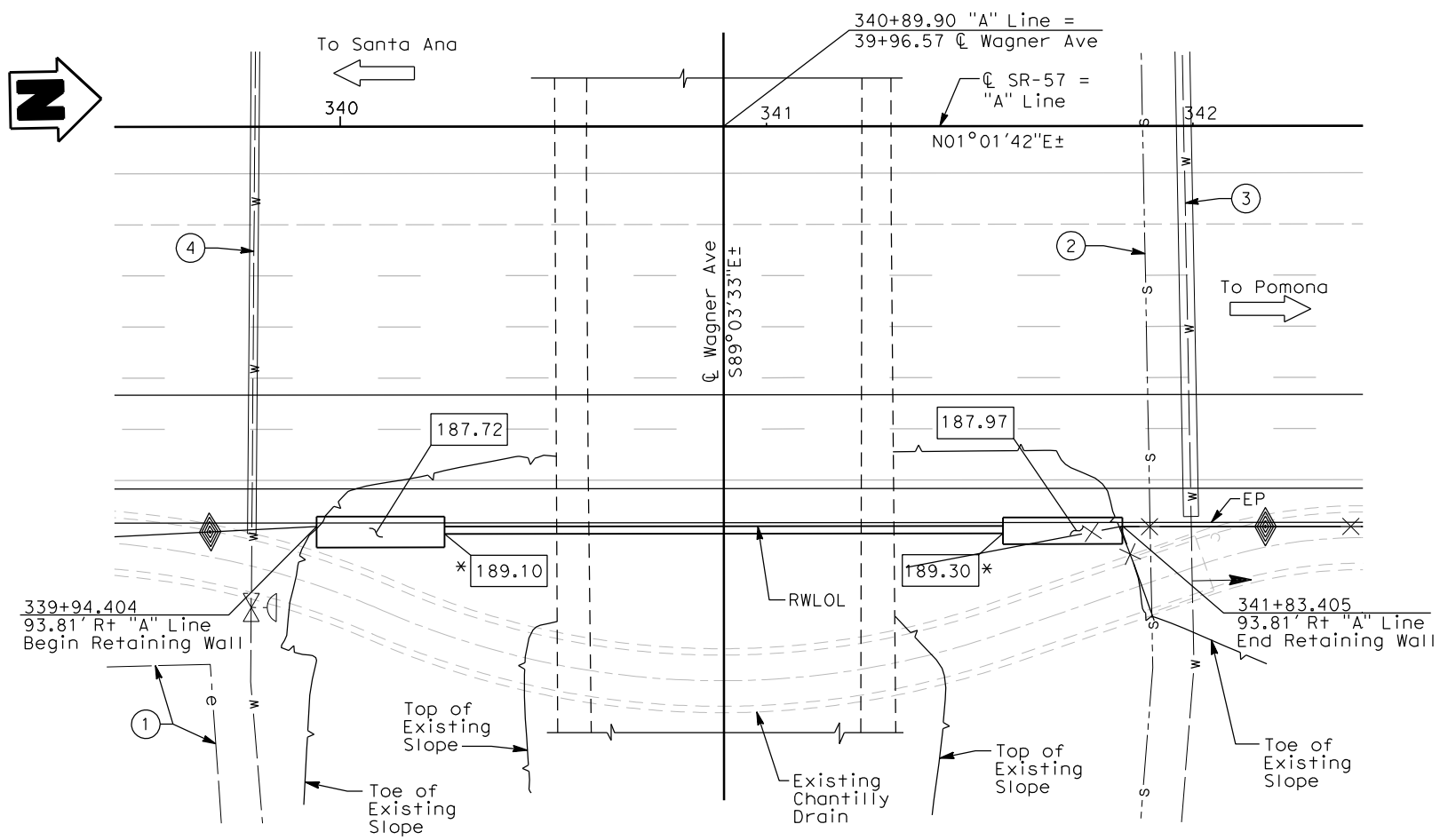

PLAN

SCALE 1"=20'

EXISTING UTILITY LINES TABLE

(BASED ON AS-BUILT DATA)

NO.	UTILITY	OWNER	ACTION
1	12 Kv OH	City Of Anaheim	Overhead - Protect In Place
2	15" VCP	City Of Anaheim	Protect In Place
3	21" CCP	City Of Anaheim	Protect In Place
4	12" CIP	City Of Anaheim	Protect In Place

LEGEND

——— Indicates New Construction

– – – – Indicates Existing

xxx.xx — Denotes Bottom of Footing Elevation @ Type 1 Retaining Wall

* xxx.xx — Denotes Bottom of Wall Elevation @ Tieback Wall

GEOTECHNICAL PROFESSIONAL APPROVAL DATE

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

DESIGN OVERSIGHT

SIGN OFF DATE

SCALE: 1"=20' | VERT.DATUM | HORZ.DATUM

PHOTOGRAMMETRY AS OF: | ALIGNMENT TIES

SURVEYED BY E. Martinez | DRAFTED BY

FIELD CHECKED BY D. Williams | CHECKED BY

	BY	CHECKED
DESIGN	D. Peavey	E. Johnson
DETAILS	E. Gray	E. Johnson
QUANTITIES	D. Peavey	E. Johnson

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0112
POST MILE 13.9

WAGNER AVE OC - RET WALL

FOUNDATION PLAN

FOUNDATION PLAN SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 3 OF 12

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USERNAME => egray DATE PLOTTED => 08\02\10 TIME PLOTTED => 10:04:45 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER ERIC A. JOHNSON No. C57355 Exp. 12/31/11 CIVIL STATE OF CALIFORNIA

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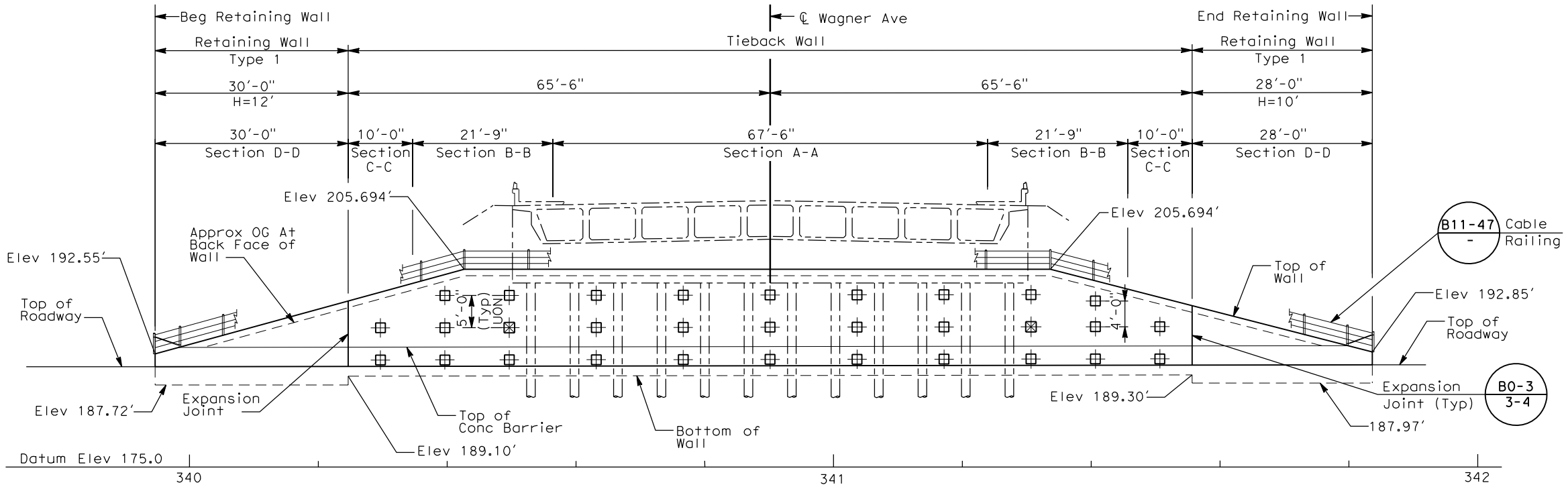
OCTA
550 S. MAIN STREET
ORANGE, CA 92863

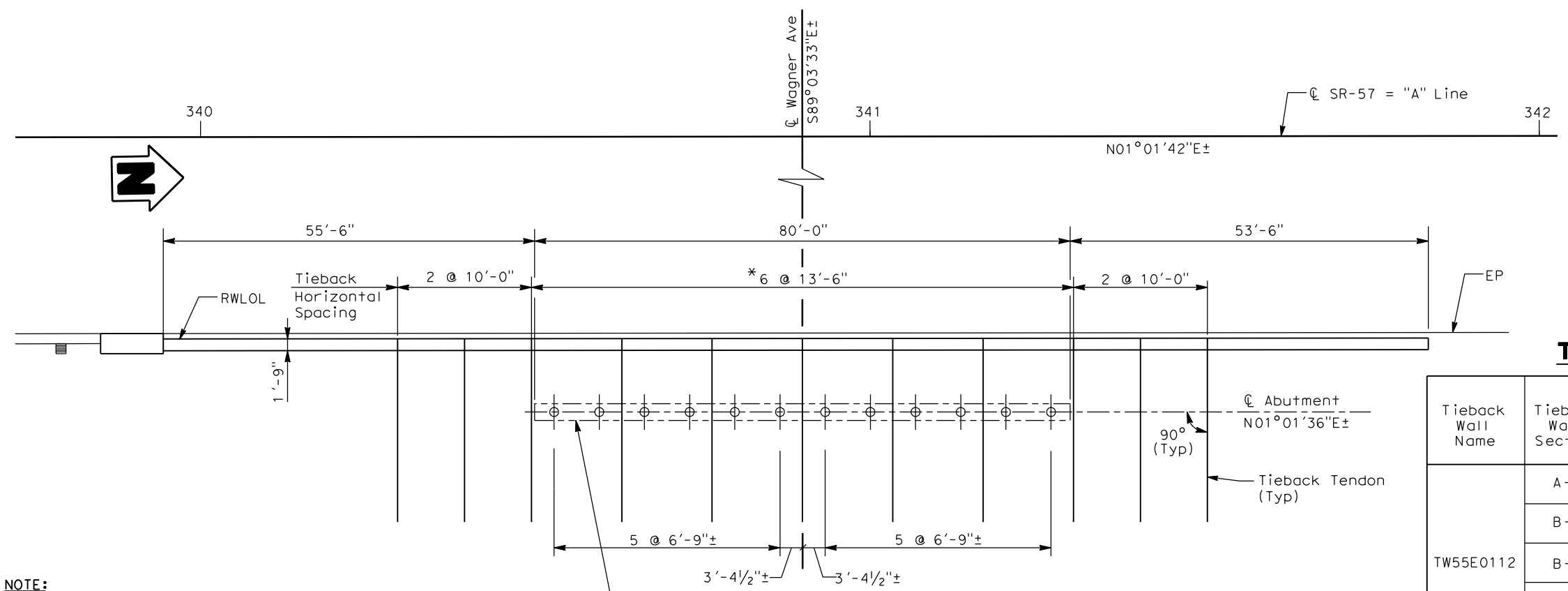
HDR ENGINEERING, INC.
3230 EL CAMINO REAL, SUITE 200
IRVINE, CA 92602-1377



ELEVATION

SCALE 1"=10'

Note: For Sections A-A, B-B, C-C And D-D, See "Retaining Wall Section" Sheet



PLAN

SCALE 1"=10'

NOTE:

The Contractor Shall Verify All Controlling Field Dimensions Before Ordering Or Fabricating Any Materials.

* These Dimensions Are Approximate. After Contractor Verification Of Existing Pile Locations, The Tieback Shall Be Placed Centered Between The Adjacent Piles.

LEGEND

Indicates Existing 16" CIDH Piles.

Indicates Location Of Tieback Assembly Or As Directed By The Engineer.

Tiebacks # 1-9 Top Row (10° Inclination)
Tiebacks # 10-20 Middle Row (10° Inclination)
Tiebacks # 21-31 Bottom Row
Tiebacks # 21, 30, 31 Drilled At 45°
Tiebacks # 22, 23, 29 Drilled At 40°
Tiebacks # 24 - 28 Drilled At 35°

Indicates Location Of Tieback Assembly Requiring Performance Test Or As Directed By The Engineer.

NOTES:

1. Prior To Installing Tiebacks, Contractor Shall Verify The Existing Footing And Pile Locations By Exposing, By Hand, One Pile At Each End Of Each Abutment.

TIEBACK DESIGN FORCE TABLE

Tieback Wall Name	Tieback Wall Section	Tieback Location (Station)	Lift Ht (Ft) / T (Kip) Upper	Lift Ht (Ft) / T (Kip) Middle	Lift Ht (Ft) / T (Kip) Lower
TW55E0112	A-A	340+56.40 To 341+23.90	5.167 / 55.6	5 / 33.8	5 / 33.8
	B-B	340+34.65 To 340+56.40	5.167 / 21.4	5 / 25.0	5 / 26.8
	B-B	341+23.90 To 341+45.65	5.167 / 21.4	5 / 25.0	5 / 26.8
	C-C	340+24.65 To 340+34.65	5.75 / 17.2	NA	5 / 23.1
	C-C	341+45.65 To 341+55.65	5.75 / 17.2	NA	5 / 23.1

DESIGN OVERSIGHT

SIGN OFF DATE

	BY	CHECKED
DESIGN	D. Peavey	E. Johnson
DETAILS	E. Gray	E. Johnson
QUANTITIES	D. Peavey	E. Johnson

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

ERIC A. JOHNSON
PROJECT ENGINEER

BRIDGE NO. 55E0112
POST MILE 13.9

WAGNER AVE OC - RET WALL
RETAINING WALL LAYOUT

DESIGN DETAIL SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 10/09 2/10 5/10 6/10

SHEET 4 OF 12

FILE => ...\55E0112r-f-rw_lo01.dgn

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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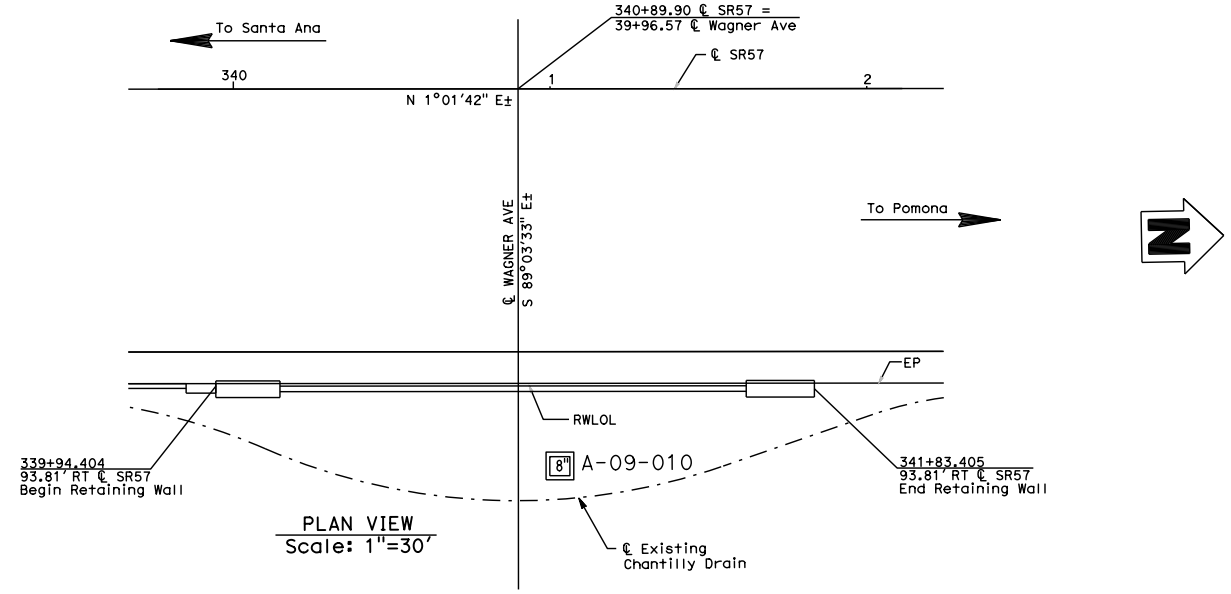
ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

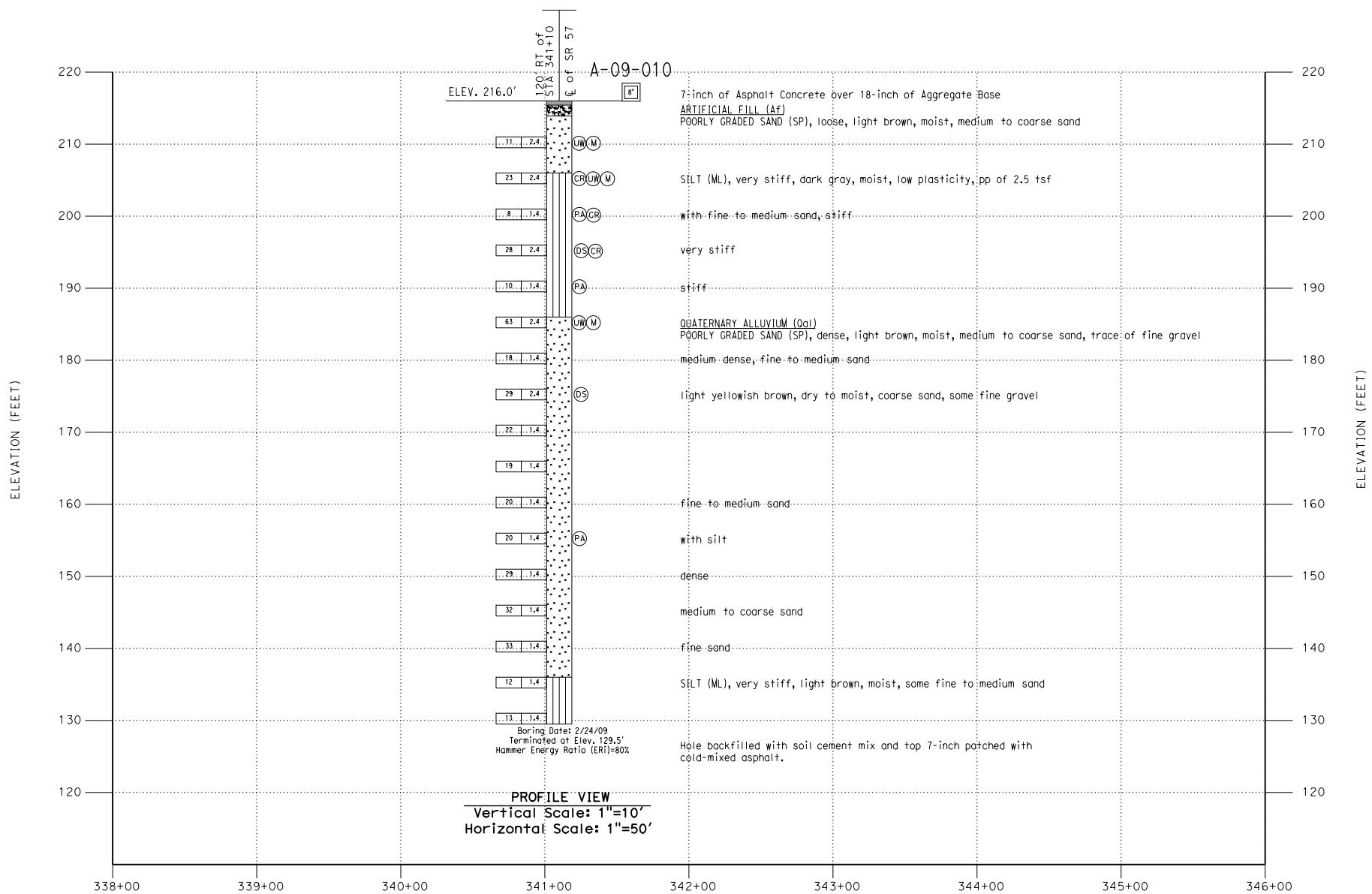
LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.



PLAN VIEW
Scale: 1"=30'



PROFILE VIEW
Vertical Scale: 1"=10'
Horizontal Scale: 1"=50'

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.

DESIGN OVERSIGHT	DRAWN BY Buu Tran	Amit Bakane FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55E0112
SIGN OFF DATE	CHECKED BY Taekuk Kim	DATE: 2/24/09			POST MILES 13.92

WAGNER AVE OC-RET WALL
LOG OF TEST BORINGS 1 OF 4

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10/09 2/10 5/10

REVISION DATES

SHEET 9 OF 12

FILE => FIGURE-2-Wagner_1of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 15:37

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
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ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

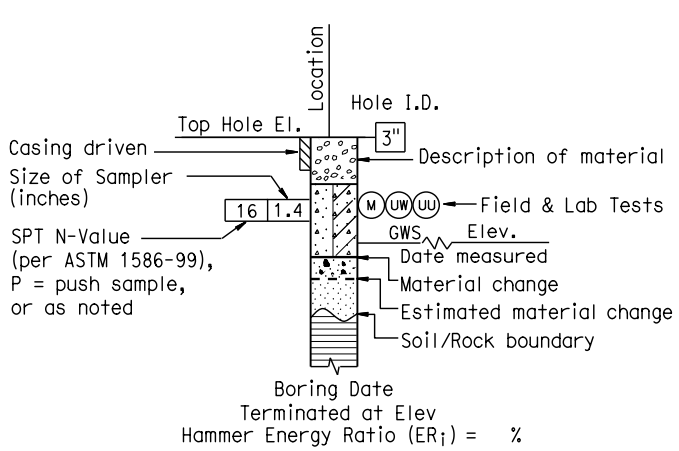
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
⛶	O	Other

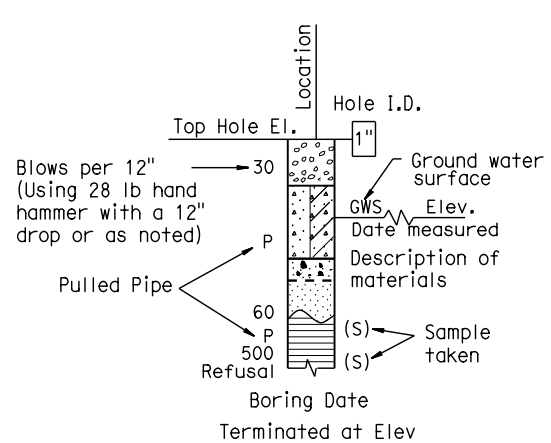
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

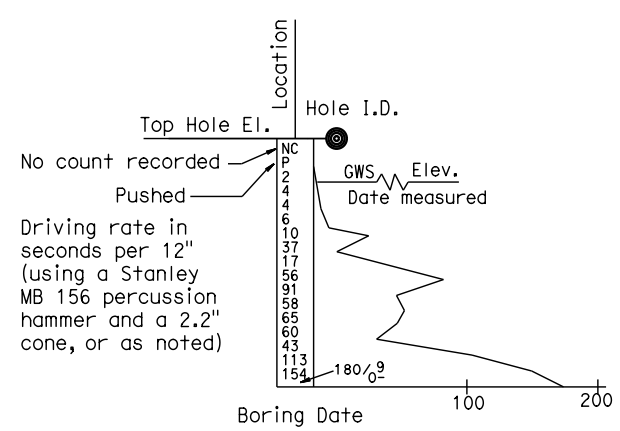
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



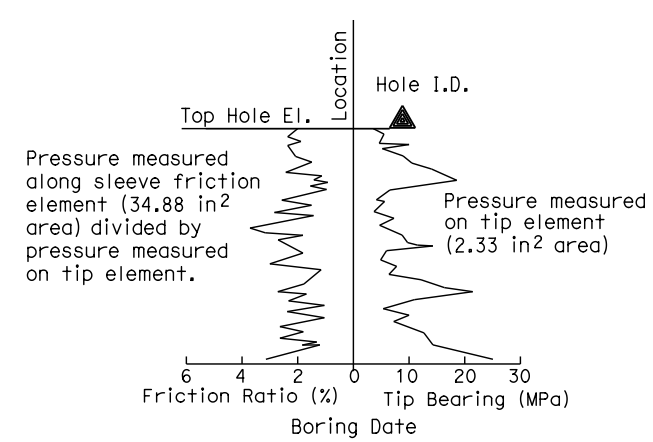
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT	DRAWN BY Buu Tran	Amit Bakane FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Djan Chandra PROJECT ENGINEER	BRIDGE NO. 55E0112
SIGN OFF DATE	CHECKED BY Taekuk Kim	DATE: 2/24/09			POST MILES 13.92

WAGNER AVE OC-RET WALL
LOG OF TEST BORINGS 2 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES: 10/09 2/10 5/10

SHEET 10 OF 12

FILE => FIGURE-2-Wagner_2of4.dgn

USERNAME => bstran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 15:39

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY Buu Tran

CHECKED BY Taekuk Kim

Amit Bakane
FIELD INVESTIGATION BY:
DATE: 2/24/09

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Djan Chandra
PROJECT ENGINEER

BRIDGE NO. 55E0112
POST MILES 13.92

WAGNER AVE OC-RET WALL
LOG OF TEST BORINGS 3 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES: 10/09 2/10 5/10

SHEET 11 OF 12

FILE => FIGURE-2-Wagner_3of4.dgn

USERNAME => btran DATE PLOTTED => 21-MAY-2010 TIME PLOTTED => 15:40

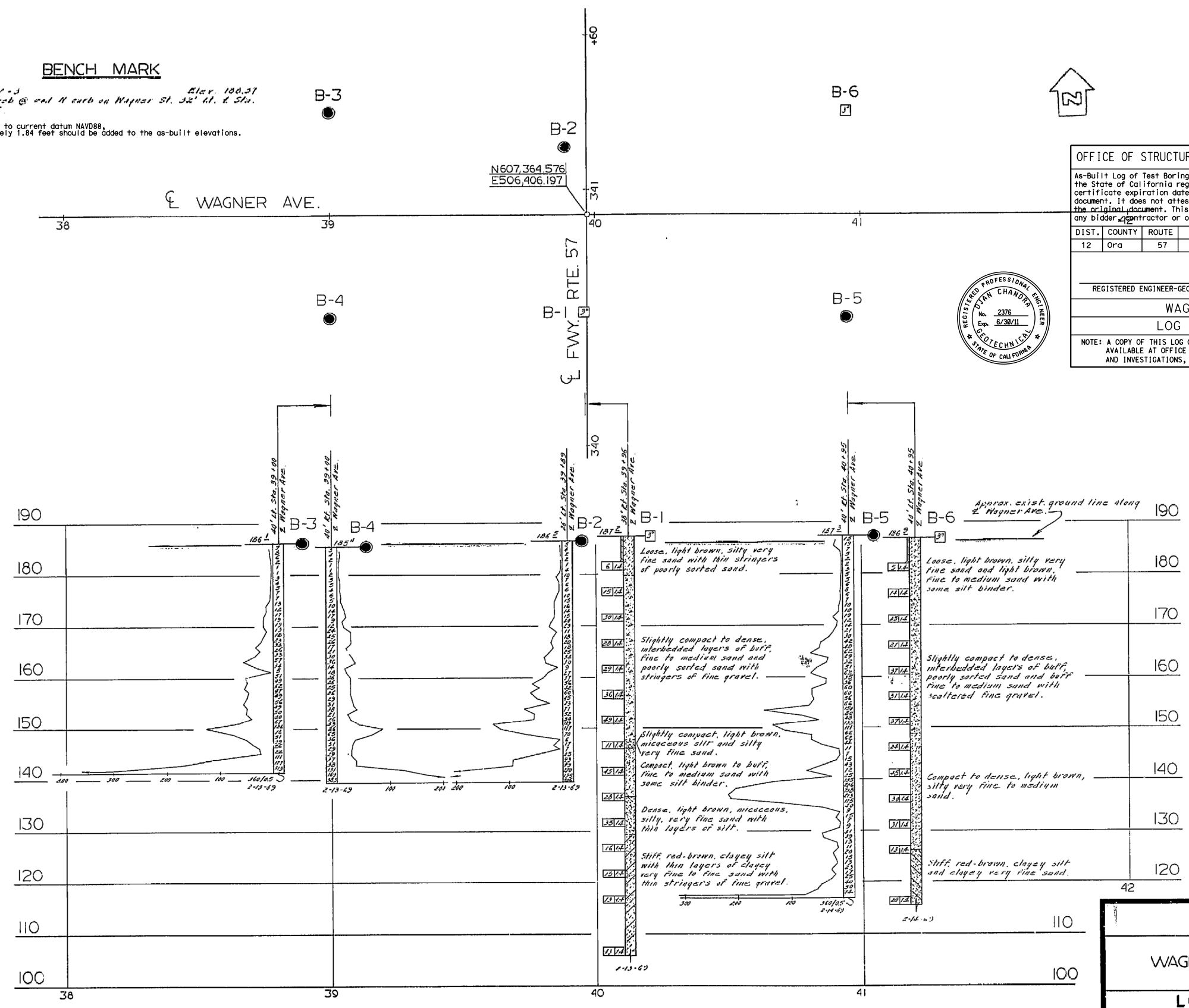
DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	ORA	57, 91	12.2/15.6, 5.2/7.0	322	443

A. E. Boehm
REGISTERED CIVIL ENGINEER NO 8556
DATE SIGNED December 18, 1972

BENCH MARK

B.M. "EY-3 Elev. 188.37
CA12 "Arch @ end N curb on Wagner St. 32' Lt. ℄ Sta. 54+50.6

To convert to current datum NAVD88, approximately 1.84 feet should be added to the as-built elevations.



PROFILE

Scale: Vert. 1" = 10'
Horiz. 1" = 20'

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE February 1969

No AS BUILT changes
CORRECTIONS BY R. Strunks
CONTRACT NO. 032021
DATE 10-10-79

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	12.2/15.2	12	12

REGISTERED ENGINEER-GEOTECHNICAL

REGISTERED PROFESSIONAL ENGINEER DAR CHANDRA Exp. 2376 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

WAGNER AVE OC - RET WALL

LOG OF TEST BORINGS 4 OF 4

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 12231
EA: 0F0401

BRIDGE NO. 55E0112

LEGEND OF BORING OPERATIONS

Penetrometer; 2½" Core Penetrometer; Sampler Boring (Dry); Rotary Boring (Wet); Auger Boring (Dry); Jet Boring; Core Boring; Test Pit; Penetration Boring; Rotary Boring; 1" Soil Tube

LEGEND OF EARTH MATERIALS

Gravel; Sand; Silt; Clay; Sandy Clay or Clayey Sand; Sandy Silt or Silty Sand; Silty Clay or Clayey Silt; Peat and/or Organic Matter; Fill Material; Igneous Rock; Sedimentary Rock; Metamorphic Rock

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

Diagram showing the basis for estimates of grade size distribution used in determining the classification of soils. If gravel is present in appreciable amounts the terms "gravelly" may be added to the class name, viz. "gravelly silt". Terms such as "coarse", "medium" and "fine" when used to describe sand, silt and gravel, refer to standard grade size limits.

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

FIELD STUDY	By: H.C. Cash	2-13-69
DRAWN	By: J. Lark	2-20-69
CHECKED	By: R. Cornelius	3-21-69

Approval Recommended by: Charles E. Mack, Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

322
323

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WAGNER AVENUE OVERCROSSING

LOG OF TEST BORINGS

BRIDGE No.	POST MILE	DRAWING No.	SHEET	OF
55 E13	12.9		11	11

REVISION DATES (PRELIMINARY STAGE ONLY) 10/17/60

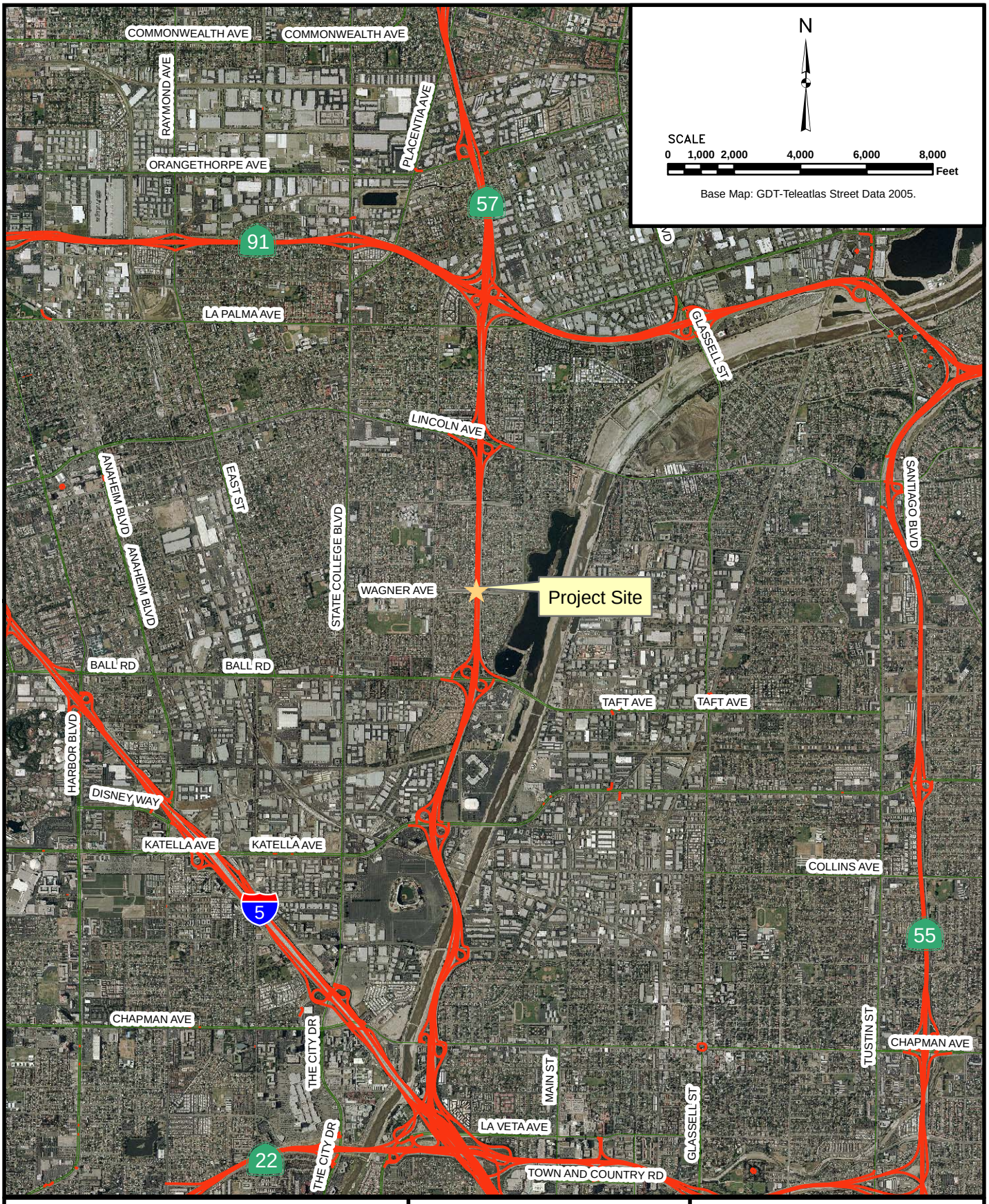
WO 032021
CU 01208

Disregard prints bearing earlier revision dates

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000 6373

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 1/23/75 SIGNATURE Victor Wiebelhaus TITLE Microfilm Technician



Retaining Wall
at Wagner Avenue Overcrossing
Northbound SR-57 Widening
Orange County, California

SITE LOCATION MAP

Project No.

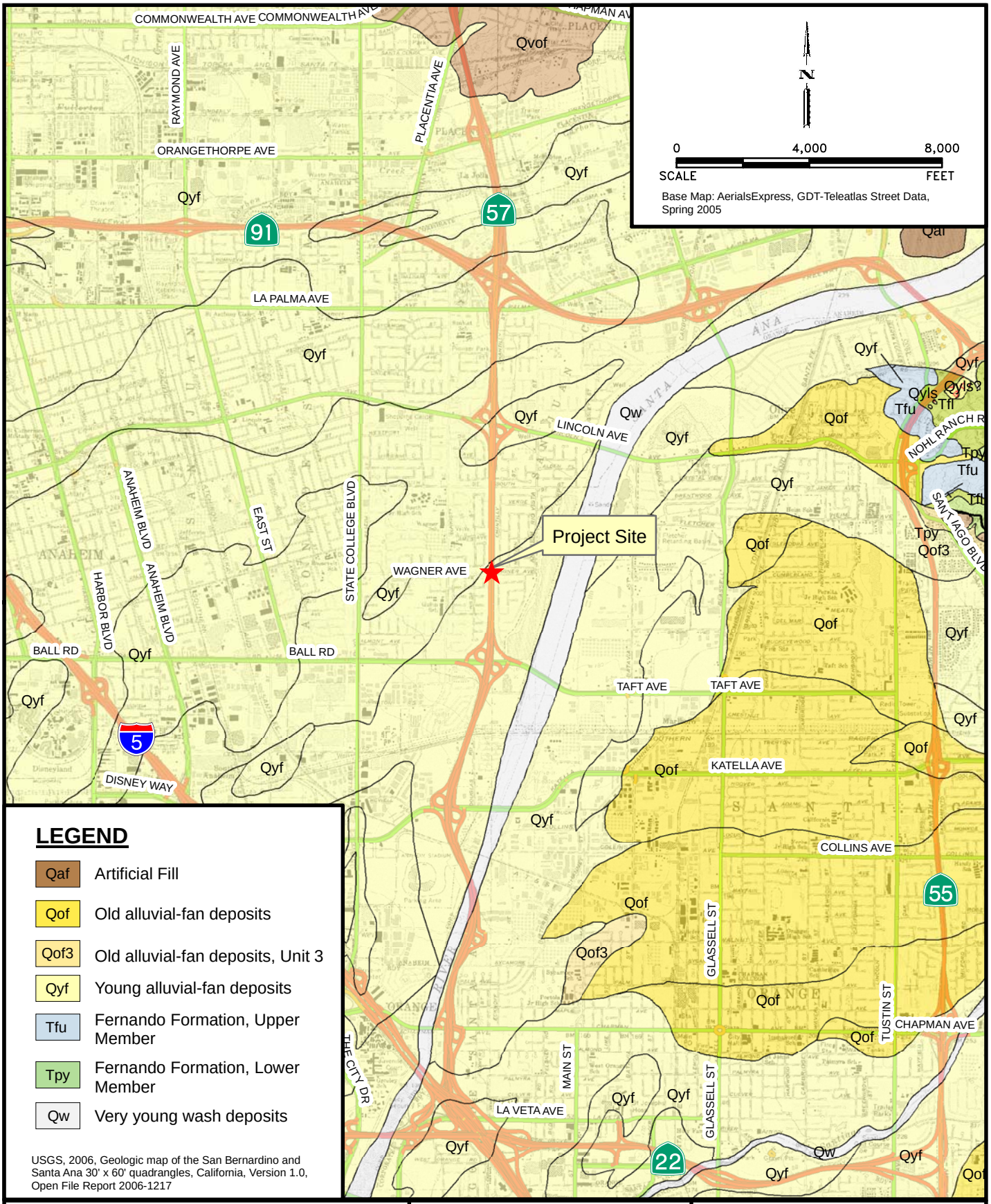
602231-002

Date

February 2010

Figure 1

P:\Drafting\602231\002\GIS\602231002_SiteLocationMap_DouglsRd.mxd



LEGEND

Qaf	Artificial Fill
Qof	Old alluvial-fan deposits
Qof3	Old alluvial-fan deposits, Unit 3
Qyf	Young alluvial-fan deposits
Tfu	Fernando Formation, Upper Member
Tpy	Fernando Formation, Lower Member
Qw	Very young wash deposits

USGS, 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California, Version 1.0, Open File Report 2006-1217

Retaining Wall
at Wagner Avenue Overcrossing
Northbound SR-57 Widening
Orange County, California

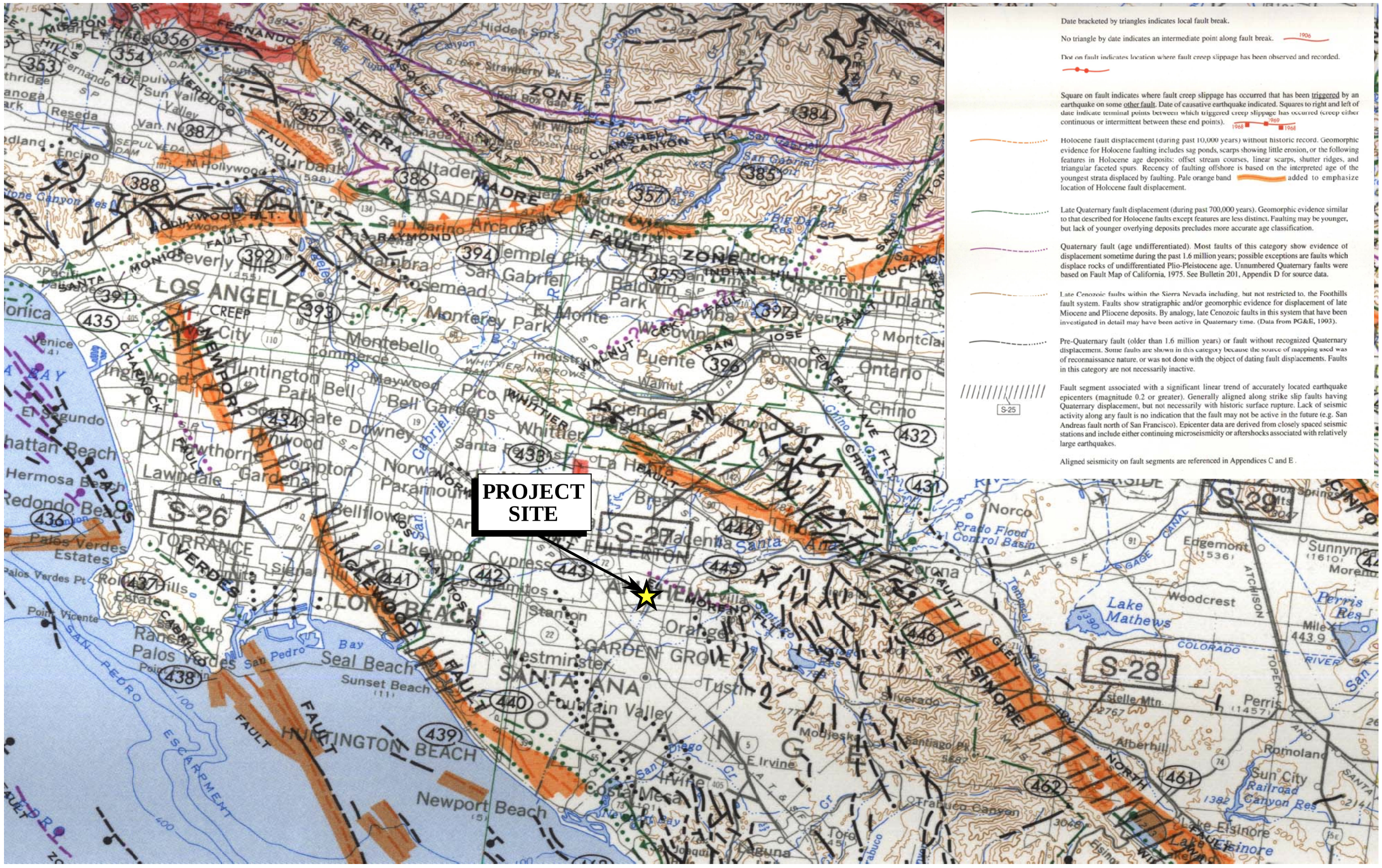
REGIONAL GEOLOGIC MAP

Project No.
602231-002

Date
February 2010

Figure 2

\\GIS\Drafting\602231\002\GIS\Figure3-GeologyMap-LincolnAve.mxd



Base Map: Fault Activity Map of California and Adjacent Areas with Location and Ages of Recent Volcanic Eruptions; CDMG 1994

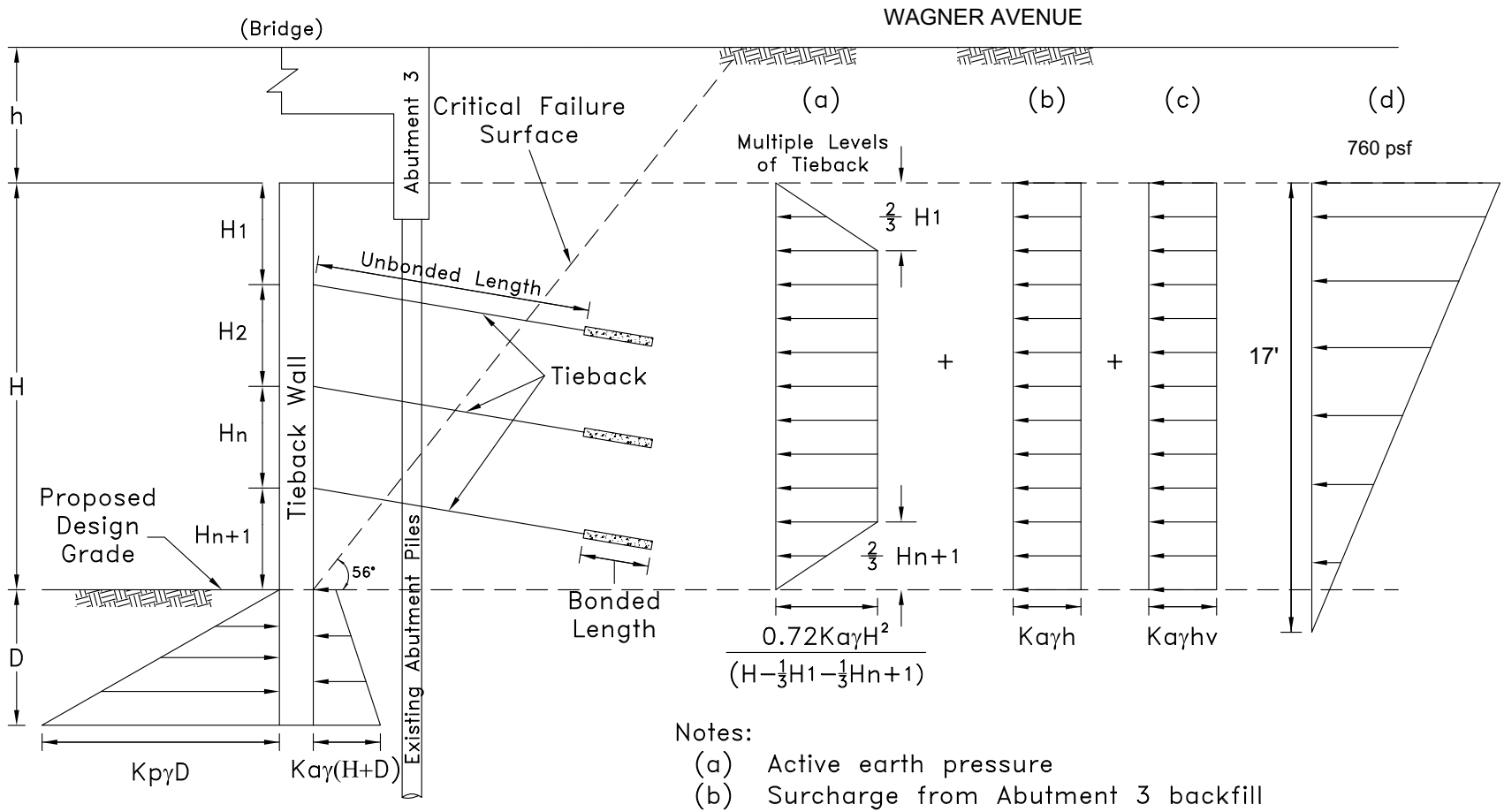
FAULT ACTIVITY MAP

Retaining Wall at Wagner Avenue Overcrossing
Northbound SR 57 Widening
Anaheim, California

Project No.	602231-002
Scale (Approx)	1:750,000
Engr./Geol.	DJC / ELB
Drafted By	BQT
Date	5/09

Leighton

Figure 3



Notes:

(a) Active earth pressure
(b) Surcharge from Abutment 3 backfill
(c) Surcharge from traffic loading
(d) Seismic pressure resulting from lateral load of the existing piles

hv –Equivalent soil height for traffic surcharge (min. 2 feet)
ka –Active earth pressure coefficient
kp –Passive earth pressure coefficient
γ –Soil unit weight

Reference: Caltrans Bridge Design Specification (2004)

Figure 4

LATERAL EARTH PRESSURE ON TIEBACK WALL WAGNER AVENUE OVERCROSSING	Leighton	Proj: 602231-002 Eng./Geol. DJC	Scale: As-Shown Drafted By: VMN	Date: 6/09 CP By: BQT

P:\DRAFTING\602231\002\OF_2009-05-04-BORING-LOGS\LINCOLN-AVENUE\FIGURE5.DWG (06-17-09 11:15:27AM) Plotted by: btran

APPENDIX A

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

				Gradation				Atterberg Limits		Maximum Density		Shear Strength: Peak		Shear Strength: Ultimate		Chemical Analyses					
Boring No.	Sample Type	Top of Sample (ft)	Bottom of Sample (ft)	Gravel (%)	Sand (%)	Silt (%)	Clay <5μm (%)	LL:PL:PI	Sand Equivalent	Max Dry Density (pcf)	Optimum Moisture Content (%)	ϕ' (deg)	C' (psf)	ϕ' (deg)	C' (psf)	pH	Sulfate (ppm)	Chloride (ppm)	Resistivity (Ω-cm)	Expansion Index of Soil	R-Value
A-09-010	R/SPT	10.0	20.0													7.0	928	60	625		
	SPT	15.0	16.5	12		88															
	RING	20.0	21.5									37	900	28	300						
	SPT	25.0	26.5	14		86															
	RING	40.0	41.5									40	0	32	0						
	SPT	60.0	61.5	9		91															

NOTE: The laboratory tests were performed in general accordance with the following standards:

Sieve Analysis - ASTM D422

Direct Shear Test - ASTM D3080

Corrosivity Tests - DOT CA 532/643 - pH, DOT CA 417 - soluble sulfates, DOT CA 422 - chlorides, DOT CA 643- minimum resistivity

Boring No.	A-09-010	A-09-010	A-09-010					
Sample No.	R-1	R-2	R-4					
Depth (ft.)	5.0	10.0	30.0					
Sample Type	Drive	Drive	Drive					
Soil Identification	Light brown poorly-graded sand (SP)	Dark gray silt (ML)	Light brown poorly-graded sand (SP)					
Pocket Penetrometer (tons/ft^2)	3.25	2.50	2.50					
Weight Soil + Rings / Tube (g)	1139.80	1141.84	1145.35					
Weight of Rings / Tube (g)	266.40	266.40	266.40					
Average Length (in.)	6.00	6.00	6.00					
Average Diameter (in.)	2.416	2.416	2.416					
Wet. Wt. of Soil + Cont. (g)	216.95	207.84	196.91					
Dry Wt. of Soil + Cont. (g)	207.54	169.45	183.32					
Weight of Container (g)	38.24	38.74	39.33					
Container No.								
Wet Density	121.0	121.2	121.7					
Moisture Content (%)	**6**	**29**	**9**					
Dry Density (pcf)	**115**	**94**	**111**					
Degree of Saturation (%)	31.9	99.3	49.4					

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MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/04/09

Boring No.	A-09-010	A-09-010	A-09-010					
Sample No.	S-1	S-2	S-7					
Depth (ft.)	15	25	60					
Sample Type	SPT	SPT	SPT					
Soil Identification	Dark gray silt with sand (ML)	Dark gray silt (ML)	Light brown poorly graded sand with silt (SP-SM)					
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00					
Dry Weight of Soil + Container (g)	0.00	0.00	0.00					
Weight of Container (g)	1.00	1.00	1.00					
Moisture Content (%)	0.00	0.00	0.00					
Sample Dry Weight Determination								
Weight of Sample + Container (g)	553.62	512.55	474.12					
Weight of Container (g)	140.80	140.10	133.05					
Weight of Dry Sample (g)	412.82	372.45	341.07					
Container No.:								
After Wash								
Method (A or B)	B	B	B					
Dry Weight of Sample + Cont. (g)	191.00	193.00	441.85					
Weight of Container (g)	140.80	140.10	133.05					
Dry Weight of Sample (g)	50.20	52.90	308.80					
% Passing No. 200 Sieve	**87.8**	**85.8**	**9.5**					
% Retained No. 200 Sieve	12.2	14.2	90.5					

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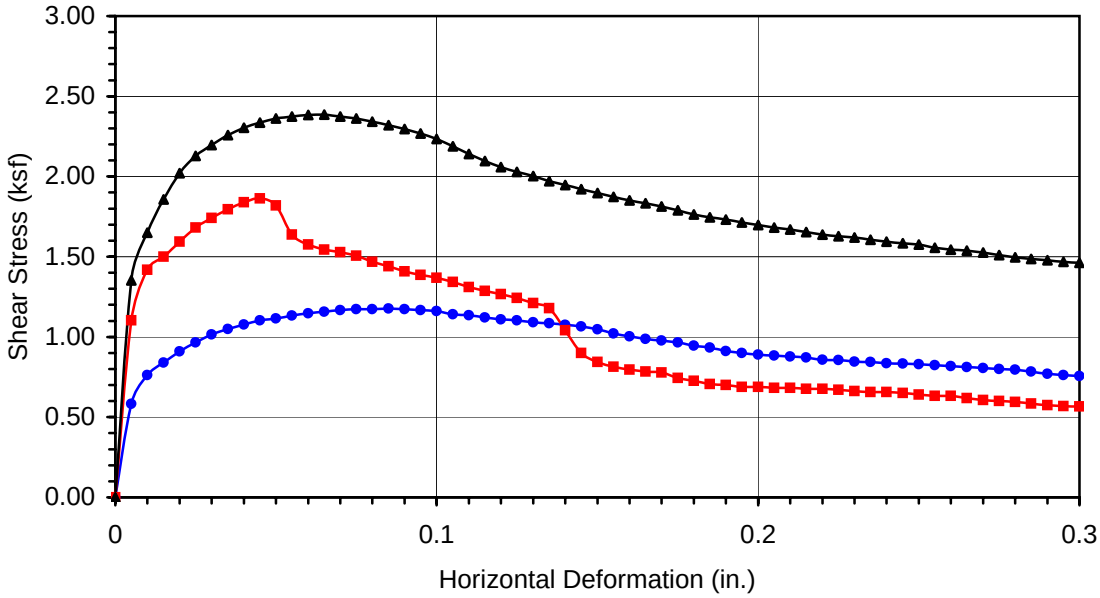
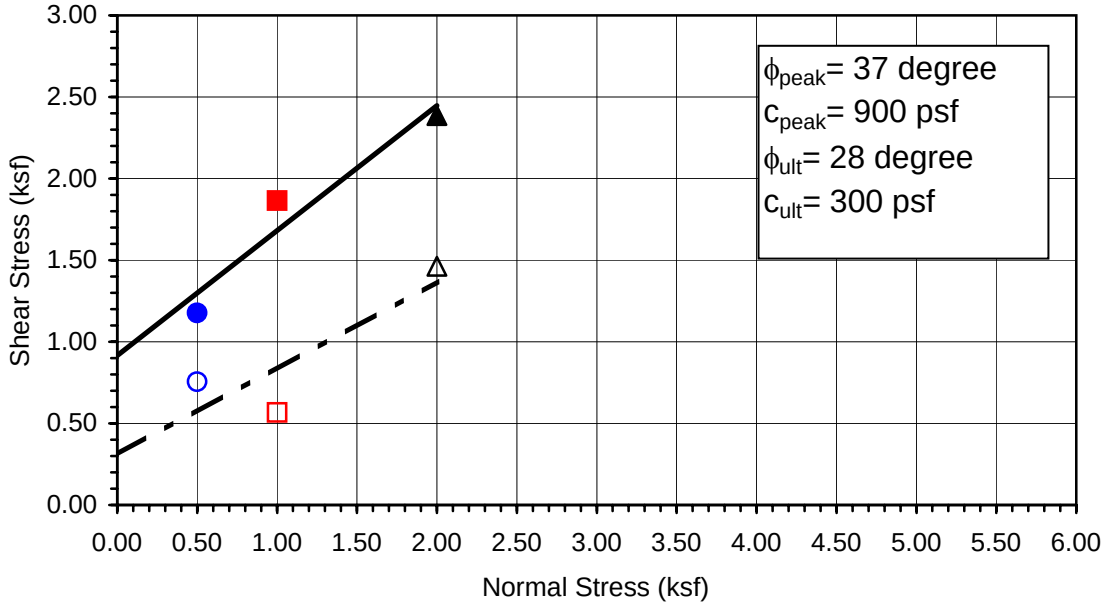
PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/04/09





Boring No.	**A-09-010**
Sample No.	**R-3**
Depth (ft)	**20**

Sample Type:

Drive

Soil Identification:
Dark gray silt (ML)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 1.176	■ 1.864	▲ 2.386
Shear Stress @ End of Test (ksf)	○ 0.755	□ 0.566	△ 1.462
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	28.81	28.81	28.81
Dry Density (pcf)	93.5	93.3	94.4
Saturation (%)	96.9	96.4	99.0
Soil Height Before Shearing (in.)	1.0060	1.0042	0.9945
Final Moisture Content (%)	34.7	35.2	33.4

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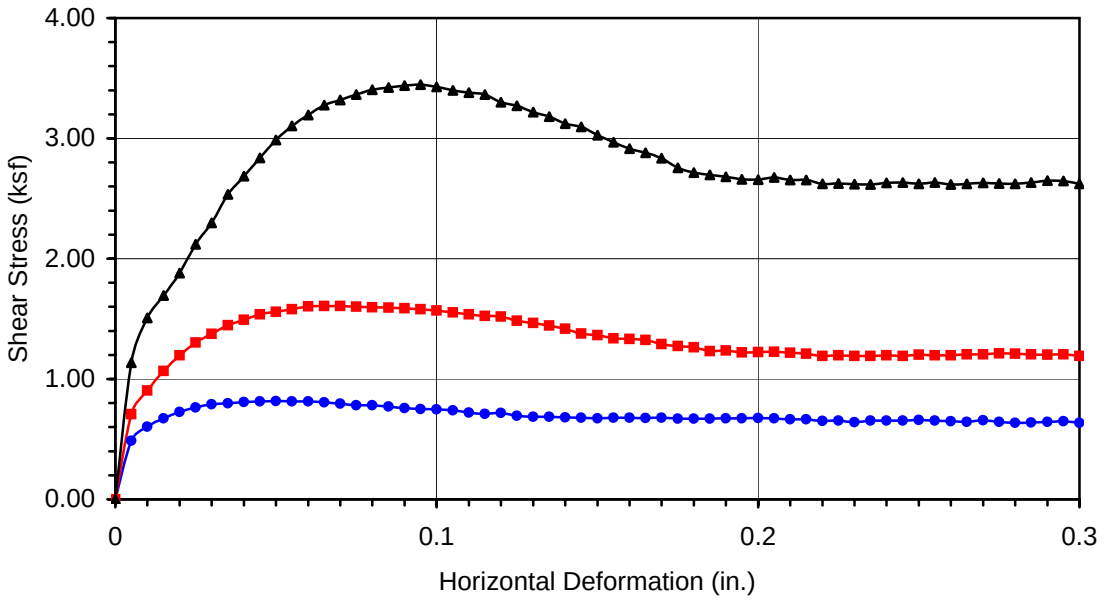
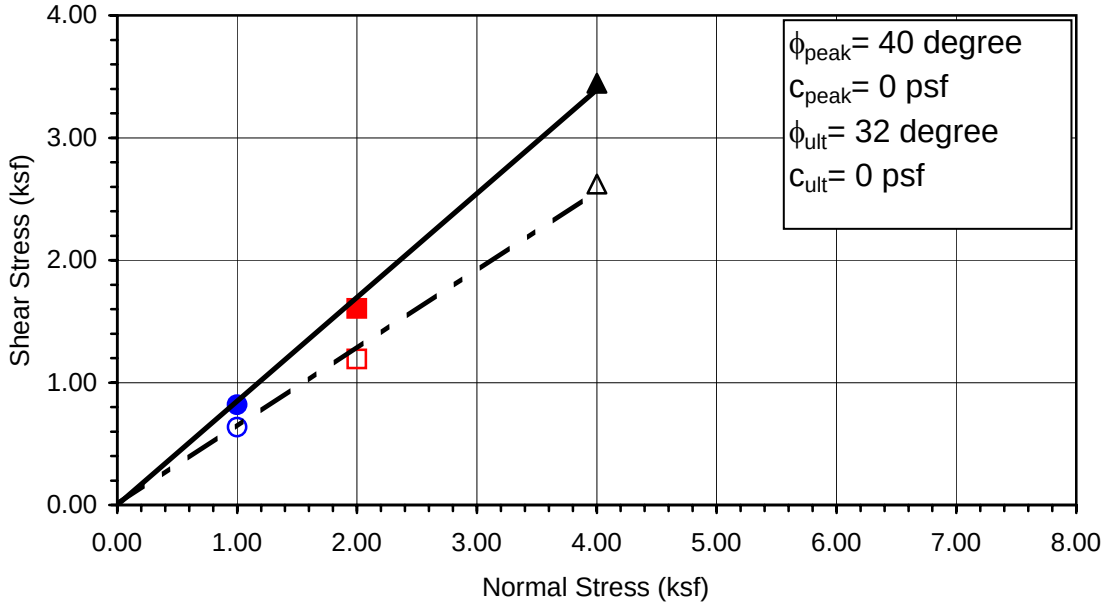
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09





Boring No.	**A-09-010**
Sample No.	**R-5**
Depth (ft)	**40**

Sample Type:

Drive

Soil Identification:
Light yellowish brown poorly graded sand (SP)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.817	■ 1.606	▲ 3.446
Shear Stress @ End of Test (ksf)	○ 0.635	□ 1.191	△ 2.622
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	2.67	2.67	2.67
Dry Density (pcf)	103.6	104.3	105.8
Saturation (%)	11.5	11.7	12.2
Soil Height Before Shearing (in.)	0.9921	0.9860	0.9754
Final Moisture Content (%)	20.3	20.7	19.8

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09

Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: SR-57 Widening

Project No. : 602231-002

Boring No.: A-09-010

Sample No. : R-2, S-1, R-3

Soil Identification: Dark gray (ML)

Tested By : V. Juliano Date: 03/16/09

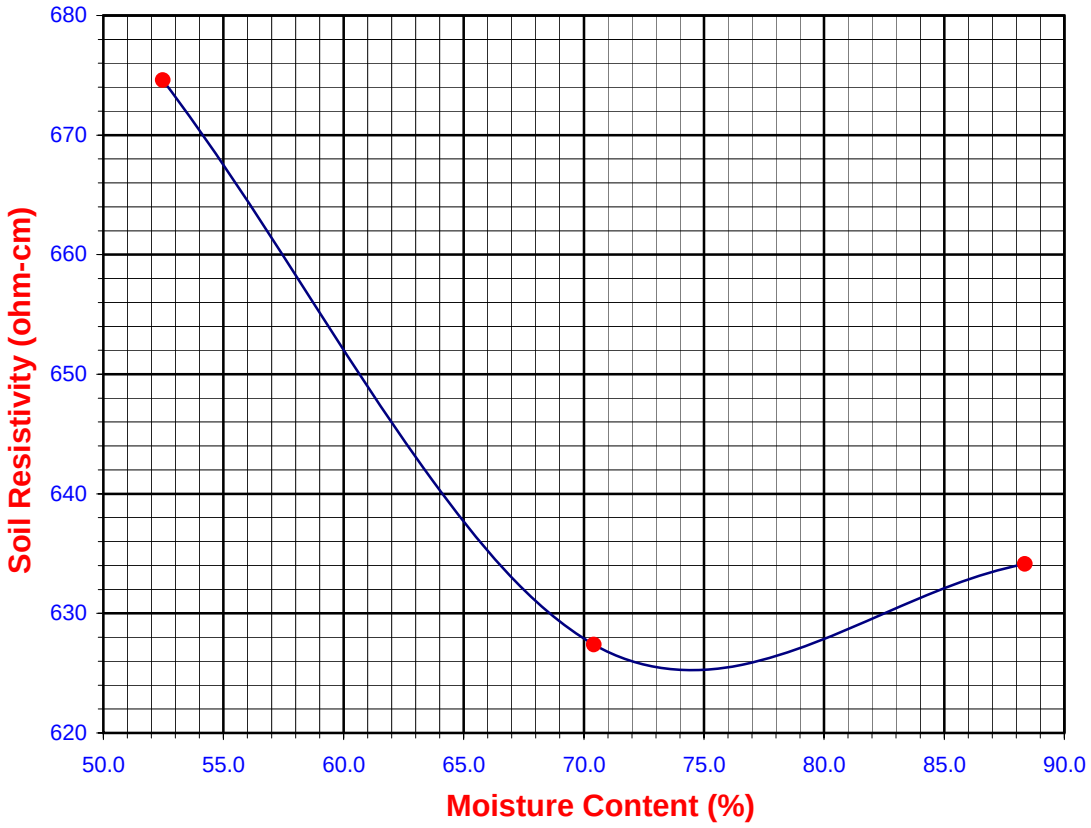
Data Input By: J. Ward Date: 03/19/09

Depth (ft.) : 10-20

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	400	52.48	100	675
2	600	70.42	93	627
3	800	88.36	94	634
4				
5				

Moisture Content (%) (MCi)	16.60
Wet Wt. of Soil + Cont. (g)	215.80
Dry Wt. of Soil + Cont. (g)	194.60
Wt. of Container (g)	66.90
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
625	**74.3**	**928**	**60**	**6.98**	**19.4**



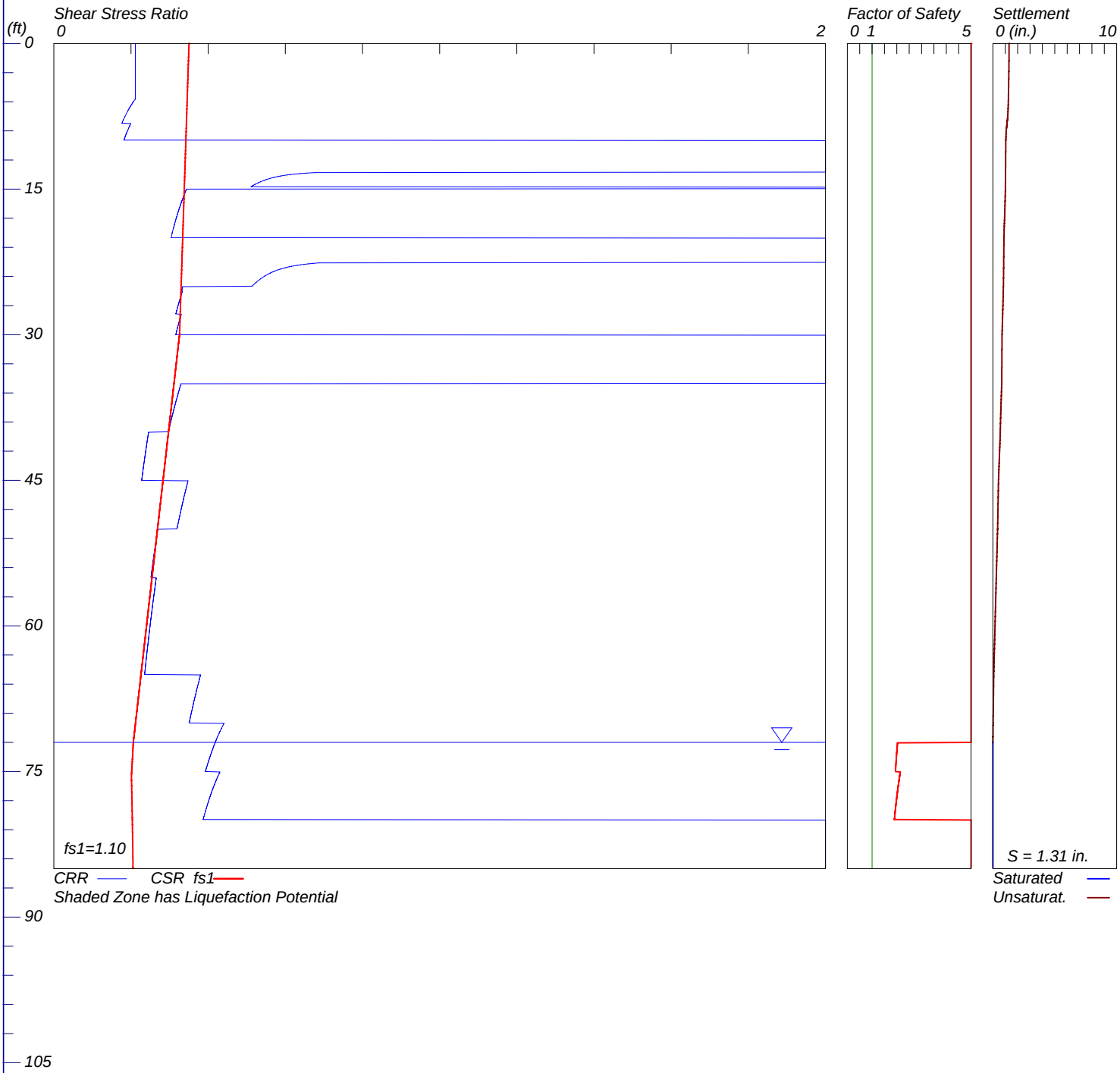
APPENDIX B

LIQUEFACTION ANALYSIS

SR 57 Widening Tieback Wall at Wagner Ave OC

Hole No.=A-09-010 Water Depth=72 ft Surface Elev.=216

Magnitude=6.6
Acceleration=0.49g



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LIQUEFACTION ANALYSIS SUMMARY
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Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 2/4/2010 12:29:44 PM

Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\B-10.liq
Title: SR 57 Widening Tieback Wall at Wagner Ave OC
Subtitle: 602231-002

Surface Elev.=216
Hole No.=A-09-010
Depth of Hole= 85.00 ft
Water Table during Earthquake= 72.00 ft
Water Table during In-Situ Testing= 90.00 ft
Max. Acceleration= 0.49 g
Earthquake Magnitude= 6.60

Input Data:
Surface Elev.=216
Hole No.=A-09-010
Depth of Hole=85.00 ft
Water Table during Earthquake= 72.00 ft
Water Table during In-Situ Testing= 90.00 ft
Max. Acceleration=0.49 g
Earthquake Magnitude=6.60

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.333
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	6.00	121.00	5.00
10.00	12.00	121.00	50.00
15.00	8.00	121.00	50.00
20.00	14.00	120.00	50.00
25.00	10.00	120.00	50.00
30.00	32.00	120.00	5.00
35.00	18.00	120.00	5.00
40.00	15.00	107.00	5.00
45.00	22.00	107.00	5.00
50.00	19.00	107.00	5.00
55.00	20.00	107.00	5.00
60.00	20.00	107.00	5.00
65.00	29.00	107.00	5.00
70.00	32.00	107.00	5.00
75.00	33.00	107.00	5.00
80.00	12.00	110.00	NoLiq
85.00	13.00	110.00	NoLiq

Output Results:
Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=1.31 in.
Total Settlement of Saturated and Unsaturated Sands=1.31 in.
Differential Settlement=0.654 to 0.863 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.21	0.35	5.00	0.00	1.31	1.31
5.00	0.21	0.35	5.00	0.00	1.26	1.26
10.00	2.77	0.34	5.00	0.00	1.04	1.04
15.00	0.34	0.34	5.00	0.00	1.01	1.01
20.00	0.30	0.33	5.00	0.00	0.89	0.89
25.00	0.51	0.33	5.00	0.00	0.85	0.85
30.00	0.32	0.33	5.00	0.00	0.74	0.74
35.00	2.64	0.31	5.00	0.00	0.71	0.71
40.00	0.30	0.30	5.00	0.00	0.60	0.60
45.00	0.23	0.28	5.00	0.00	0.45	0.45
50.00	0.32	0.27	5.00	0.00	0.38	0.38
55.00	0.25	0.25	5.00	0.00	0.27	0.27
60.00	0.25	0.24	5.00	0.00	0.17	0.17
65.00	0.24	0.23	5.00	0.00	0.07	0.07
70.00	0.35	0.21	5.00	0.00	0.02	0.02
75.00	0.39	0.20	1.95	0.00	0.00	0.00
80.00	2.00	0.20	5.00	0.00	0.00	0.00
85.00	2.00	0.21	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf,
Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Lateral Earth Pressure Calculation

ϕ (degree)	28
c (psf)	500
ϕ (degree)	32
γ (pcf)	120.0
Individual Pile	No
Factor of Safety	1.0

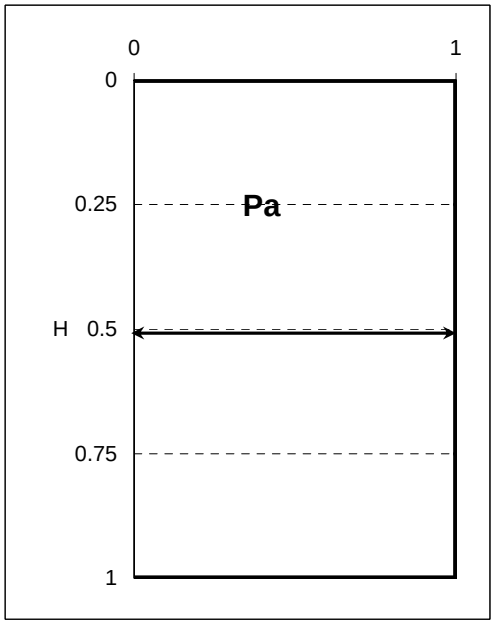
Temporary Excavation - Braced Cut

1	2	3	
Sand	Soft & Medium Clay	Stiff Clay	

Soil Type: **1**

Soil Pressure (psf): **24.0**

	Level Backfill
Friction resistance	0.42
K_p	3.25
K_0	0.47
K_a	0.31
P_p (pcf)	**390.6**
P_0 (pcf)	**56.4**
P_a (pcf)	**36.9**



Assumption: Wall friction (δ) assumed to be 0.
Passive Pressure: Rankine Theory
Active Pressure: Rankine Theory for Level Backfill and NAVFAC DM 7.02 Ch3 for Sloping Backfill.
At rest condition: empirical relationship by Jaky 1944

Jaky, J., 1944, The Coefficient of Earth Pressure at Rest," Journal of the Society of Hungarian Architects and Engineers, Vol 7, 355-358

NAVFAC Figure 33, Passive pressure distribution for solider piles, p7.2-112

LATERAL EARTH PRESSURES-STATIC CONDITION
SR-57 RETAINING WALL
AT WAGNER AVENUE OVERCROSSING
ANAHEIM, CALIFORNIA

PROJECT NAME : SR-57/Wagner Retaining Wall
PROJECT NO: 602231-002
DESIGNED BY: TK
CHECKED BY: DJC
DATE: 2/3/2010

Figure B2

602231-002/ SR 57 N Widening/Wagner Ave Tieback Wall/3 Rows/H=15ft

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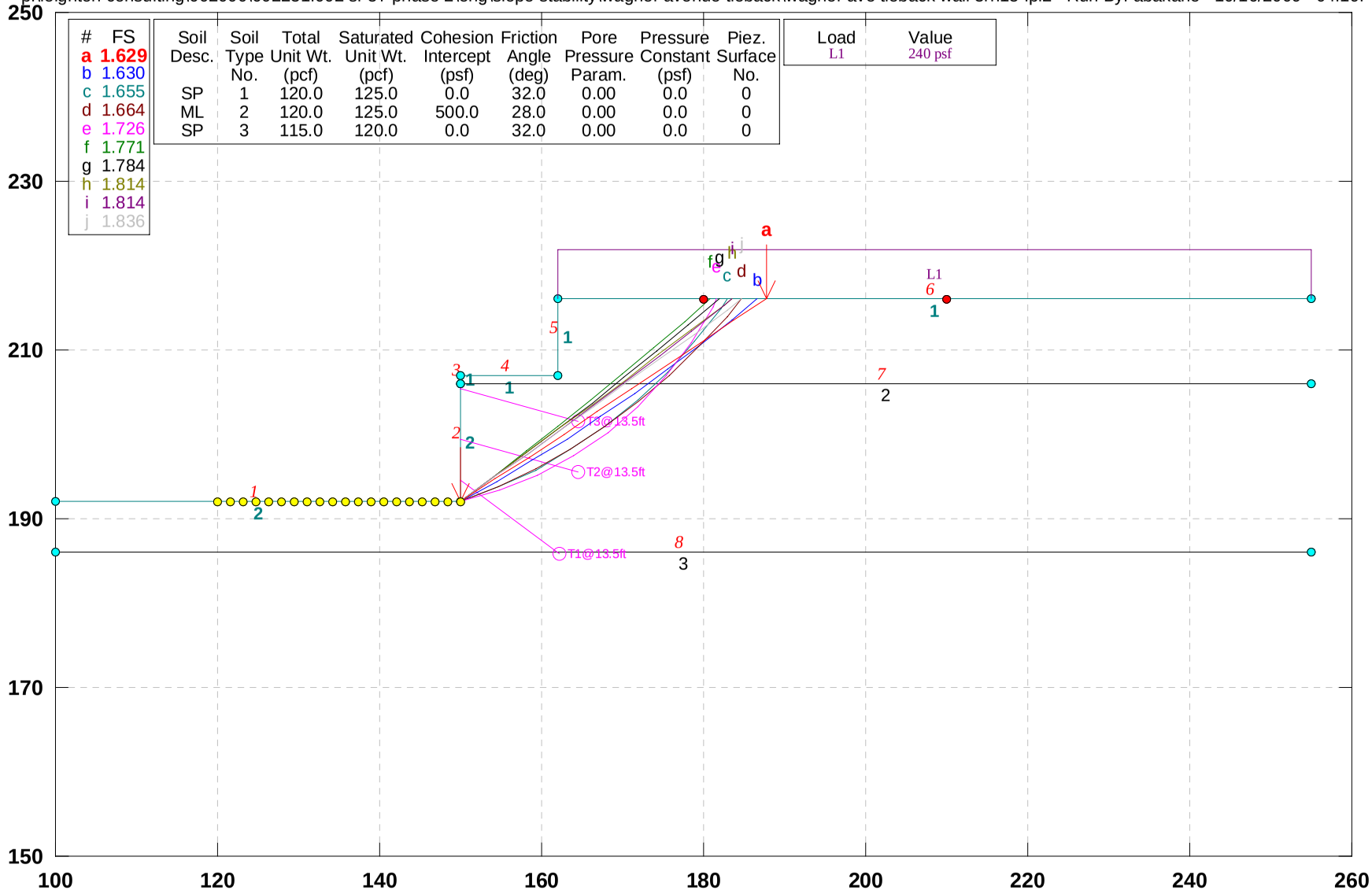

#	FS
a	1.629
b	1.630
c	1.655
d	1.664
e	1.726
f	1.771
g	1.784
h	1.814
i	1.814
j	1.836

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
SP	1	120.0	125.0	0.0	32.0	0.00	0.0	0
ML	2	120.0	125.0	500.0	28.0	0.00	0.0	0
SP	3	115.0	120.0	0.0	32.0	0.00	0.0	0

Load	Value
L1	240 psf

GSTABL7 v.2 FSmin=1.629

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Wagner Ave Tieback Wall/3 Rows/Pseudo Static/H=15ft

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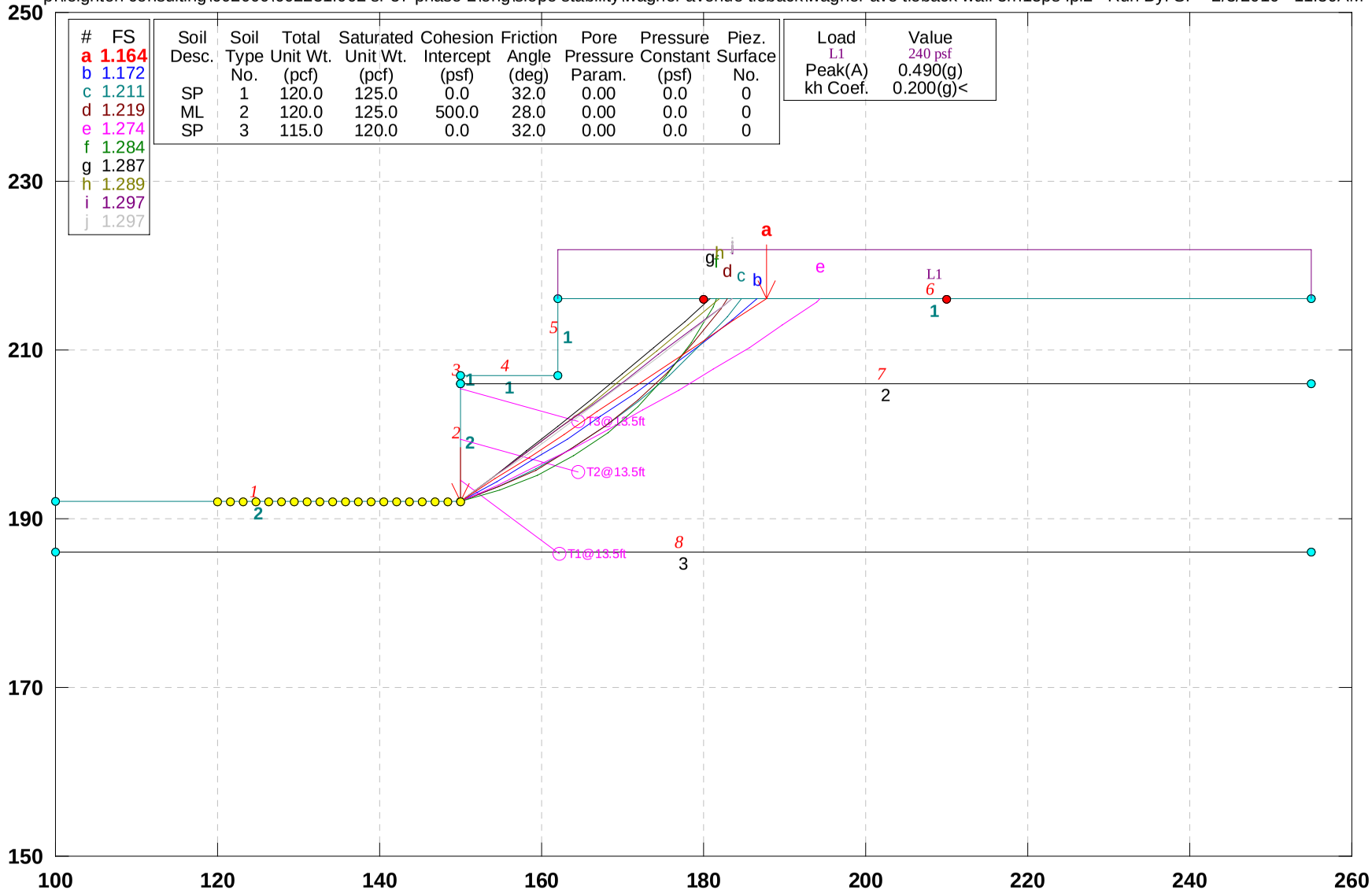

GSTABL7 v.2 FSmin=1.164

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Wagner Ave Tieback Wall/2 Rows H=12ft

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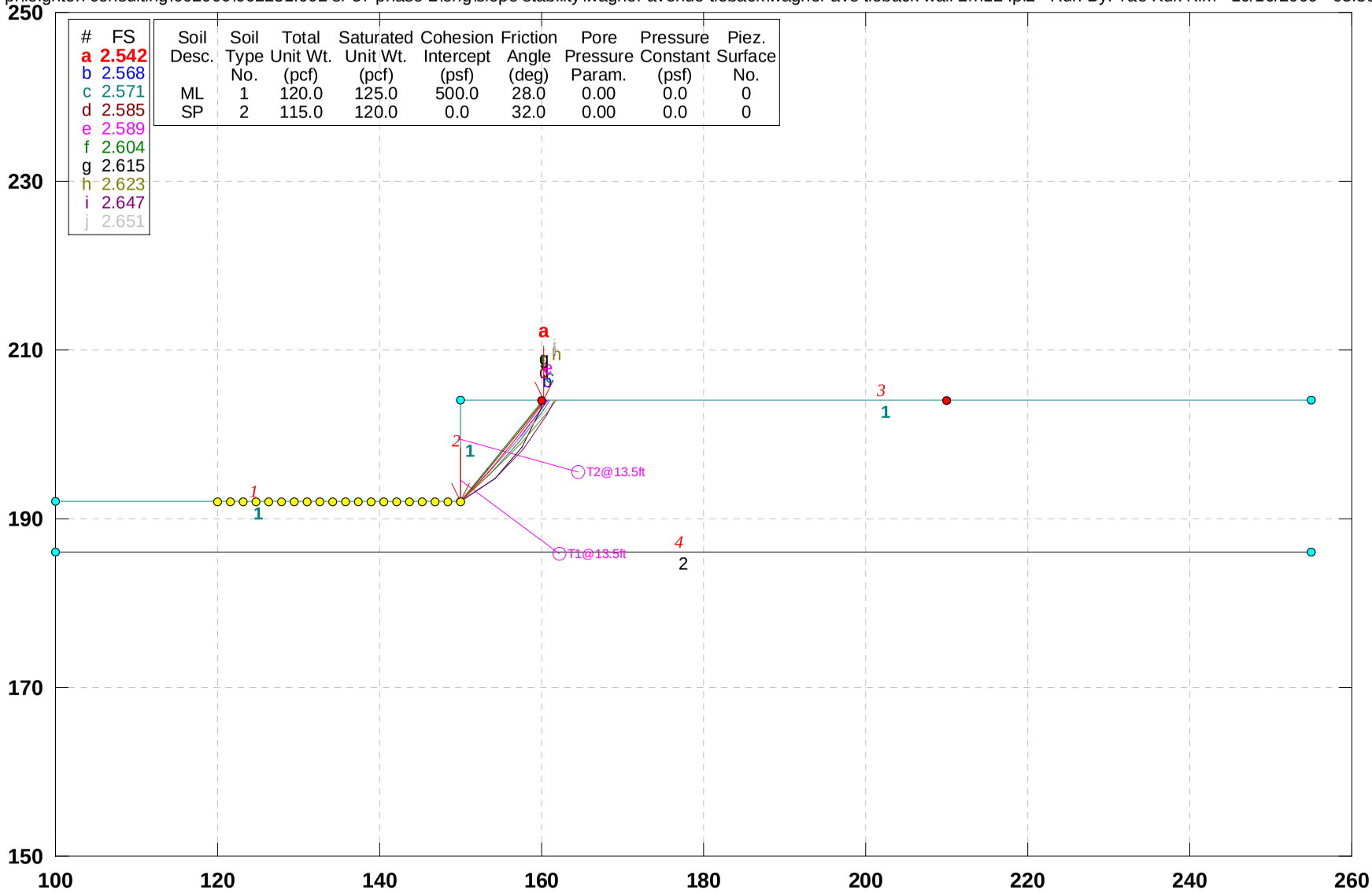

GSTABL7 v.2 FSmin=2.542

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Wagner Ave Tieback Wall/2 Rows/Pseudo Static/H=12ft

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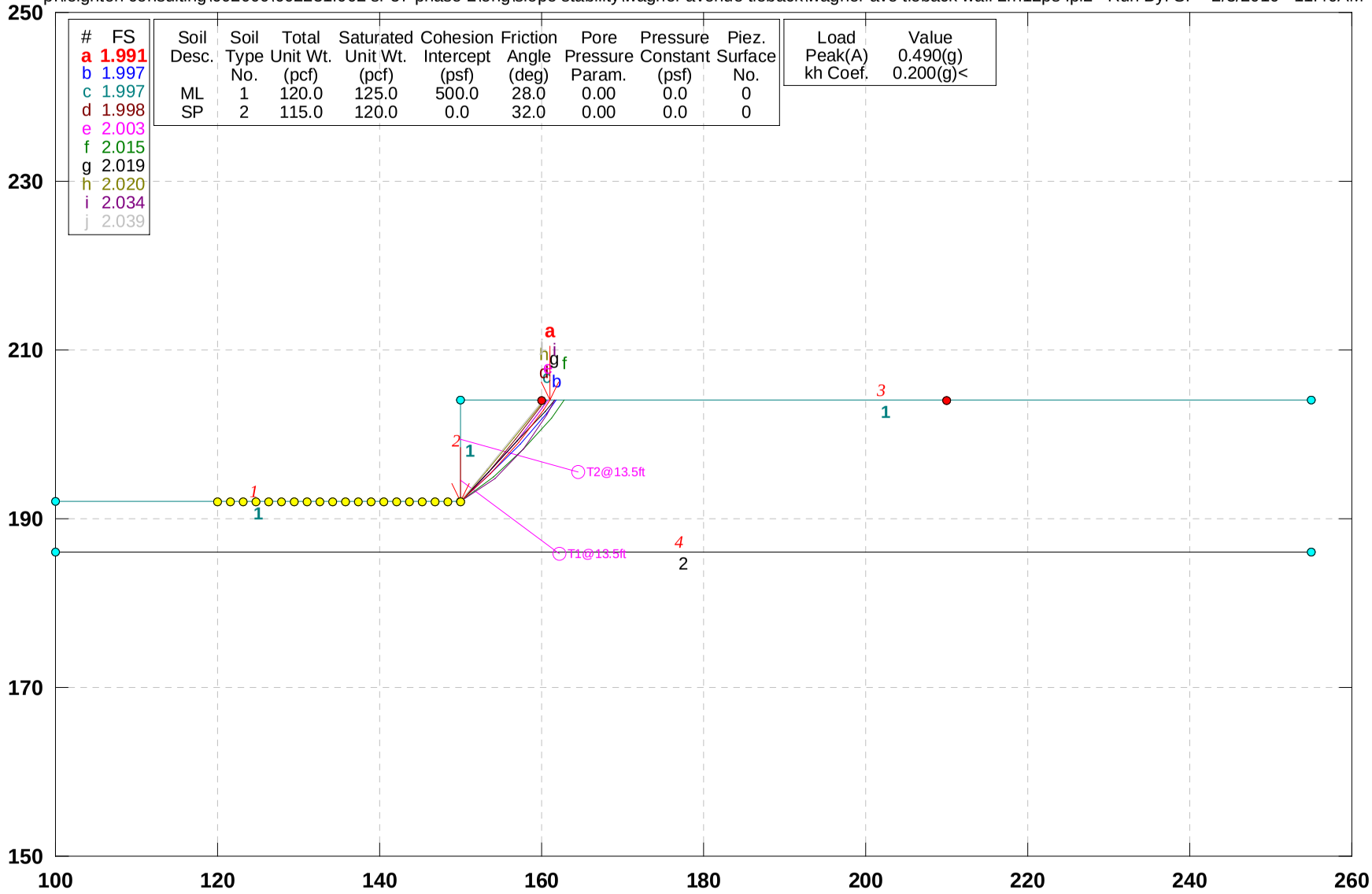

GSTABL7 v.2 FSmin=1.991

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Wagner Ave Type I Retaining Wal/H=14ft

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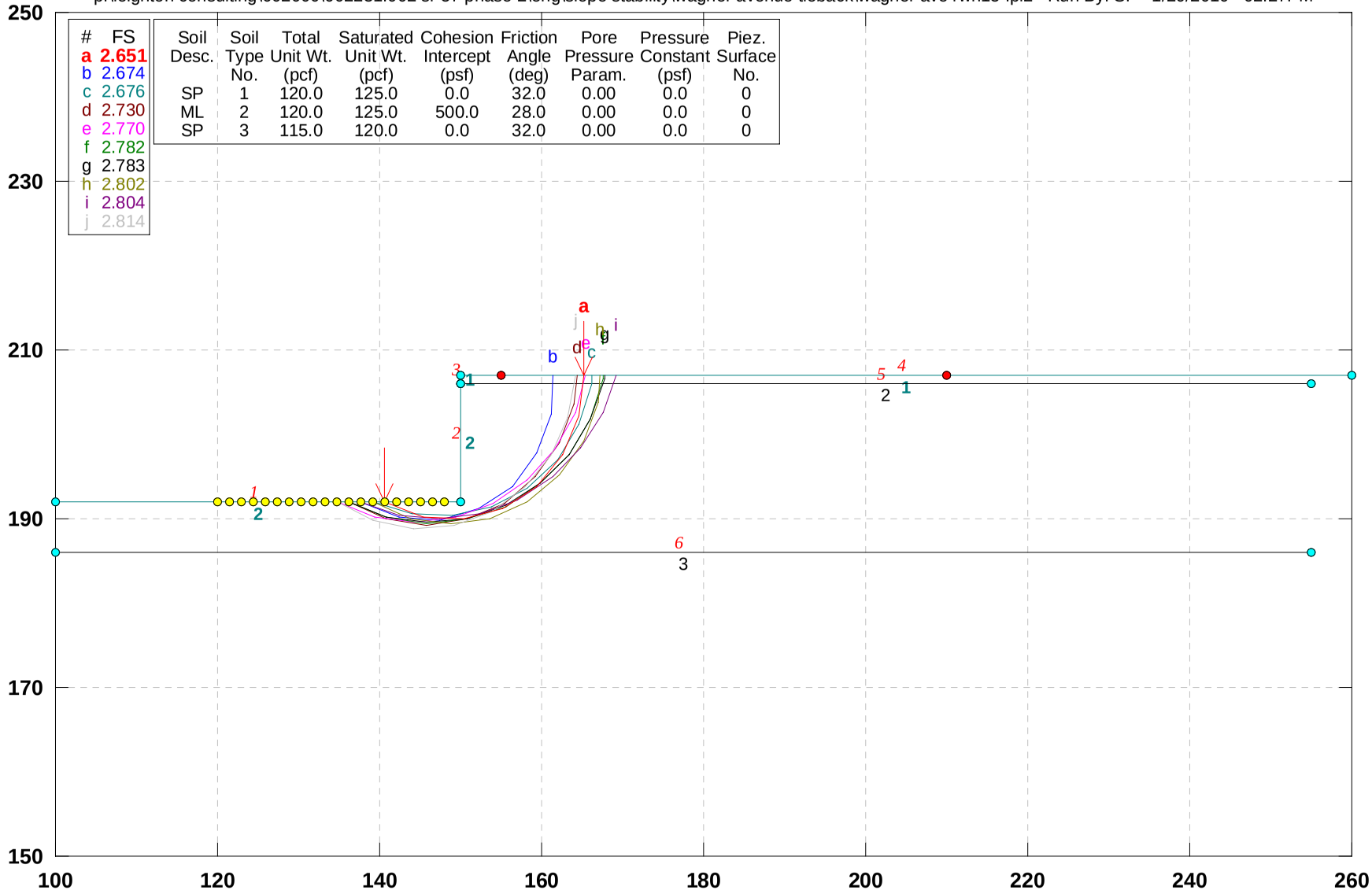
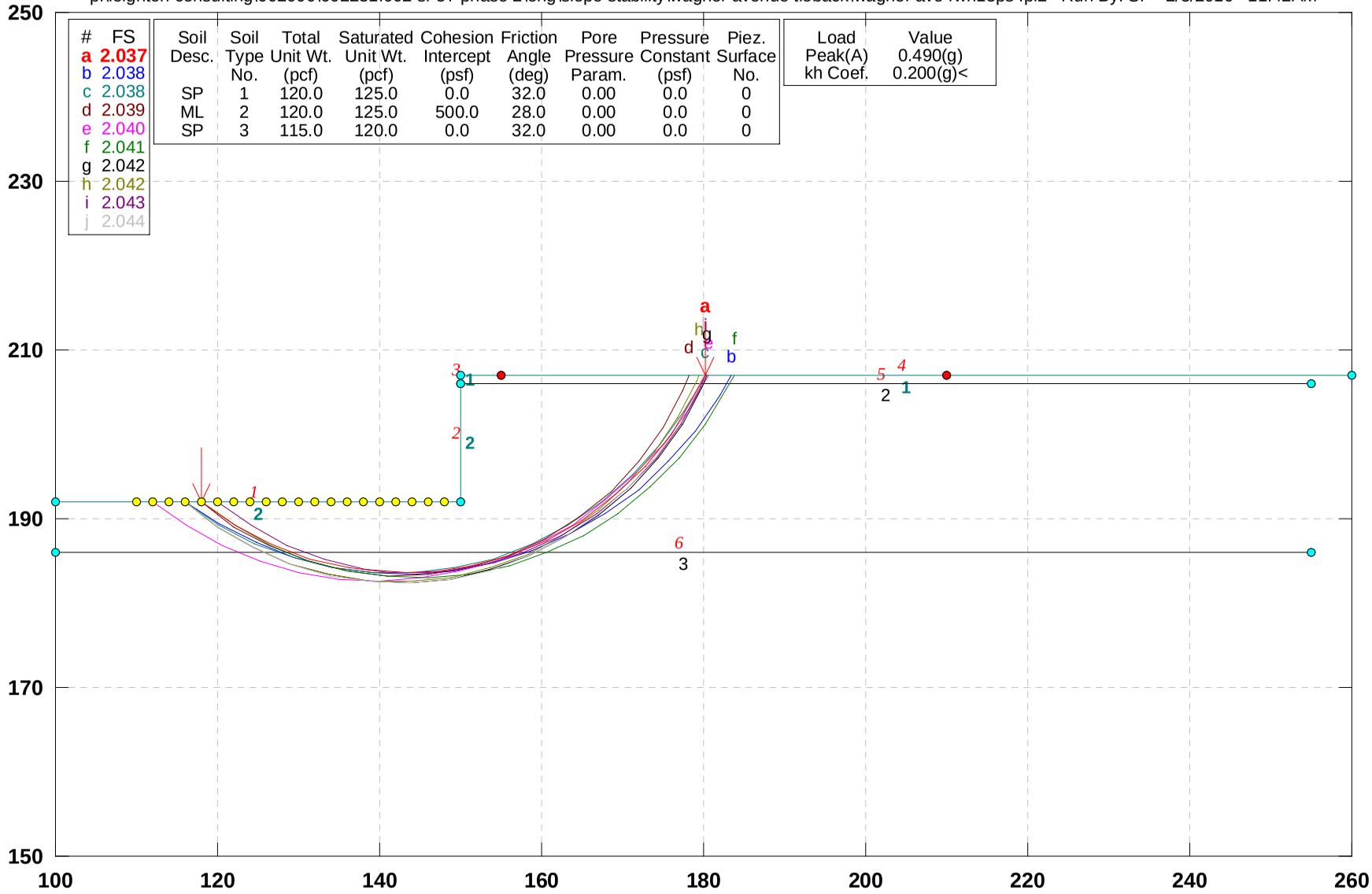


GSTABL7 v.2 FSmin=2.651

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Wagner Ave Type I RW/Pseudo Static/H=14ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\wagner avenue tieback\wagner ave rwh15ps .pl2 Run By: SP 2/3/2010 11:42AM

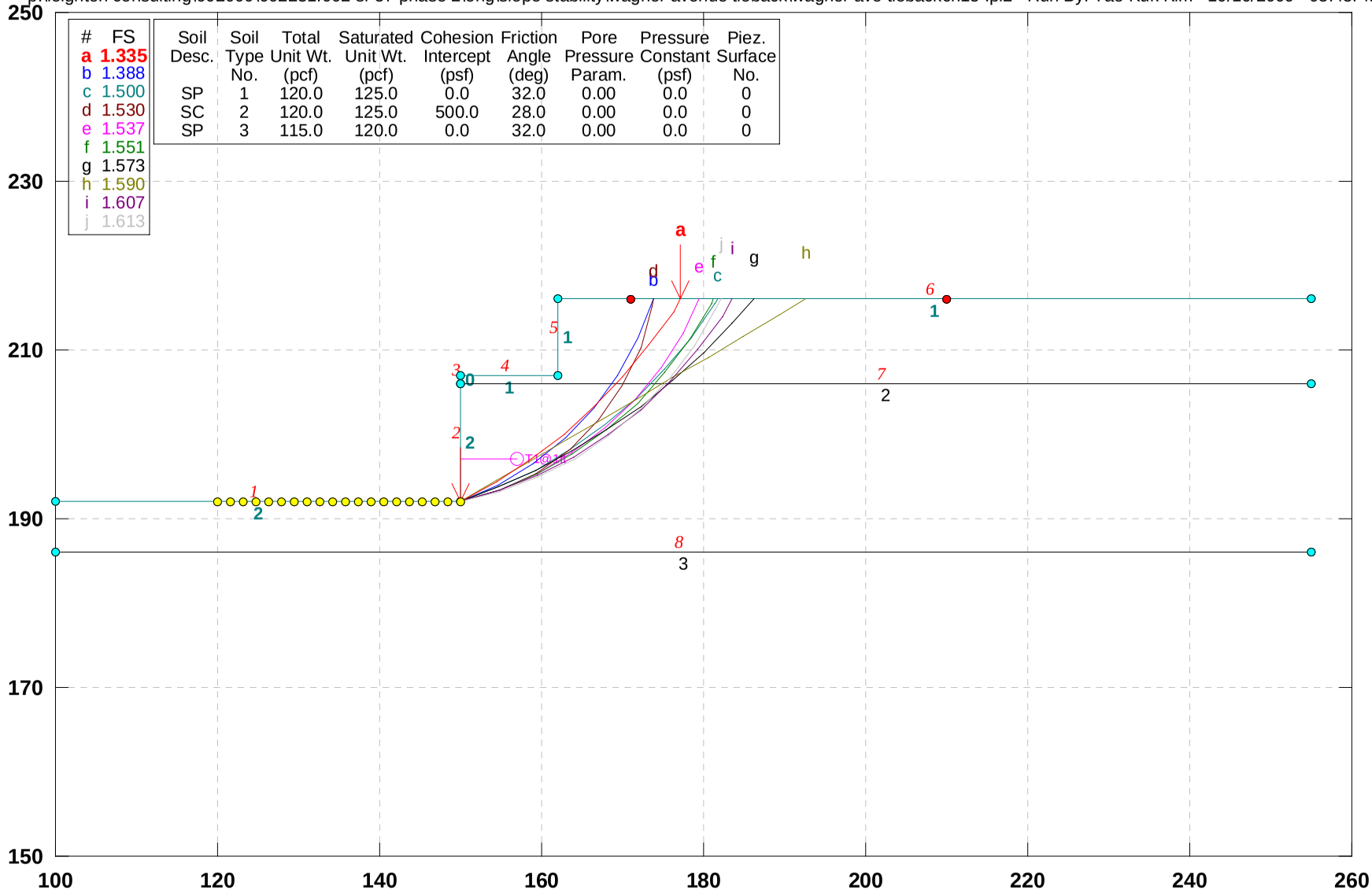


GSTABL7 v.2 FSmin=2.037

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/ SR 57 N Widening/Wagner Ave Tieback Wall Critical Failure H=15ft

p:\leighton consulting\602000\602231.002 sr 57 phase 2\eng\slope stability\wagner avenue tieback\wagner ave tiebackch15 .pl2 Run By: Tae Kuk Kim 10/16/2009 05:45PM



GSTABL7 v.2 FSmin=1.335

Safety Factors Are Calculated By The Modified Bishop Method

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Existing Abutment 3 16-inch diameter CIDH Pile at Wagner Avenue Overcrossing

PROPOSED DEPTH = 51.0 FT

NUMBER OF LAYERS = 2

WATER TABLE DEPTH = 72.0 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 2.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY = 2.00

SOIL INFORMATION

LAYER NO 1----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.100E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.320E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.120E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.100E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.320E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.120E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.160E+02

LAYER NO 2----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.100E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.320E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.115E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.160E+02

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.100E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.320E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.115E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.100E+11
DEPTH, FT	= 0.720E+02

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	1.330	FT.
DIAMETER OF BASE	=	1.330	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	16.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	2.001	SQ.IN.
ELASTIC MODULUS, Ec	=	0.380E+07	LB/SQ IN
VOLUME OF UNDERREAM	=	0.000	CU.YDS.

PREDICTED RESULTS

QS = ULTIMATE SIDE RESISTANCE;
QB = ULTIMATE BASE RESISTANCE;
WT = WEIGHT OF DRILLED SHAFT (FOR UPLIFT CAPACITY ONLY);
QU = TOTAL ULTIMATE RESISTANCE;
QBD = TOTAL ALLOWABLE LOAD USING A FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE RESISTANCE;
QDN = TOTAL ALLOWABLE LOAD USING FACTORS OF SAFETY APPLIED TO THE ULTIMATE SIDE RESISTANCE AND THE ULTIMATE BASE RESISTANCE.

LENGTH (FEET)	VOLUME (CU.YDS)	QS (TONS)	QB (TONS)	QU (TONS)	QBD (TONS)	QDN (TONS)	QU/VOLUME (TONS/CU.YDS)
17.0	0.87	2.55	7.41	9.96	6.26	4.98	11.39
18.0	0.93	5.26	7.41	12.67	8.96	6.33	13.67
19.0	0.98	8.11	7.41	15.52	11.81	7.76	15.87
20.0	1.03	11.11	7.41	18.52	14.82	9.26	18.00
21.0	1.08	14.27	7.41	21.68	17.97	10.84	20.06
22.0	1.13	17.57	7.41	24.98	21.28	12.49	22.06
23.0	1.18	21.02	7.41	28.43	24.73	14.22	24.02
24.0	1.24	24.63	7.41	32.04	28.33	16.02	25.94
25.0	1.29	28.38	7.41	35.79	32.09	17.90	27.82
26.0	1.34	32.29	7.41	39.70	35.99	19.85	29.67

27.0	1.39	36.34	7.41	43.75	40.05	21.88	31.49
28.0	1.44	40.54	7.41	47.96	44.25	23.98	33.28
29.0	1.49	44.90	7.41	52.31	48.61	26.16	35.05
30.0	1.54	49.40	7.41	56.82	53.11	28.41	36.80
31.0	1.60	54.06	7.41	61.47	57.77	30.74	38.53
32.0	1.65	58.86	7.41	66.28	62.57	33.14	40.25
33.0	1.70	63.82	7.41	71.23	67.53	35.62	41.94
34.0	1.75	68.93	7.41	76.34	72.63	38.17	43.63
35.0	1.80	74.18	7.41	81.59	77.89	40.80	45.30
36.0	1.85	79.59	7.41	87.00	83.29	43.50	46.96
37.0	1.90	85.14	7.41	92.56	88.85	46.28	48.61
38.0	1.96	90.85	7.41	98.26	94.56	49.13	50.25
39.0	2.01	96.71	7.41	104.12	100.41	52.06	51.88
40.0	2.06	102.71	7.41	110.12	106.42	55.06	53.50
41.0	2.11	108.87	7.41	116.28	112.58	58.14	55.11
42.0	2.16	115.18	7.41	122.59	118.88	61.29	56.72
43.0	2.21	121.63	7.41	129.05	125.34	64.52	58.32
44.0	2.26	128.24	7.41	135.65	131.95	67.83	59.91
45.0	2.32	135.00	7.41	142.41	138.70	71.20	61.50
46.0	2.37	141.91	7.41	149.32	145.61	74.66	63.08
47.0	2.42	148.96	7.41	156.38	152.67	78.19	64.65
48.0	2.47	156.17	7.41	163.58	159.88	81.79	66.22
49.0	2.52	163.53	7.41	170.94	167.24	85.47	67.79
50.0	2.57	171.04	7.41	178.45	174.74	89.22	69.35
51.0	2.62	178.70	7.41	186.11	182.40	93.05	70.91

RESULT FROM TREND (AVERAGED) LINE

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.8375E+00	0.8041E-03	0.1625E-02	0.1000E-03
0.8521E+01	0.8110E-02	0.1625E-01	0.1000E-02
0.2167E+02	0.2059E-01	0.4063E-01	0.2500E-02
0.4207E+02	0.4092E-01	0.8127E-01	0.5000E-02
0.5966E+02	0.5989E-01	0.1219E+00	0.7500E-02
0.7458E+02	0.7729E-01	0.1625E+00	0.1000E-01
0.1274E+03	0.1506E+00	0.4063E+00	0.2500E-01
0.1612E+03	0.2168E+00	0.8127E+00	0.5000E-01
0.1761E+03	0.2608E+00	0.1219E+01	0.7500E-01
0.1836E+03	0.2959E+00	0.1616E+01	0.1000E+00
0.1893E+03	0.4544E+00	0.3671E+01	0.2500E+00
0.1908E+03	0.7070E+00	0.5558E+01	0.5000E+00
0.1921E+03	0.9593E+00	0.7222E+01	0.7500E+00
0.1929E+03	0.1211E+01	0.8367E+01	0.1000E+01
0.1946E+03	0.1810E+01	0.1082E+02	0.1596E+01

APPENDIX C

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. JON HAMAGUCHI
Office of Special Funded Projects

Date: December 16, 2009
File: 12-ORA-57-PM 13.92
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
Wagner Avenue OC.
Bridge No. 55-0515

Subject: Review of the Draft Foundation Report

On October 28, 2009, we received a draft Foundation Report for the Tieback wall at Abutment 3 of the Wagner Avenue OC Bridge No. 55-0515. Construction of this wall is part of the Northbound widening of the SR-57 between Katella and Lincoln Avenues. The following comments are based on review of the subject report dated October 19, 2009, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

Faulting and Seismicity

- A section for Response Spectra should be added. Also Deterministic and Probabilistic Response Spectrum for each fault should be provided.
- 2008 USGS Deaggregated Hazard (Beta) Curve should be used as design curve if there is a difference of more than 10% between USGS and ARS online probabilistic data.
- QC/QA sheets should be included for all faults listed in calculated spectra.

Log of Test Borings (LOTB)

- The laboratory test result in rectangular boxes on the right side of the boring stick are not defined in the Soil Legend sheets.
- The laboratory test symbols (i.e. PA) should be attached to the boring stick.
- Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NAVD88.
- The project name in title block of as built LOTB should be the same as current LOTB (sheet 1 of 4) and Soil Legend (sheets 2 of 4 and 3 of 4). The project name should read "Wagner Ave. OC – Retaining Wall".
- Place Post Mile 13.92 in LOTB including Soil Legend sheets and design plans.

- There is not such a term as "clayey silt". It is suggested to use elastic silt, silty clay or another acceptable cohesive soil group name.
- The word "loose" at elevation 210 should be moved to elevation 213 after (SP).
- Delete the word "wet" at elevations 205 unless it is defining a perched water.
- Change the term "medium dense" to "very stiff" at elevations 205 and 135.
- Add the terms "very stiff" at elevation 195 and "stiff" at elevations 200 and 190.

Design Plans

- Typical section of Type 1 wall is not shown in General Plan or any other plan sheets.
- The reason for extending shotcrete limits to Type 1 walls as shown in General Plan.
- Cohesive soil parameters as presented in the report's Foundation Plan for the top two rows and granular soil parameters for the third row should be used. Design Foundation Plan was not included in the design plans submittal.
- Show the label orientation on the cross sections in Retaining Wall Section Plan (i.e. vertical E-E label on Section E-E).

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by:

Date: 12/16/2009

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
No. 2869
Exp. 6-30-2010
GEOTECHNICAL
STATE OF CALIFORNIA

c: OGDS1 - LA. File
OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of Wagner Ave OC Bridge No. 55-0515, dated October 19, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Faulting & Seismicity	Faramarz Gerami	A section for Response Spectra should be added. Also Deterministic and Probabilistic Response Spectrum for each fault should be provided. 2008 USGS Deaggregated Hazard (Beta) Curve should be used as design curve if there is a difference of more than 10% between USGS and ARS online probabilistic data. QC/QA sheets should be included for all faults listed in calculated spectra.	ARS curve is not required for the tieback and Type 1 retaining wall design.
2	Log of Test Borings (LOTB)	Faramarz Gerami	The laboratory test result in rectangular boxes on the right side of the boring stick arc not defined in the Soil Legend sheets. The laboratory test symbols (i.e. P A) should be attached to the boring stick. Add an adjustment note (similar to note in 1.2-project description) under Bench Mark in as built LOTB for conversion of NGVD29 to NA VD88. The project name in title block of as built LOTB should be the same as current LOTB (sheet 1 of 4) and Soil Legend (sheets 2 of 4 and 3 of 4). The project name should read "Wagner Ave. OC - Retaining Wall". Place Post Mile 13.92 in LOTB including Soil Legend sheets and design plans. There is not such a term as "clayey silt". It is suggested to use elastic silt, silty clay or another acceptable cohesive soil group name.	We will remove the boxes. We will revise our LOTBs accordingly.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of Wagner Ave OC Bridge No. 55-0515, dated October 19, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			The word "loose" at elevation 210 should be moved to elevation 213 after (SP). Delete the word "wet" at elevations 205 unless it is defining a perched water. Change the term "medium dense" to "very stiff' at elevations 205 and 135. Add the terms "very stiff' at elevation 195 and "stiff' at elevations 200 and 190.	
3	Design Plans	Faramarz Gerami	Typical section of Type 1 wall is not shown in General Plan or any other plan sheets. The reason for extending shotcrete limits to Type 1 walls as shown in General Plan. Cohesive soil parameters as presented in the report's Foundation Plan for the top two rows and granular soil parameters for the third row should be used. Design Foundation Plan was not included in the design plans submittal. Show the label orientation on the cross sections in Retaining Wall Section Plan (i.e. vertical E-E label on Section E-E).	We understand that HDR will revise the plans accordingly. We will provide the appropriate soil parameters for the third (lower) row of the tieback.

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: February 15, 2010
File: 12-ORA-57-PM 13.92
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
Wagner Avenue OC.
Bridge No. 55-0515

Subject: 2nd Review of the Foundation Report

On February 22, 2010, we received a Foundation Report for the Tieback wall at Abutment 3 of the Wagner Avenue OC Bridge No. 55-0515. Construction of this wall is part of the Northbound widening of the SR-57 between Katella and Lincoln Avenues. The following comments are based on review of the subject report revised February 15, 2010, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

4.1 Table 4 – As Built Foundation Data

- As Built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified.

- Please explain the reason Nominal Resistance is exceeding 2 x Allowable Capacity.

Log of Test Borings (LOTB)

- Bottom of footing elevations (Tieback or Type 1) should not be shown on LOTB.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 3/15/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
No. 2669
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STATE OF CALIFORNIA

c: OGDS1 - LA. File
OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MARCH 15, 2010
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

2nd Review of the Draft Foundation Report for Tieback Wall at Abutment 3 of Wagner Ave OC Bridge No. 55-0515, dated February 15, 2010.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Table 4 – As Built Foundation Data	Faramarz Gerami	As built pile cutoff/bottom of footing elevations and specified pile tip elevations should not be modified. Please explain the reason Nominal Resistance is exceeding 2X Allowable Capacity.	We have revised Page 12 of our report accordingly. We have revised Page 12 of our report to indicate nominal resistance as 2 times the allowable pile capacity.
2	Log of Test Borings (LOTB)	Faramarz Gerami	Bottom of footing elevations (Tieback or Type 1) should not be shown on LOTB.	We have revised our LOTB accordingly.

State of California **Business, Transportation and Housing Agency**

M e m o r a n d u m

Flex your power!
Be energy efficient!

To: MR. SUDHAKAR VATTI
Office of Special Funded Projects

Date: June 7, 2010
File: 12-ORA-57-PM 13.92
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Tieback Wall at Abut. 3
Wagner Avenue OC.
Bridge No. 55-0515

Subject: 3rd Review of the Foundation Report-Addendum

On May 26, 2010, we received an addendum to Foundation Report for the proposed Tieback wall No. 55E0112 at Abutment 3 of the Wagner Avenue OC Bridge No. 55-0515. The subject report including responses dated May 20, 2010, is prepared by Leighton Consulting, Inc.

We have no further comments after reviewing the referenced submittal and responses to our previous review comments dated February 15, 2010. Any questions should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 6/7/2010

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
No. 2669
Exp. 6/30/2010
GEOTECHNICAL
STATE OF CALIFORNIA

c: OGDS1 - LA. Electronic File
OGDS1 - Sac. Electronic File
GS – Sac. Electronic File

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

TRANSMITTAL

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: February 15, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail/Overnight		Draft Report		Your Use
X	Courier	X	Final Report	X	As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Geotechnical Design Report for Retaining Wall Nos. 275 and 293, Proposed Widening of Northbound State Route 57, Orange County, California

LEIGHTON CONSULTING, INC.

By: Djan Chandra

Distribution: (6) Addressee

17781 Cowan ■ Irvine, CA 92614-6009
949.253.9836 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

GEOTECHNICAL DESIGN REPORT FOR RETAINING WALL NOS. 275 AND 293 PROPOSED WIDENING OF NORTHBOUND STATE ROUTE 57, ORANGE COUNTY, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 57
PROJECT POST MILES: 12.2/15.2, EA # 0F0401

Prepared For:

HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

October 20, 2009
(Revised February 15, 2010)

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

October 20, 2009
(Revised February 15, 2010)

Project No. 602231-002

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Attention: Mr. Scott Bacsikin

Subject: Geotechnical Design Report for Retaining Wall Nos. 275 and 293, Proposed Widening of Northbound State Route 57, Orange County, California

In response to your request, Leighton Consulting, Inc. has performed a geotechnical exploration for Retaining Nos. 275 and 293 for the proposed widening of northbound State Route 57 (SR-57) in Orange County, California. The proposed widening extends from approximately 0.3 miles south of Katella Avenue (Post Mile 12.2) to approximately 0.3 miles north of Lincoln Avenue (Post Mile 15.2). The proposed retaining walls will be located at the toe of the existing freeway embankment between Katella Avenue and Ball Road to keep the widened embankment within the existing right-of-way. This project is sponsored by OCTA and Leighton Consulting has been retained as the geotechnical consultant by HDR Engineering, Inc. A draft version of this report was issued on October 20, 2009, for review by Caltrans and the design team. Caltrans review comments and our responses are included in Appendix C of this report.

This report defines the geotechnical conditions as evaluated from field and laboratory test data and used in the development of the geotechnical design. It provides recommendations and specifications for project design and construction. It is our professional opinion that the site can be developed as planned from a geotechnical perspective, provided the recommendations presented in this report are incorporated into design and construction.

17781 Cowan ■ Irvine, CA 92614-6009
949.253.9836 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/lr

Distribution: (6) Addressee

Leighton

Caltrans Oversight Review Form

In general accordance with Deputy Director Richard P. Weaver's January 28, 1993 memorandum the project is approved regarding impact on State facilities and conformance with applicable State standards and practices, and technical oversight was performed as described in the California Department of Transportation A&E Consultant Services Manual.

Caltrans personnel who had responsibility of geotechnical oversight:

Name	Title	Registration No.
Civil Engineer		

Name	Title	Registration No.
Engineering Geologist		

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Leighton

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Leighton

1.0 INTRODUCTION

1.1 Project Description

The California Department of Transportation (Caltrans), District 12, in cooperation with the Orange County Transportation Authority (OCTA), proposes to widen northbound SR-57 between 0.3 miles south of Katella Avenue (Post Mile 12.2) and approximately 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project segment of SR-57 is approximately 3 miles long, passing through the City of Anaheim in Orange County, California. SR-57 was constructed in 1974 and currently has four general purpose lanes and a high-occupancy vehicle (HOV) lane in each direction. Six grade separations exist within this segment; namely at Katella Avenue, Douglass Road, Ball Road, Wagner Avenue, South Street and Lincoln Avenue.

The purpose of the proposed project is to improve both existing and future mobility, reduce congestion and improve mainline merge and diverge movements. The project consists of widening of approximately 3 miles of northbound SR-57 by approximately 35 feet to provide standard lane widths, an additional general purpose lane (fifth lane) and a standard 10-foot wide shoulder. The existing asphalt concrete shoulder will be removed and an approximately 20-foot wide concrete pavement and 10-foot wide asphalt concrete shoulder will be constructed.

The southern segment of the project south of Ball Road is on an elevated embankment. Widening of this segment will require import material and two retaining walls to keep the widened embankment within the existing right-of-way. Retaining Wall (RW) No. 275 will be approximately 1,608 feet long and located between Katella Avenue and Douglass Road. RW No. 293 will be approximately 1,344 feet long and located between Douglass Road and Ball Road. The location of the retaining walls is shown on Figure 1, *Site Location Map*. Both walls will be Caltrans standard Type 1 retaining wall with a maximum height of 12 feet.

1.2 Purpose and Scope

This report presents the results of our geotechnical exploration for the proposed RW Nos. 275 and 293 at northbound SR-57 in Orange County, California. This work has been performed under subcontract to HDR for OCTA. Geotechnical recommendations provided herein are based on the subsurface data collected from our exploration and design information provided by HDR. Recommendations for structures along the

alignment, such as widening of the existing bridges and tieback walls, are provided in separate foundation reports and materials related recommendations are provided in a separate materials report.

Our scope of work for this project included the following tasks:

- *Literature Review*: We reviewed various documents pertinent to the project site including the as-built Log of Test Borings (LOTBs) prepared by Caltrans for the existing bridges. The as-built LOTBs are attached to this report. A list of references used in preparation of this report is presented in Section 7.0.

- *Site Reconnaissance:* We performed a site reconnaissance to visually evaluate the accessibility of the site for drilling equipment and locate and mark the proposed boring locations.

- *Subsurface Exploration*: We performed a subsurface exploration that included drilling, logging and sampling of three 8-inch diameter hollow-stem auger borings to a maximum depth of 66½ feet below ground surface. We also advanced seven Cone Penetration Tests (CPTs) to a depth of 70 feet below the existing grade. Logs of the borings and CPT are included in Sheets 2 through 4 of the attached LOTBs for the two retaining walls.

- *Laboratory Testing*: Laboratory testing was performed on selected soil samples collected from our field exploration to evaluate the engineering properties of the soils. The laboratory test results are included in Appendix A.

- *Seismic Analysis*: Based upon the encountered subsurface conditions and regional seismicity of the area, we performed ground motion analysis for the project site for use in structural analysis and design.

- *Geotechnical Design and Analysis*: Geotechnical analysis was performed on the collected data to develop recommendations for design and construction. Results of the analysis are included in Appendix B.

- *Report Preparation*: Relevant geotechnical data were compiled in this report along with our findings and recommendations for the proposed project.

2.0 GEOTECHNICAL FIELD AND LABORATORY INVESTIGATIONS

2.1 Subsurface Exploration

An initial site reconnaissance was performed to mark the proposed boring locations and to evaluate the proposed boring and CPT locations with respect to access for drilling equipment and subsurface structures. USA was then notified of the marked locations. We also coordinated with Caltrans personnel during our field exploration. Our field exploration consisted of advancing three 8-inch diameter hollow-stem borings to a maximum depth of 65 feet below the current grade and seven CPTs to a maximum depth of 70 feet below the current grade where refusal was encountered. The approximate location of these borings and CPTs is shown in Sheet 1 of the attached LOTBs for the two retaining walls. A summary of the boring and CPT locations, elevations and depth is presented in Table 1. Datum for all elevations referenced herein is mean sea level (msl).

Table 1 - Field Exploration Summary

Boring No.	SR-57 Stationing	Offset[1]	Approximate Ground Surface Elevation (feet)	Exploration Depth (feet)
Retaining Wall No. 275				
CPT-09-104	277+60	187 feet Right	165.0	60.0
CPT-09-108	279+65	175 feet Right	167.0	70.0
A-09-101	282+00	175 feet Right	167.0	61.5
CPT-09-105	284+90	175 feet Right	168.0	65.0
CPT-09-109	287+95	180 feet Right	170.0	60.0
Retaining Wall No. 293				
CPT-09-106	296+00	160 feet Right	175.0	65.0
CPT-09-110	298+15	145 feet Right	175.0	70.0
A-09-102	299+50	150 feet Right	175.0	66.5
CPT-09-107	305+30	195 feet Right	178.0	68.0
A-09-103	305+70	195 feet Right	178.0	66.5

[1]Offsets were measured from the indicated station line.

Standard Penetration Test (SPT) was performed within the hollow-stem borings using a 140-pound automatic hammer falling freely for 30 inches. The samplers were driven for a total penetration of 18 inches and the blow counts were recorded for every 6 inches of penetration. Relatively undisturbed samples were collected from the borings using the Modified California Ring sampler. The field sampling procedures were conducted in accordance with ASTM D 1586 and D 3550 for SPT and split-barrel sampling of soil. In addition to driven samples, representative bulk soil samples were also collected from the borings.

The test borings were logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. The samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the borings were backfilled with soil cutting mixed with cement, tamped and capped with rapid set concrete, where asphalt was penetrated.

The CPTs were performed in general accordance with ASTM D 3441. The tests consisted of pushing an instrumented cone-tipped probe into the ground while simultaneously recording the tip resistance and side friction resistance of the soils during penetration. Geotechnical logs of the borings and CPT are included in the LOTBs.

We also advanced two borings and one CPT for the proposed widening of Douglass Overhead located between RW No. 275 and RW No. 293. Location and geotechnical logs of these borings and CPT are also included in the LOTBs.

2.2 Geotechnical Laboratory Testing

Laboratory tests were performed on representative soil samples to determine the geotechnical engineering properties of subsurface materials. The following laboratory tests were performed:

- In-situ moisture content and density;
- Atterberg Limits;
- Grain-size distribution;
- Percent passing No. 200 sieve;
- Direct shear;
- Consolidation;

- Expansion Index; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests were performed in general conformance with ASTM or California Test Methods. Results of the laboratory tests are presented in Appendix A of this report.

3.0 GEOTECHNICAL FINDINGS

3.1 Geologic Setting

The subject site is located in the Tustin Plain within the southeastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. In general, the Tustin Plain consists of approximately 1,400 feet of unconsolidated to semi-consolidated Quaternary-age alluvial sediments. Underlying the Quaternary alluvial deposits are Tertiary-age bedrock units consisting of sandstone, siltstone, shale and conglomerate on the order of 31,000 feet in thickness.

The site lies near the lower reaches of the Santa Ana River. The surface distribution of Holocene sediments, as recorded in early editions of regional soil survey maps (Eckmann et al., 1916) suggests that the Santa Ana River has recently wandered back and forth across the Orange County coastal plain from Alamitos Bay to Newport Bay. Historical accounts and documents further support the process of widespread sheet flooding being the dominant depositional process associated with the Santa Ana River prior to the construction of Prado Dam in 1941 (California Department of Water Resources, 1957). Currently, the Santa Ana River is located approximately 500 to 1,000 feet east of the proposed retaining walls.

3.2 Subsurface Earth Materials

The subsurface soils encountered our borings and CPTs at the southern portion of the RW No. 275 (Station Nos. 10+00 to 19+00) consist of medium dense to very dense sand and silty sand with isolated layers of medium stiff to stiff silty clay to a depth of 40 feet. The soils below 40 feet to a depth of 61½ feet typically consist of medium stiff to stiff silty clay and medium dense silty sand and sandy silt.

The subsurface soils encountered at Station Nos. 19+00 to 26+08 of RW No. 275 and at RW No. 293 generally consist of loose to very dense sand and silty sand with varying contents of clay to the maximum depth explored (66½ feet). The boring and CPT logs are presented in the LOTBs.

3.3 Groundwater

Groundwater was encountered during our field exploration at depths ranging from 40 feet to 44 feet below the existing grade (elevations 134 to 125½ and 134 feet). Groundwater was also encountered in Borings B-1 and B-3 by Caltrans in 1962 at depths ranging from 33 to 34.5 feet below the existing grade (elevation of 135.7 to 134.2 feet). It should be noted that the elevations used by Caltrans in 1962 were based on an old datum that was approximately 2.5 feet lower than the current datum. The historically high groundwater table at the site is on the order of 30 feet below existing grade (CDMG, 1997), corresponding to elevation 141 feet. The groundwater data from the borings are summarized in Table 2. Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff.

Table 2 – Groundwater Tables

Boring No.	SR-57 Station-ing	Offset	Time of Drilling	Total Depth (feet)	Bottom Elevation of Boring[1] (feet)	Groundwater Table	
						Depth below Existing Grade (feet)	Elevations[1] (feet)
A-09-004[2]	289+90	70' RT	2009	111.5	91.5	72.0	131.0
A-09-005[2]	291+60	100' RT	2009	81.5	89.5	40.5	130.5
A-09-101[2]	282+00	175' RT	2009	61.5	105.5	41.5	125.5
A-09-102[2]	299+50	150' RT	2009	66.5	108.5	40.5	134.5
A-09-103[2]	305+70	195' RT	2009	66.5	111.5	44.0	134.0
B-1[3]	291+70	25' LT	1962	82.0	86.7	34.5	134.2
B-3[3]	291+97	26' RT	1962	75.0	93.7	33.0	135.7

[1]Elevations of the borings by Caltrans were based on the old datum (NGVD29) and approximately 2.5 feet should be added to convert the elevations to the current datum (NAVD88).

[2]Borings by Leighton Consulting;

[3]Borings by Caltrans

3.4 Faulting and Seismicity

Our review of available in-house literature indicates that there are no known active or potentially active faults that have been mapped at the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in southern California. According to the California Geological Survey fault database, the closest active faults that could affect the site are the San Joaquin Hills Blind Thrust, Puente Hills Blind Thrust, and Whittier faults.

We have performed seismic analysis for the site following Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). Distance of faults to the site was estimated using Caltrans ARS online program and peak ground acceleration for each fault was estimated using Caltrans excel worksheet. The estimated peak ground accelerations caused by various faults near the site are summarized in the following table.

Table 3 – Peak Bedrock Accelerations

Fault	Maximum Magnitude	Distance (km)	Peak Bedrock Acceleration
Peralta Hills	6.2	3.7	0.39g
Compton-Los Alamitos Blind Thrust	6.8	11.8	0.38g
Puente Hills Blind Thrust	7.3	12.3	0.34g
Elsinore fault zone (Whittier Section)	7.6	13.1	0.29g
Elsinore fault zone (Chino Section)	7.6	17.8	0.33g

As shown in the table above, the Peralta Hills fault is the nearest fault to the site at a distance of approximately 3.7 km. A maximum earthquake magnitude of 6.2 has been estimated for this fault, resulting in a peak horizontal ground acceleration of about 0.39g at the site. This fault, however, is not included in the latest California Geological Survey fault database.

We have also performed probabilistic seismic analysis using Caltrans ARS online program. The peak ground acceleration was calculated to be 0.48g with a deaggregated moment magnitude (Mw) of 6.6. We have used this ground acceleration and earthquake magnitude in our liquefaction analysis.

3.5 Seismic Hazards

3.5.1 Fault Rupture

Based on available literature and reports, no known active faults are known to traverse the project site, and the site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. As such, the principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in the region as discussed in Section 3.4.

3.5.2 Liquefaction

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading.

The site is located within an area designated as potentially liquefiable on the *California Seismic Hazard Zone Map* (CDMG, 1998). We have performed liquefaction analysis of the soil profiles encountered at Borings A-09-101 through A-09-103 and the profile obtained from the interpretation of the field data collected from CPT-09-104 through CPT-09-110. Our borings and CPTs encountered loose to medium dense sand and silty sand and medium stiff to stiff clay below the historically high groundwater table of 30 feet below the street grade.

The liquefaction analysis was performed using procedures outlined by Youd et al. (2001) and in accordance with the guidelines in the *Special Publication 117*. The historically high groundwater level and a peak ground acceleration of 0.48g with a moment magnitude (Mw) of 6.6 were used in the analysis.

The effect of liquefaction is expected to be settlement due to the post-liquefaction consolidation of the soils that experience liquefaction in response to the seismic event. We have used the procedure described by Tokimatsu and Seed (1987) to calculate the liquefaction-induced settlement. The results of our analysis indicate the presence of sandy soil layers between approximately 30 and 55 feet below the existing street grade that are potentially susceptible to liquefaction. The results of

our liquefaction analysis are summarized in Table 4 and the details are shown in Appendix B.

Table 4 – Results of Liquefaction Analysis

CPT / Boring No.	Type of Structure	Depth of Liquefiable Layers (feet)	Liquefaction induced settlement (inches)	Seismic Dry Settlement (inches)	Total Seismic Settlement (inches)
CPT-09-104	Retaining Wall No. 275	41 to 50 57 to 59	0.4	0.2	0.6
CPT-09-108		40 to 55	0.2	0.2	0.4
A-09-101		35 to 40 50 to 55	1.0	0.6	1.6
CPT-09-105		40 to 46 51 to 53	0.4	0.3	0.7
CPT-09-109		34 to 48 50 to 56	0.3	0.3	0.6
CPT-09-106	Retaining Wall No. 293	32 to 38 41 to 56	1.1	0.3	1.4
CPT-09-110		34 to36 43 to 52	0.3	0.2	0.5
A-09-102		35 to 45 55 to 60	2.5	0.5	3.0
CPT-09-107		30 to 34 38 to 50	1.5	0.3	1.7
A-09-103		45 to 65	4.0	0.6	4.7

3.5.3 Seismically Induced Settlement

Seismically induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). This settlement occurs primarily within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event.

As noted in Table 4, the total seismic settlement calculated using the boring data is higher than the CPT data. A CPT sounding yields several hundred continuous data points throughout the soil column, producing a more realistic model of the actual soil profile. SPT sampling from borings generally yields data points at 5-foot intervals; consequently, each data point must be used to estimate the soil

characteristics over a representative 5-foot thick layer. If the SPT data point indicates a potentially liquefiable condition, it is assumed that the liquefiable condition exists over the entire representative layer, often an overly conservative assumption. Based on the results of the liquefaction analyses, the seismically induced settlement for RW No. 275 was estimated to be on the order of ½ inch for the CPTs and 1½ inches for the boring. The seismically induced settlement for RW No. 293 was estimated to be on the order of ½ to 1½ inches for the CPTs and 3 to 4 inches for the borings. The differential settlement may be taken as half of the total settlement.

The magnitude of the estimated settlement for RW No. 275 is considered relatively minor, especially considering that the potentially liquefiable layers are relatively thin. For RW No. 293, the seismically induced settlement could cause differential settlement and cracks on the wall. Based on our discussion with the structural engineer, we understand that the seismically induced settlement, if it occurs, is not expected to cause collapse or catastrophic failure of the proposed Type 1 retaining wall supported on a shallow foundation system.

If desired, the liquefaction potential of the soils can be reduced by in-situ ground improvement techniques such as vibro-replacement or deep soil mixing at the depths between 30 and 50 feet below the existing grade. Alternatively, the retaining walls may be supported by a deep foundation system that extends below the liquefiable soils. Since the potentially liquefiable layers are relatively deep and design of the deep foundation system would consider downdrag forces from the liquefaction zone and above, the deep foundation system may need to extend to a depth of 80 feet or greater. While the details of these methods have not been evaluated, the relevant cost could be very significant and mitigation of the seismically induced settlement for this widening project would face practical and constructability problems.

3.5.4 Seisches and Tsunami

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Based on the absence of enclosed bodies of water near the site and the inland location of the site, seiches and tsunami risks at the site are considered negligible.

3.6 Scour

Scour is not considered a design issue for the retaining walls since the site is not located in or near a river, creek or drainage channel.

3.7 Slope Stability

For our slope stability analyses, we have considered the profile at Station 25+00 of RW No. 275 where the proposed height of the retaining wall is 12 feet and the slope height behind the wall is 19 feet. This profile represents the worst case scenario in terms of the heights of the wall and slope. The slope stability analyses were performed using the Modified Bishop's method. For pseudo-static analysis, a horizontal seismic coefficient of 0.16g, approximately one third of the peak ground acceleration (Caltrans, 2004), was used. Our analysis indicates that the walls have a global factor of safety higher than 1.5 and 1.1 for static and pseudo-static conditions, respectively.

3.8 Embankment Fill Settlement

Imported fill of a maximum height of 12 feet will be placed on the existing embankment slope behind the proposed retaining walls for the widening of northbound SR-57. The new fill will be benched into the existing embankment fill.

Boring A-09-101 and CPT-09-104 encountered a thin layer of clay at approximately 5 to 10 feet below the existing grade. The subsurface soils below the clay layer consisted of sandy materials. The proposed fill height of the subject area will be generally 6 feet with a maximum height of approximately 10 feet. Consolidation settlement of the clay layer due to the new fill was estimated to be less than ½ inch.

The rest of the retaining walls are expected to be mostly underlain by sandy soils. The immediate settlement of the sandy soils was estimated to be less than 1 inch. Due to the nature of sandy soils, the immediate settlement is expected to occur during or within a short period after placement of the embankment fill.

3.9 Corrosion Potential

Representative samples of the subsurface soils were subjected to analytical testing to evaluate the potential for corrosion to concrete and ferrous metals. The test results are included in Appendix B and indicate the tested soils exhibited sulfate concentration of 55 to 81 parts per million (ppm), minimum resistivity of 3,171 to 12,143 Ohm-cm, chloride concentration of 33 to 41 ppm, and pH of 7.5 to 8.1. Caltrans specifications define a corrosive soil as a material in which any of the conditions exist: a chloride content greater than 500 ppm; soluble sulfate content greater than 2,000 ppm; or a pH of 5.5 or less. Based on the guidelines established by Caltrans, the subsurface soils along the proposed retaining walls are not considered corrosive.

4.0 FOUNDATION DESIGN RECOMMENDATIONS

Based upon our evaluation of the soils and geologic information, we conclude that the proposed project is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in the design and construction of the project. The recommendations in this report are considered minimum and may be superseded by more stringent requirements of the structural engineer and/or the governing agencies. Leighton should be notified, in a timely manner, of changes in the project plans that might impact recommendations in this report.

4.1 Allowable Bearing Capacity

Type 1 retaining walls are proposed for the project. The wall heights will range from 4 to 12 feet and, per *Standard Plan B3-1* (Caltrans, 2006d), the toe pressures of the walls range from 1.1 to 2.7 ksf. Based on our borings and CPTs, the subsurface soils at the foundation level of the proposed retaining wall are expected to consist of medium dense sand and silty sand. This soil will have an allowable soil bearing pressure of 3,000 psf for footings having a minimum width of 24 inches and a minimum embedment of 24 inches below the lowest adjacent ground surface. This allowable bearing capacity exceeds the toe pressure of the proposed Type 1 retaining wall.

Boring A-09-101 and CPT-09-104 encountered a thin layer of clay at approximately 5 to 10 feet below the existing grade. Consolidation settlement of the clay layer due to the load from the retaining wall was estimated to be less than ½ inch. The remaining area is underlain by sandy soils and the immediate settlement due the load from the retaining wall was estimated to be less than ¾ inch.

4.2 Lateral Earth Pressure and Load Resistance

Based on the provided plans, the proposed Type 1 retaining walls will have a 2H:1V (Horizontal:Vertical) backfill slope (Case II loading, 2H:1V unlimited slopes). The lateral "equivalent-fluid" earth pressure was calculated to be 50 pcf for an active condition. This value does not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design. The design value indicated above is based upon drained conditions. Proper drainage should be provided behind the walls in accordance with *Standard Plan B-03* (Caltrans, 2006d) to prevent buildup of hydrostatic pressure behind the walls. Type 1 retaining wall should be designed in accordance with *Standard Plan B3-1* (Caltrans, 2006d).

Resistance to lateral loads can be provided by friction acting at the base of the foundation and by passive earth pressure, and should be calculated in accordance with Section 5.6.4 of *Bridge Design Specifications* (Caltrans, 2004). A coefficient of friction of 0.45 may be used to calculate the frictional resistance. For a level condition, a passive lateral equivalent fluid pressure of 400 psf per foot of depth up to a maximum of 3,500 psf may be used for sides of the foundation poured against competent native soil. Not more than 50 percent of the available passive earth pressure should be considered in the calculation of the lateral load resistance. Additionally, the lateral passive resistance is taken into account only if it is ensured that the soil against embedded structures will remain intact with time.

4.3 Embankment Fill

Based on the existing topography at the site, widening of northbound SR-57 will require imported fill. The imported materials within the upper 4 feet of roadway finished grade should have a minimum R-value of 40 and should be non-corrosive. Class 3 aggregate subbase can be used for the imported material within the upper 4 feet of roadway finished grade. Additionally, the backfill material behind the proposed retaining walls should have a minimum angle of internal friction of 34 degrees and should be non-corrosive.

The slopes of the existing embankments should be benched into a minimum of 6 feet horizontally as the new fill is brought up in layers. Excavated material should be recompacted along with the new embankment material. All materials and placement should conform to Sections 19-6 and 19-7 of Caltrans *Standard Specifications*.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Construction Advisories

On-site soils are considered rippable and excavations are feasible with conventional excavation equipment.

5.2 Construction Considerations that Influence Specifications

Slopes to receive erosion control should have all loose rocks larger than 2 inches in maximum dimension, roots and other debris on the surface removed and disposed of prior to applying erosion control materials.

The contractor should be aware of water pollution control work as defined in "Section 7-1.01G, Water Pollution" in Caltrans *Standard Specifications*.

5.3 Pre-Construction Survey and Construction Monitoring

Prior to any site work and excavations, conditions of existing structures and improvements that may be impacted by the construction should be surveyed and photo/video documented. Structures and improvements that are to be left in-place and within a distance equal to the height of excavations, including back cuts for retaining walls, should be surveyed prior to start of construction and monitored during construction.

Final project Plans and Specifications should be reviewed prior to construction to verify that the full intent of the recommendations presented in this Geotechnical Design Report have been incorporated. Following review of Plans and Specifications, sufficient and timely observation during construction should be performed by a qualified geotechnical consultant to correlate findings of the exploration with actual subsurface conditions exposed during construction.

5.4 Differing Site Conditions

Soil and groundwater conditions were observed and interpreted at the exploration locations only. This information was used as the basis of analyses and recommendations provided herein. Conditions may vary between the exploration locations and seasonal fluctuations in the groundwater level may occur due to variations in rainfall and local groundwater management practices. If conditions encountered during construction differ from those described herein, our recommendations may be subject to modification.

6.0 EARTHWORK RECOMMENDATIONS AND SPECIFICATIONS

6.1 Grading and Earthwork

All grading and earthwork activities should be performed in accordance with the applicable portions of Sections 16 and 19 of the latest Caltrans *Standard Specifications* and the recommendations contained in this report.

6.2 Clearing and Grubbing

Debris, organic material or other unsuitable material should be removed and disposed of in accordance with Sections 16 and 19-2.02 of Caltrans *Standard Specifications*, or the material can be removed and delivered to an approved sanitary landfill.

6.3 Materials Specifications

All engineered fill, including imported soils, to be used in this project should be well-graded soils with a maximum dimension of 4 inches and less than 50 percent passing the No. 200 sieve, free of organic and other deleterious debris, non-corrosive, essentially non-plastic (Liquid Limit less than 30, Plasticity Index less than 12), and with an Expansion Index (EI) of less than 50. In general, well-graded mixtures of gravel, sand, and non-plastic silt meeting the above requirements are acceptable for use as general embankment fill. Additionally, imported material within the upper 4 feet of the roadway finished grade for the proposed widening should have R-value greater than 40. Backfill material behind the retaining walls should have a minimum angle of internal friction of 34 degrees.

Structure backfill should conform to Section 19-3.06 of Caltrans *Standard Specifications*. All structure backfill (including fill placed behind walls) should be placed in thin, loose lifts, moisture-conditioned, and compacted per Section 19-5.03 of Caltrans *Standard Specifications*. Ponding and jetting of structure fill should not be allowed.

6.4 Fill Placement and Compaction

Loose soils, if encountered at footing subgrade, should be removed to competent material and recompacted. Onsite soils to be used as compacted structural fill should be free of organic material and/or construction debris. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches for structural fill placement, moisture-conditioned as necessary to within three percent above optimum, and compacted to a minimum of 90 percent of the maximum density as determined by Caltrans Test Method 216. Embankment fill within 150 feet of bridge abutment should be compacted to a minimum of 95 percent relative compaction. Crushed aggregate base should be compacted to a minimum of 95 percent relative compaction. Subgrade within a depth of 30 inches below the finished grade should also be compacted to at least 95 percent relative compaction. Earthwork should be in accordance with Section 19 of Caltrans *Standard Specifications.*

6.5 Geotechnical Observation

It is recommended that observation and testing be performed by the geotechnical engineer's representative during the following stages of construction:

- Grading operations, including excavations and fill placement;
- Excavations for utility trenches;
- Placement of utility trench bedding and backfill;
- Removal of buried utilities or structures, if any;
- Subgrade preparation and pavement construction; and
- When any unusual conditions are encountered.

7.0 REFERENCES

The following references were used in preparation of this report:

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — DYAN CHANDRA — No. 2376 — Exp. 6/30/11 — GEOTECHNICAL — STATE OF CALIFORNIA

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ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

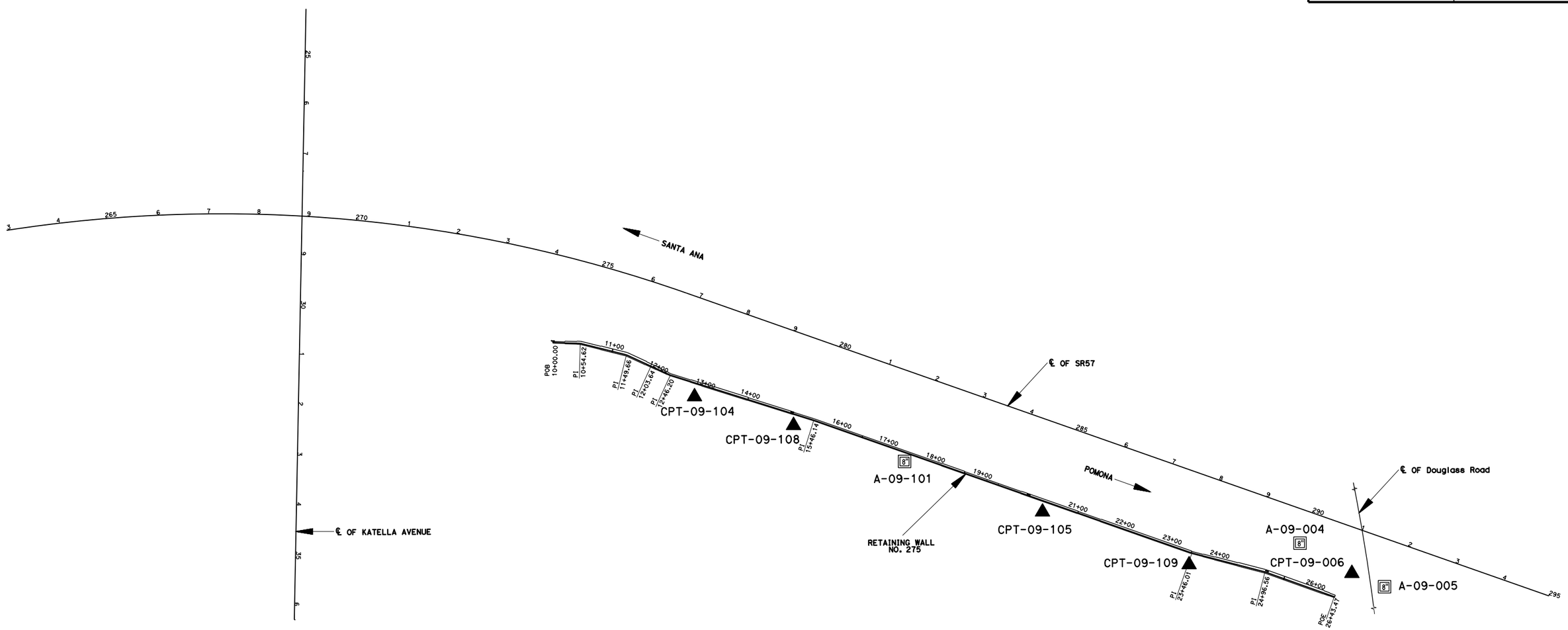
LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual.

PLAN VIEW
Scale: 1"=100'



ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	RETAINING WALL NO. 275
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY:	DESIGN BRANCH	POST MILES 12.5/13.0	LOG OF TEST BORINGS 1 — R-27
NAME:	CHECKED BY: T. KIM	Amit Bakane			

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => RW-Sheet-1 of 8.dgn

USERNAME => bbrown DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:04

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — DYAN CHANDRA — No. 2376 — Exp. 6/30/11 — GEOTECHNICAL — STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

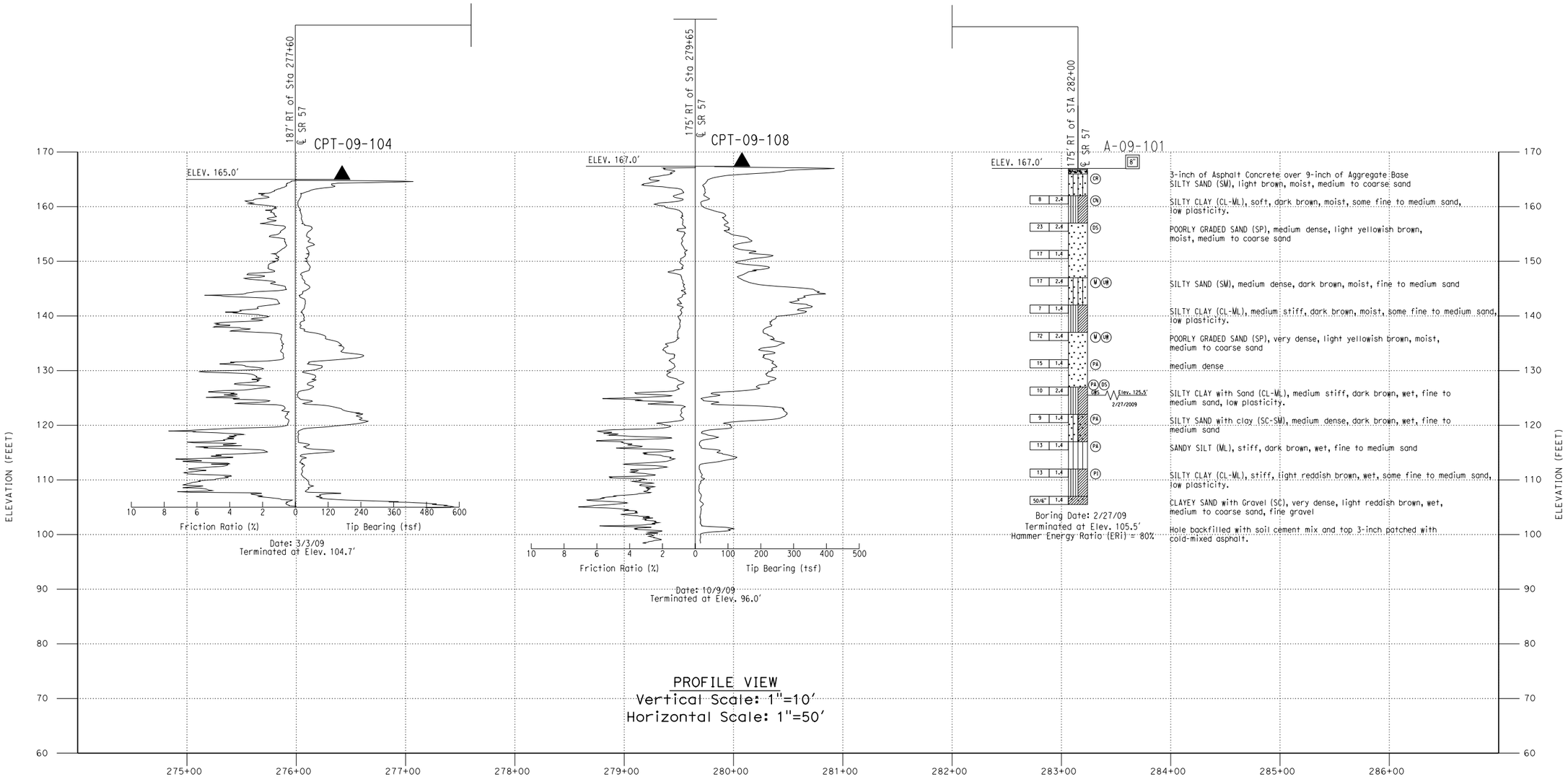
LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

FOR PLAN VIEW SEE "RETAINING WALL NO. 275, LOG OF TEST BORINGS 1 OF 8"



Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	RETAINING WALL NO. 275
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY:	DESIGN BRANCH	POST MILES 12.5/13.0	LOG OF TEST BORINGS 2 — R-28
NAME:	CHECKED BY: T. KIM	Amit Bakane			

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET — OF

FILE => RW-Sheet-2-3 of 8.dgn

USERNAME => btran DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:06

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DYAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

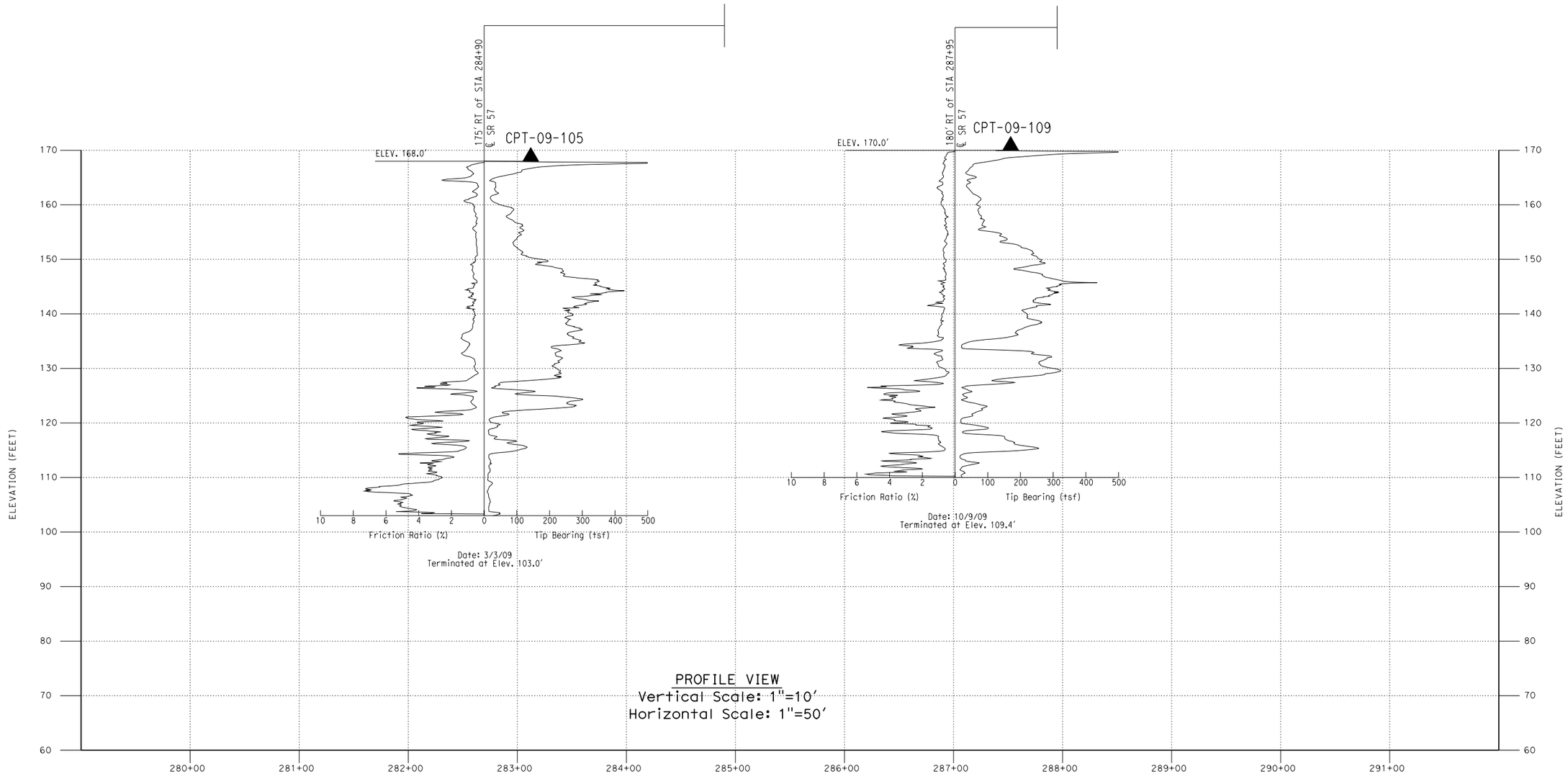
LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

FOR PLAN VIEW SEE "RETAINING WALL NO. 275, LOG OF TEST BORINGS 1 OF 8"



Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILES 12.5/13.0	RETAINING WALL NO. 275 LOG OF TEST BORINGS 3	R-29
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY: Amit Bakane				
NAME:	CHECKED BY: T. KIM					

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

FILE => RW-Sheet-2-3 of 8.dgn

DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:08
USERNAME => bstran

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — DIAN CHANDRA — No. 2376 — Exp. 6/30/11 — GEOTECHNICAL — STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
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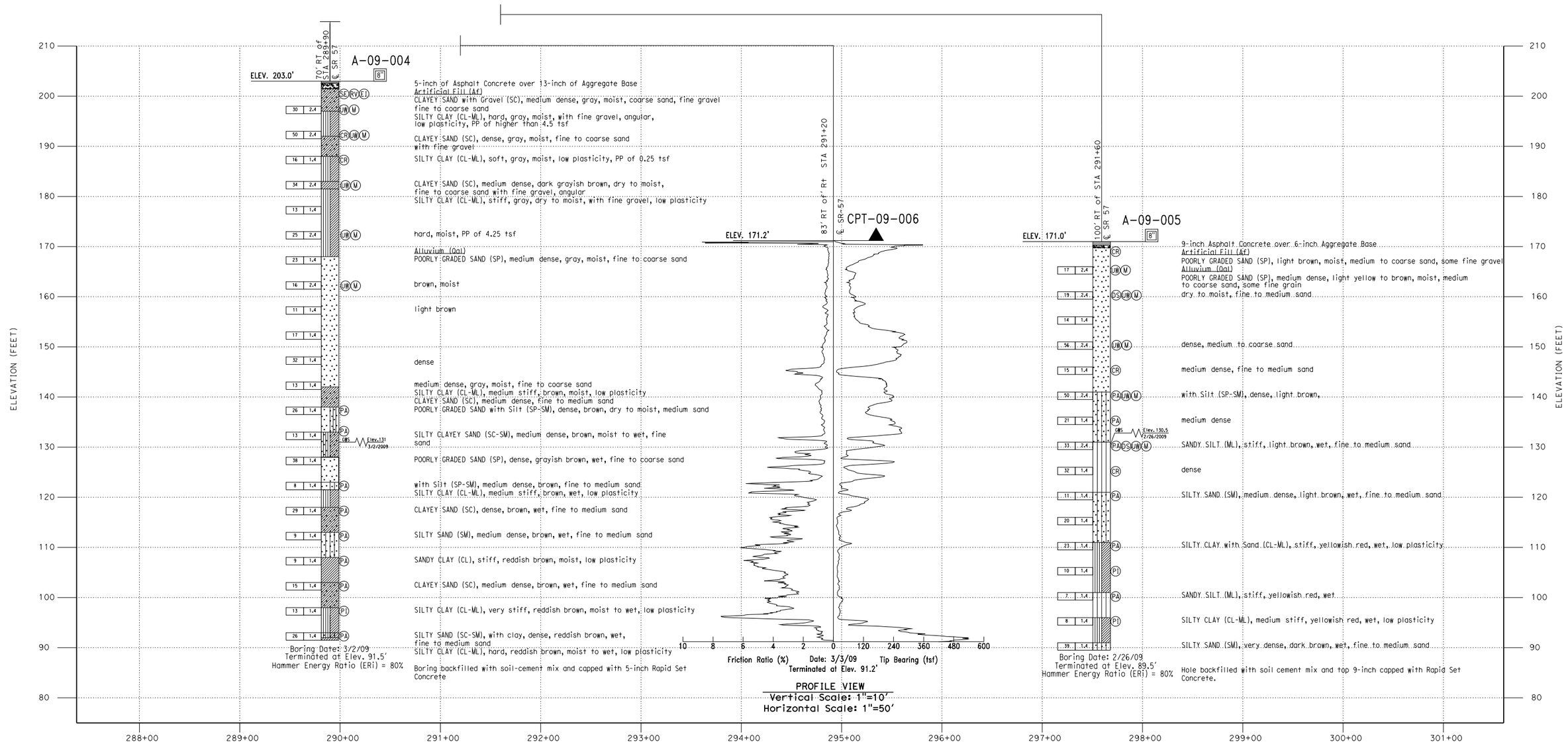
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

FOR PLAN VIEW SEE "RETAINING WALL NO. 275, LOG OF TEST BORINGS 1 OF 8"



ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILES 12.5/13.0	RETAINING WALL NO. 275 LOG OF TEST BORINGS 4	R-30
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY:				
NAME:	CHECKED BY: T. KIM	Amit Bakane				
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 12231 EA 0F0401	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES	SHEET OF

FILE => RW-Sheet-4 of 8.dgn

DATE PLOTTED => 17-FEB-2010 TIME PLOTTED => 11:08

USER NAME => btran

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DIAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
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ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

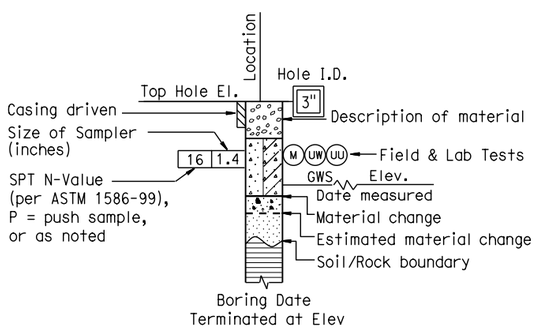
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
[ ]	O	Other

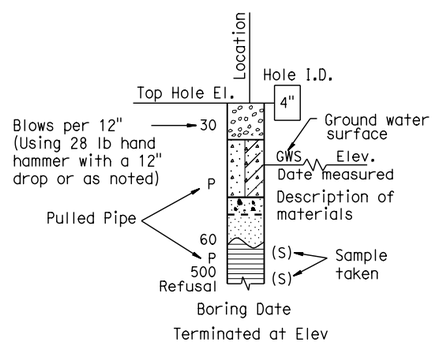
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

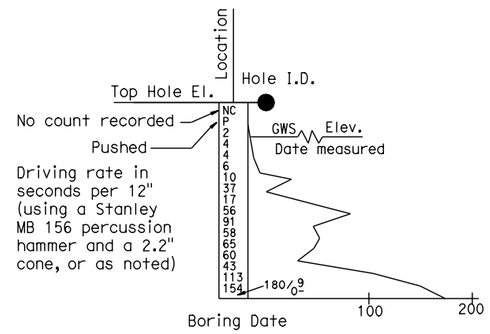
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



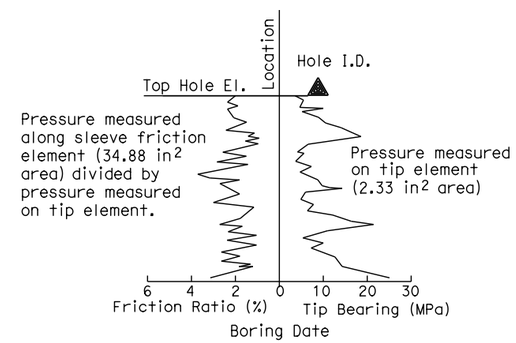
DRY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE 12.5/13.0	RETAINING WALL NO. 275 LOG OF TEST BORINGS 5	R-31
PREPARED BY	BUU TRAN					
CHECKED BY	T. KIM					

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => RW-Sheet-5 of 8.dgn

USERNAME => btran DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:10

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DIAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

ENGINEERING SERVICES | GEOTECHNICAL SERVICES

PREPARED BY: BUU TRAN
CHECKED BY: T. KIM

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO.
POST MILE 12.5/13.0

RETAINING WALL NO. 275
LOG OF TEST BORINGS 6

R-32

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => RW-Sheet-6 of 8.dgn

USERNAME => btran DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:13

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	ORA	57,91	12.5/15.6, 5.9/7.0	285	443

A. E. Bacher
DIVISION ENGINEER SUPERVISOR — ASSISTANT CIVIL ENGINEER AND BRIDGE
DATE APPROVED December 18, 1972

BENCH MARK

B.M. #15-ORA-61 — Elev. 150.75
Standard Orange County survey monument at station 24+16 E.C. ℄ Katella Ave.

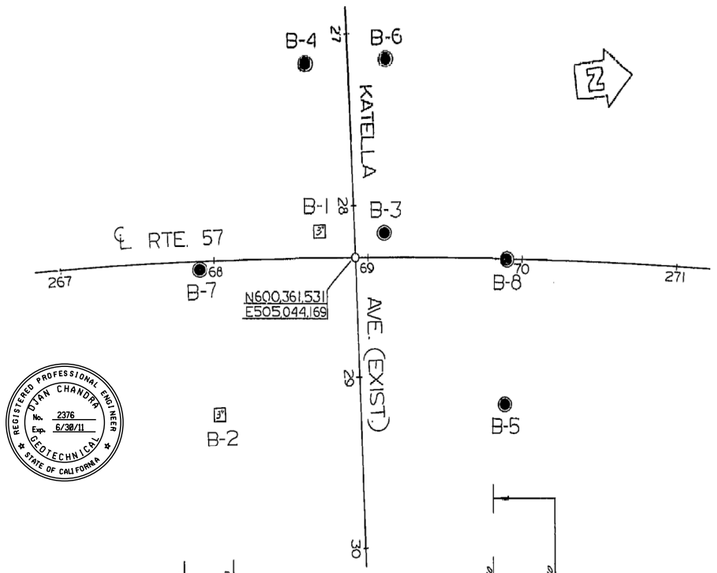
To convert to current datum NAVD88, approximately 2.5 feet should be added to the as-built elevations.

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	12.5/13.0		
REGISTERED ENGINEER-GEOTECHNICAL					
RETAINING WALL NO. 275					
LOG OF TEST BORINGS 7					R-33
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU: 12231 EA: 0F0401		BRIDGE NO.

REGISTERED PROFESSIONAL ENGINEER — ARAN CHANDRA — No. 2376 — Exp. 6/30/11 — GEOTECHNICAL — STATE OF CALIFORNIA

PLAN

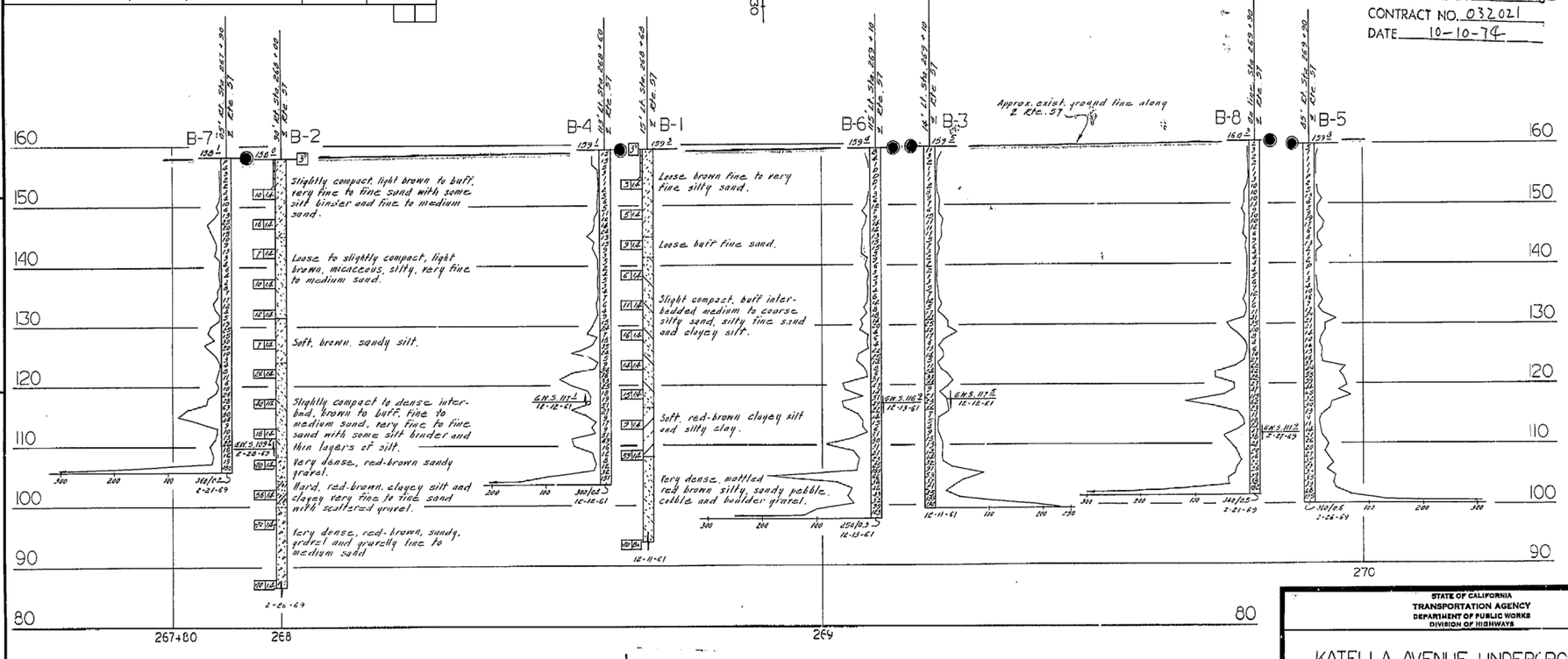
Scale: 1" = 40'



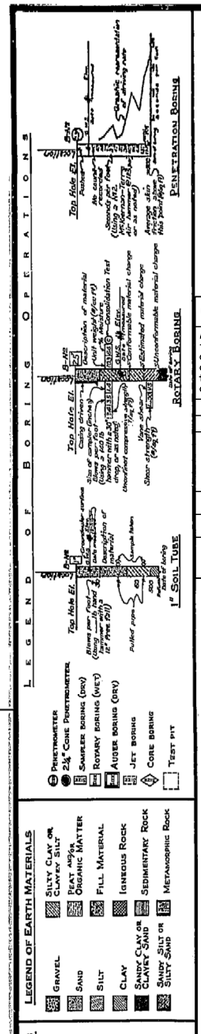
PROFILE

Scale: Vert. 1" = 10'
Horiz. 1" = 10'

NO AS BUILT changes
CORRECTIONS BY R. Strungs
CONTRACT NO. 032021
DATE 10-10-74



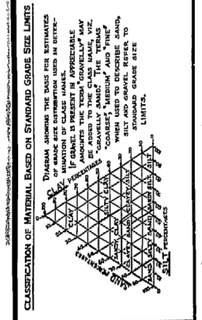
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

Gravel; Sand; Silt; Clay; Shale Clay or Clayey Sand; Sandy Silt or Silty Sand; Silty Clay or Clayey Silt; Peat and/or Organic Matter; Fill Material; Igneous Rock; Sedimentary Rock; Metamorphic Rock

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS



NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

FIELD STUDY	By H. C. Lin	2-27-69
DRAWN	By J. Lee	3-13-69
CHECKED	By H. C. Lin	5-14-69

Approved Recommended: Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000 6373

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

KATELLA AVENUE UNDERCROSSING

LOG OF TEST BORINGS

BRIDGE NO.	55-501	POST MILE	12.5	DRAWING NO.	SHEET 17 OF 17

WO 032021
CU 07206

Disregard prints bearing earlier revision dates → REVISION DATES (PRELIMINARY STAGE ONLY) 10/1/74

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 1/20/06 — SIGNATURE — TITLE

FED. ROAD DIV. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
7	CAL.				

DIST.	COUNTY	ROUTE	SECTION	SHEET NO.	TOTAL SHEETS
VII	Ora	57	12.5/13.0	300	443

R.E. Bacher
REGISTERED CIVIL ENGINEER

DATE APPROVED December 18, 1972

REGISTERED PROFESSIONAL ENGINEER JOAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	12.5/13.0		

REGISTERED ENGINEER-GEOTECHNICAL

RETAINING WALL NO. 275

LOG OF TEST BORINGS 8 — R-34

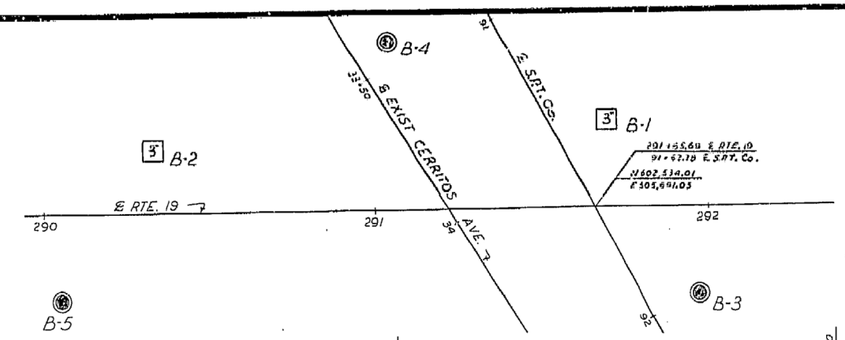
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA — CU: 12231 EA: 0F0401 — BRIDGE NO.

BENCH MARK #12-19A-56

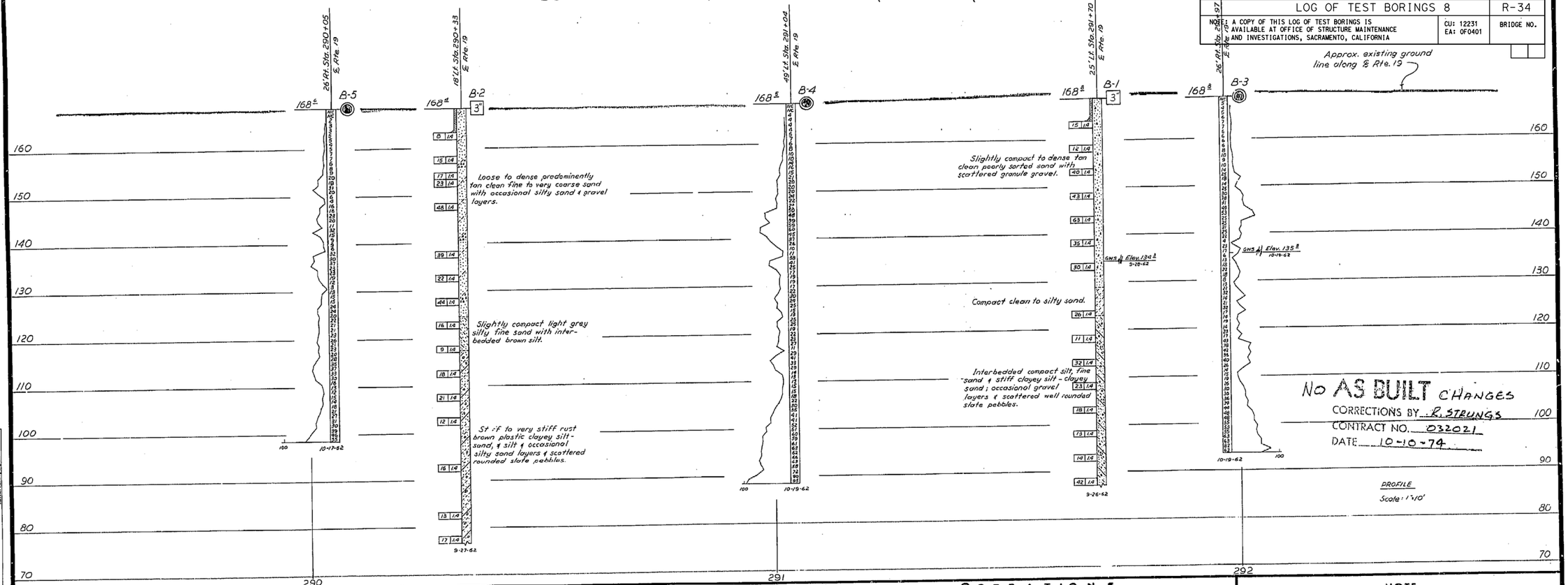
C.S.T. & W. in E. side of 24" Euc tree, 3' above grnd. 27.5' S. of ℄ of Cerritos Ave. on ℄ Wasser Rd. prod., 71' N. & 27' E. of N.E. cor. of one-story frame house.

ELEV. 171.47

To convert to current datum NAVD88, approximately 2.5 feet should be added to the as-built elevations.



PLAN
Scale: 1"=20'



BRIDGE DEPARTMENT

DRAWN By: K. Tochino 11-19-62
CHECKED By: J. Eggen 11-19-62
Approval Recommended by: Bridge Maintenance Engineer
Bridge Maintenance Engineer

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

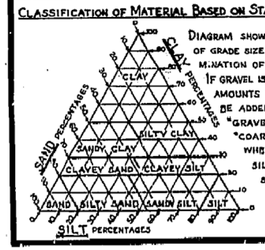


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

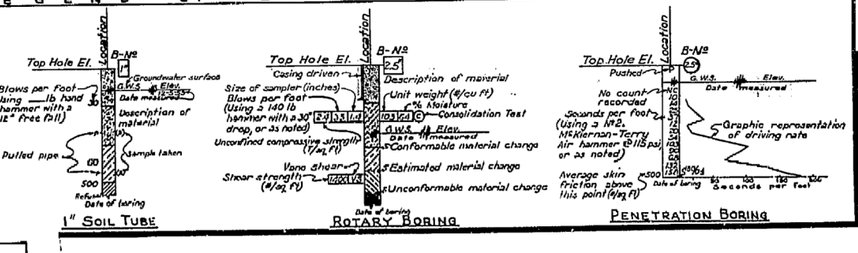
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ, "GRAVELLY SAND." THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND/OR ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PENETROMETER
- 2¼" CONE PENETROMETER
- SAMPLER BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT



NOTE

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

SHEET 15 OF 15

DOUGLASS OVERHEAD

LOG OF TEST BORINGS

SCALE As Noted | BRIDGE 55-337 | FILE | DRAWING

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000 6373

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 1/29/75 SIGNATURE

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
DYAN CHANDRA
No. 2376
Exp. 6/30/11
GEOTECHNICAL
STATE OF CALIFORNIA

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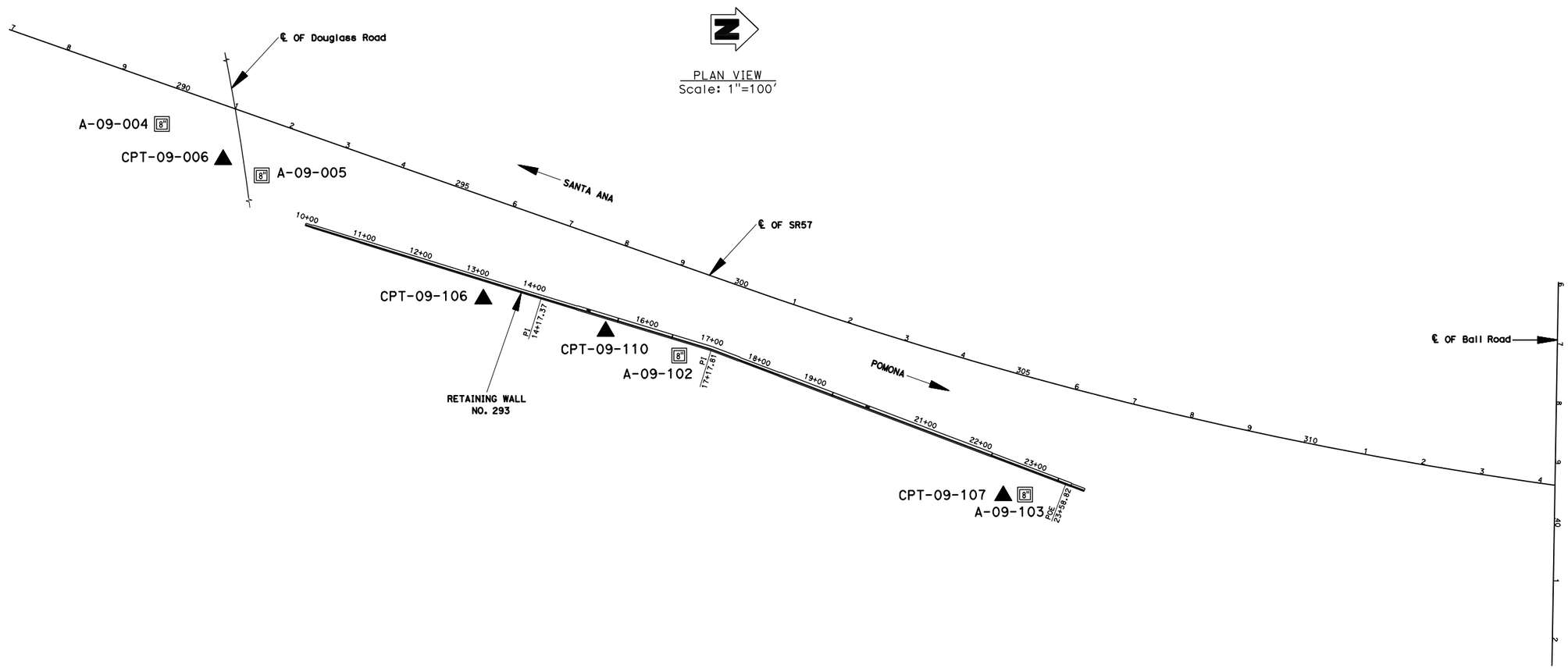
ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614



BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual.

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILES 13.0/13.4	RETAINING WALL NO. 293 LOG OF TEST BORINGS 1	R-35
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY: Amit Bakane				
NAME:	CHECKED BY: T. KIM					

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => RW-Sheet-1 of 8.dgn

USERNAME => btran DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:16

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DIAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

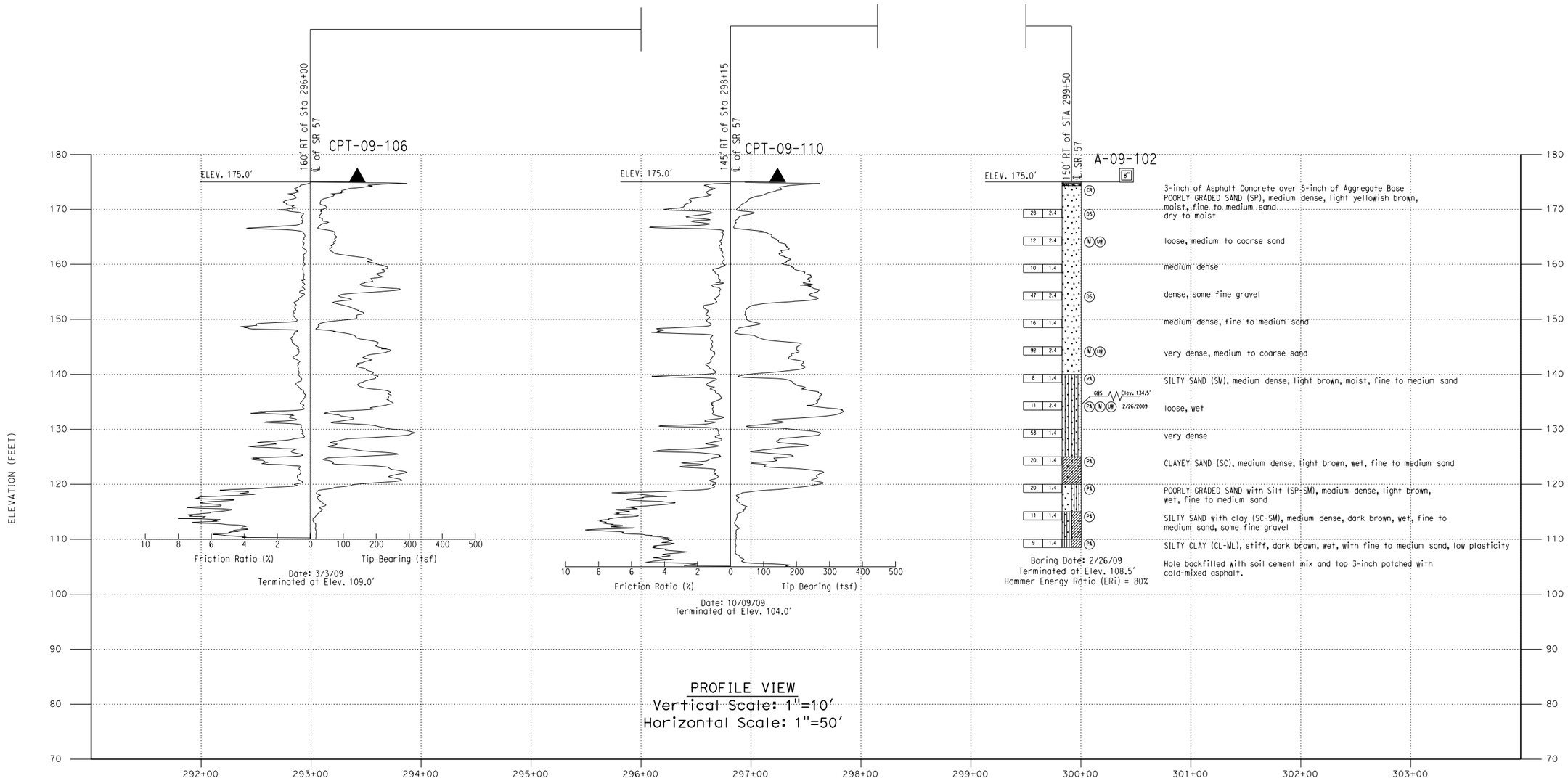
LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

FOR PLAN VIEW SEE "RETAINING WALL NO. 293, LOG OF TEST BORINGS 1 OF 8"



Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILES 13.0/13.4	RETAINING WALL NO. 293 LOG OF TEST BORINGS 2	R-36
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY: Amit Bakane				
NAME:	CHECKED BY: T. KIM					

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => RW-Sheet-2-3 of 8.dgn

USERNAME => btran DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:18

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DYAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

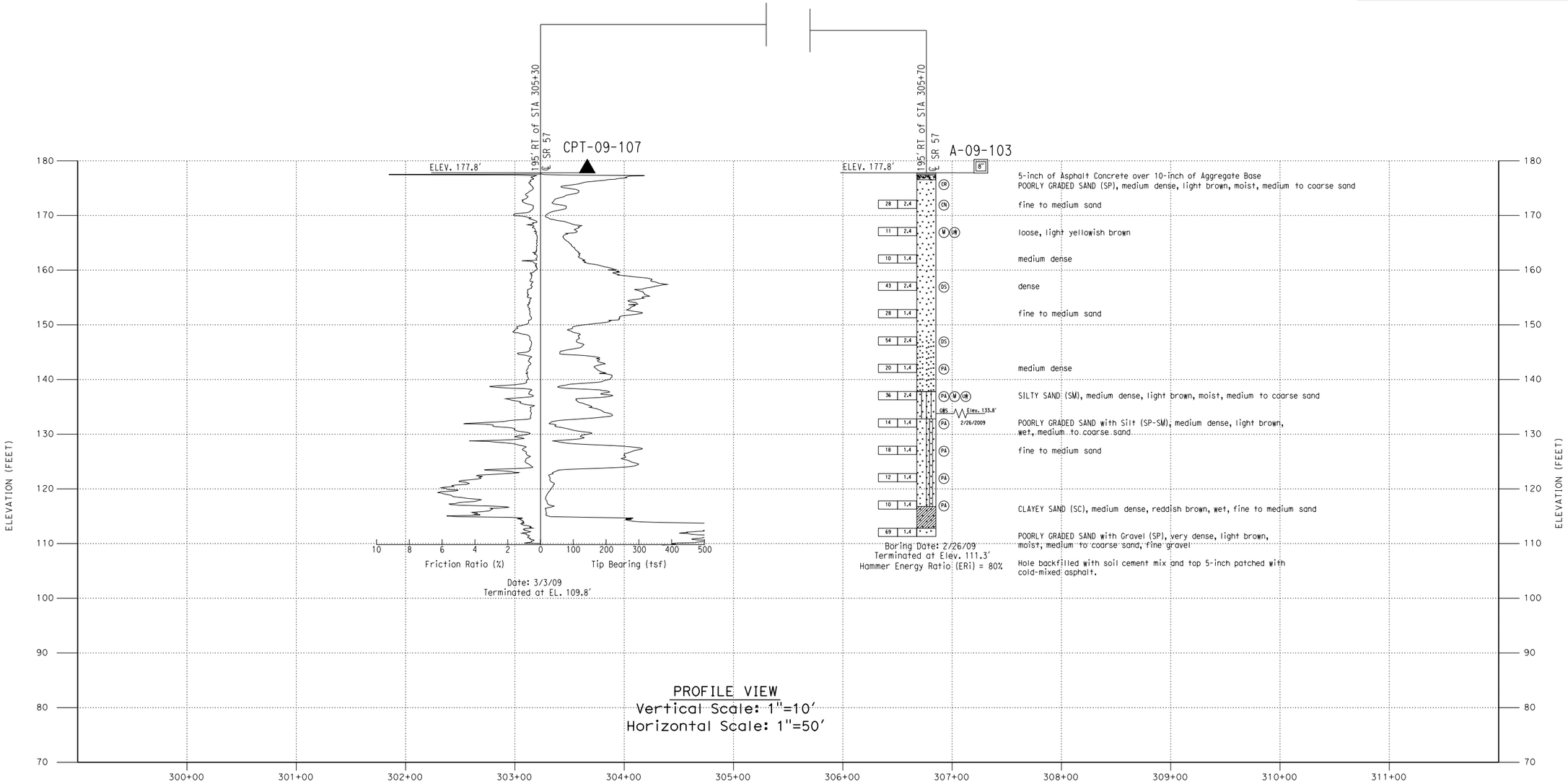
LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual. 2.4-inch diameter modified California Ring sampler and 1.4-inch diameter SPT sampler were used for field sampling.

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

FOR PLAN VIEW SEE "RETAINING WALL NO. 293, LOG OF TEST BORINGS 1 OF 8"



Conversion factor of 2.4-inch diameter sampler blow count to SPT blow count may be taken as 0.6 for cohesionless soils and 0.65 for cohesive soils.

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	RETAINING WALL NO. 293
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY:	DESIGN BRANCH	POST MILES 13.0/13.4	LOG OF TEST BORINGS 3 — R-37
NAME:	CHECKED BY: T. KIM	Amit Bakane			

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => RW-Sheet-2-3 of 8.dgn

USERNAME => bstran DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:19

BENCH MARK

ELEVATIONS SHOWN HEREON ARE BASED ON O.C.S. VERTICAL CONTROL DATA SHEET DESIGNATION 1K-29-80 AS ELEVATION 202.237'NAVD 88 (O.C.S. 2006 ADJUSTMENT), PER RECORDS ON FILE IN THE OFFICE OF THE COUNTY SURVEYOR.

This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging Classification and Presentation Manual.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — DYAN CHANDRA — No. 2376 — Exp. 6/30/11 — GEOTECHNICAL — STATE OF CALIFORNIA

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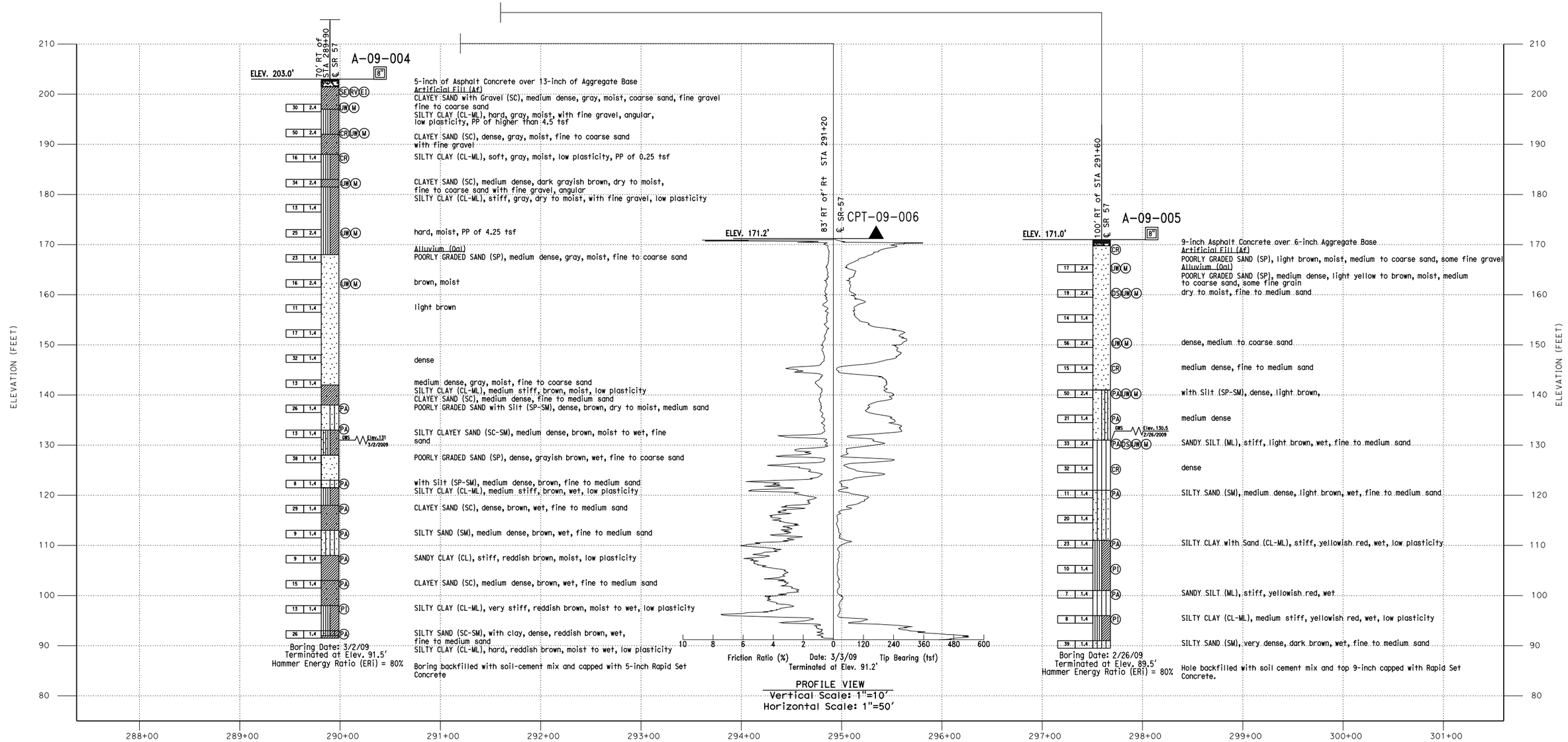
ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

FOR PLAN VIEW SEE "RETAINING WALL NO. 293, LOG OF TEST BORINGS 1 OF 8"



ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILES 13.0/13.4	RETAINING WALL NO. 293 LOG OF TEST BORINGS 4	R-38
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY:				
NAME:	CHECKED BY: T. KIM	Amit Bakane				
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 12231 EA 0F0401	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES	SHEET OF

FILE => RW-Sheet-4 of 8.dgn

DATE PLOTTED => 17-FEB-2010 TIME PLOTTED => 11:22

USER NAME => btran

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

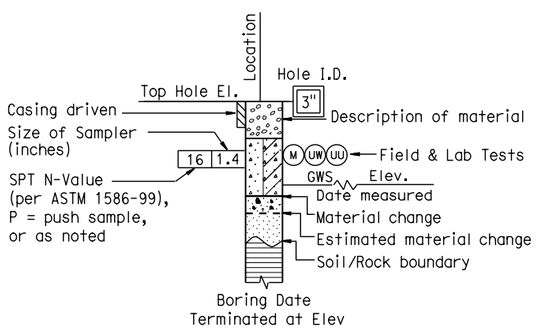
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
[ ]	O	Other

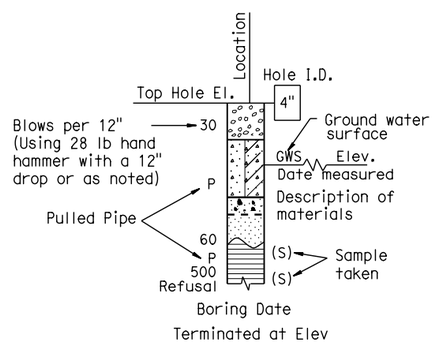
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

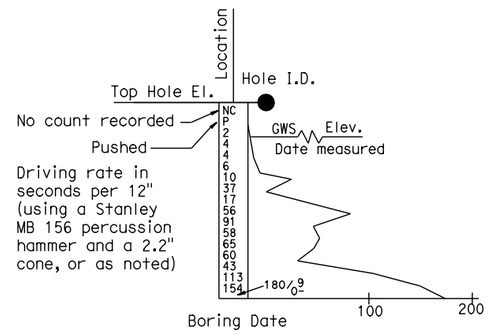
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



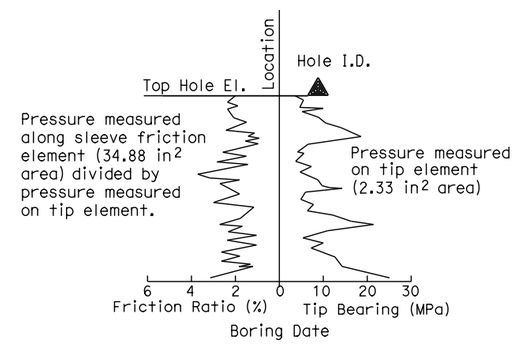
DRY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE 13.0/13.4	RETAINING WALL NO. 293 LOG OF TEST BORINGS 5	R-39
PREPARED BY	BUU TRAN					
CHECKED BY	T. KIM					

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => RW-Sheet-5 of 8.dgn

USERNAME => btran DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:21

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	12.2/15.2		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

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ORANGE COUNTY TRANSPORTATION AUTHORITY
550 SOUTH MAIN STREET
ORANGE, CA 92863

LEIGHTON CONSULTING INC.
17781 COWAN
IRVINE, CA 92614

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

ENGINEERING SERVICES | GEOTECHNICAL SERVICES

PREPARED BY: BUU TRAN
CHECKED BY: T. KIM

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO.
POST MILE 13.0/13.4

RETAINING WALL NO. 293
LOG OF TEST BORINGS 6

R-40

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12231
EA 0F0401

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

FILE => RW-Sheet-6 of 8.dgn

USERNAME => btran DATE PLOTTED => 12-FEB-2010 TIME PLOTTED => 11:23

FED. ROAD DIV. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
7	CAL.				

DIST.	COUNTY	ROUTE	SECTION	SHEET NO.	TOTAL SHEETS
VII	Ora	57	13.0/13.4	300	443

C.E. Barker
DATE APPROVED December 18, 1972

REGISTERED PROFESSIONAL ENGINEER JOHN CHANDLER No. 2376 Exp. 6/30/11 GEOTECHNICAL STATE OF CALIFORNIA

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	13.0/13.4		

REGISTERED ENGINEER-GEOTECHNICAL

RETAINING WALL NO. 293

LOG OF TEST BORINGS 7 — R-41

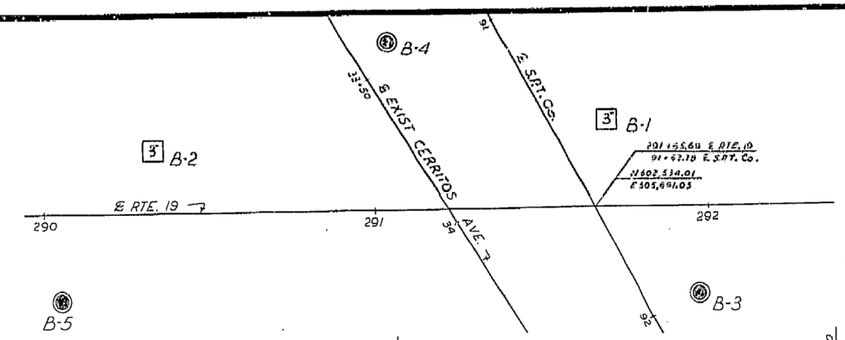
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA — CU: 12231 EA: 0F0401 — BRIDGE NO.

BENCH MARK #12-19A-56

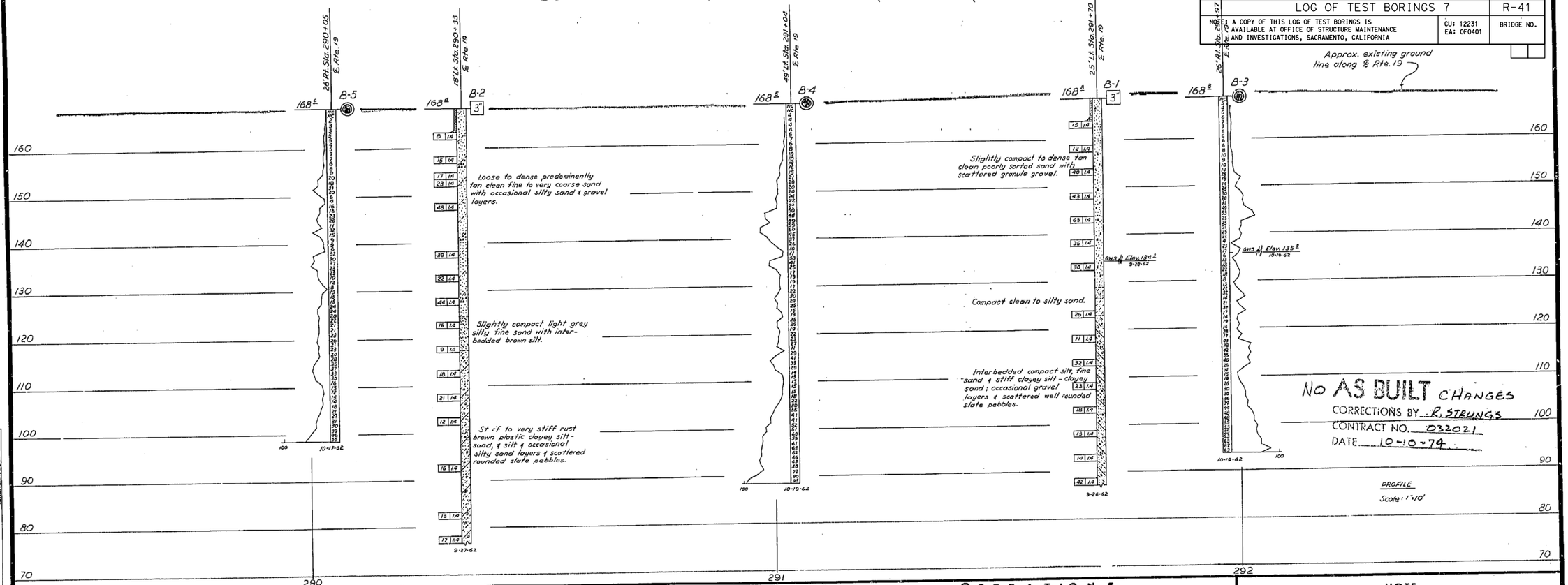
C.S.T. & W. in E. side of 24" Euc tree, 3' above grnd. 27.5' S. of ℄ of Cerritos Ave. on ℄ Wasser Rd. prod., 71' N. & 27' E. of N.E. cor. of one-story frame house.

ELEV. 171.47

To convert to current datum NAVD88, approximately 2.5 feet should be added to the as-built elevations.



PLAN
Scale: 1"=20'



BRIDGE DEPARTMENT

DRAWN By: K. Tochino 11-19-62
CHECKED By: J. Eggen 11-19-62
Approval Recommended by: Bridge Maintenance Engineer

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

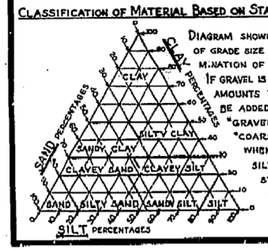


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

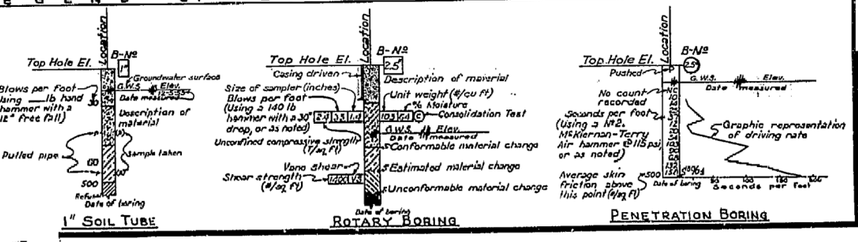
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ, "GRAVELLY SAND." THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND/OR ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PENETROMETER
- 2¼" CONE PENETROMETER
- SAMPLER BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT



NOTE

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

SHEET 15 OF 15

DOUGLASS OVERHEAD

LOG OF TEST BORINGS

SCALE As Noted | BRIDGE 55-337 | FILE | DRAWING

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000 6373

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 1/29/75 SIGNATURE

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	ORA	57,91	12.5/16.6; 6.9/7.0	311	443

A. E. Bachu
REGISTERED PROFESSIONAL ENGINEER — REGISTERED CIVIL ENGINEER NO. 8558
DATE APPROVED December 18, 1972

BENCH MARK

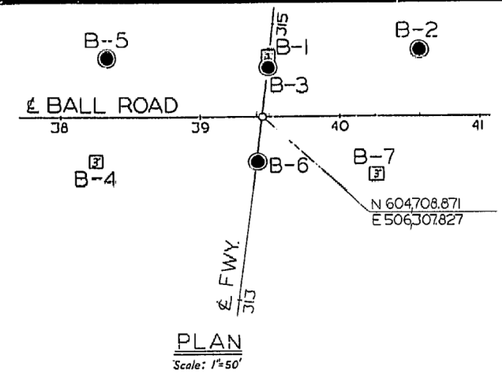
BM# J40-ANA-6J Elev 180.59

Fd city of Anaheim brass cap in south curb, 1 ft. east of end of curb return at southeast corner of Sunkist and Wagner No. 2700A.

To convert to current datum NAVD88, approximately 2.5 feet should be added to the as-built elevations.

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, licence number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	57	13.0/13.4		
REGISTERED ENGINEER-GEOTECHNICAL					
RETAINING WALL NO. 293					
LOG OF TEST BORINGS 8					R-42
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA				CU: 12231 EA: 0F0401	BRIDGE NO.

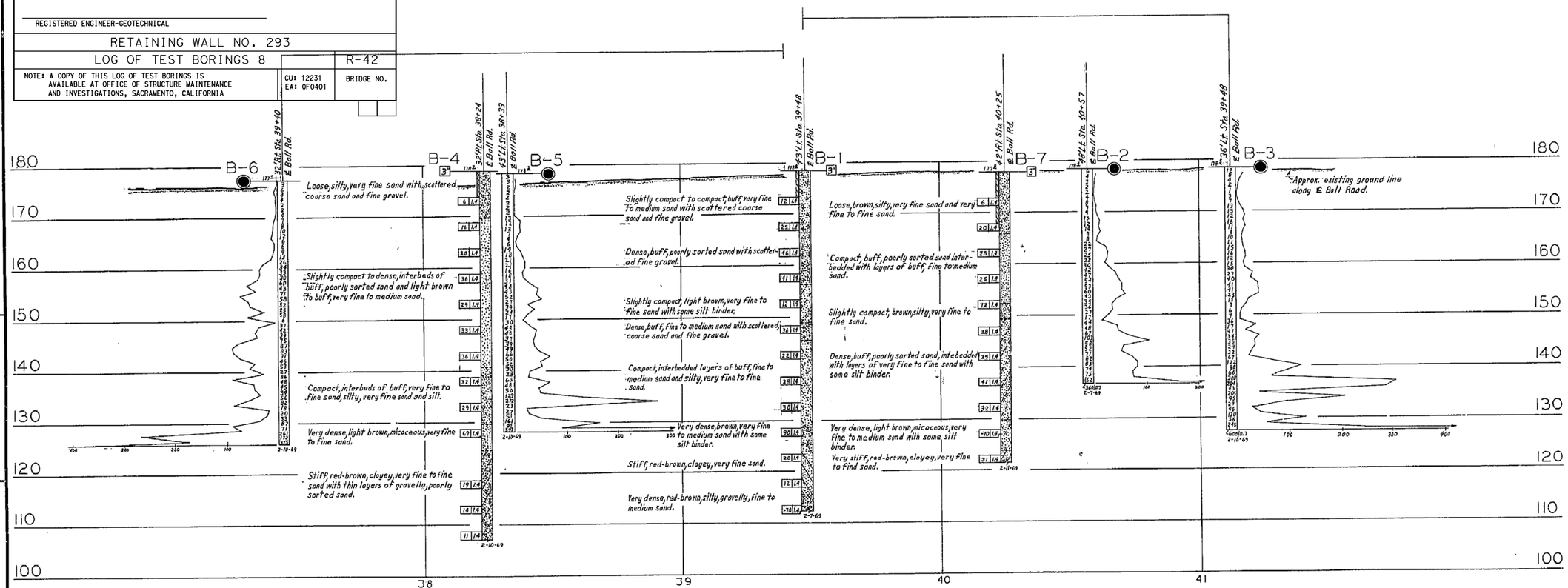
REGISTERED PROFESSIONAL ENGINEER — DYAN CHANDRA — No. 2376 — Exp. 6/30/11 — GEOTECHNICAL — STATE OF CALIFORNIA



PLAN

Scale: 1"=50'

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION DATE FEBRUARY 1969



PROFILE

Scale: Vert. 1"=10' Horiz. 1"=20'

No AS BUILT CHANGES
CORRECTIONS BY R. STRUNGS
CONTRACT NO. 032021
DATE 10-10-74

AS BUILT PLANS
Contract No. 07-032024
Date Completed
Document No. 07000-6373

LEGEND OF BORING OPERATIONS

Penetrometer; Cone Penetrometer; Sampler; Sampler Boring (Dry); Rotary Boring (Wet); Auger Boring (Dry); Jet Boring; Core Boring; Test Pit

LEGEND OF EARTH MATERIALS

Gravel; Sand; Silt; Clay; Silty Clay or Clayey Silt; Organic Matter; Fill Material; Igneous Rock; Sedimentary Rock; Sandy Clay or Clayey Sand; Sandy Silt or Silty Sand; Metamorphic Rock

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

Diagram showing the basis for estimates of grain size distribution and limits in determination of class names.

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

FIELD STUDY	by W. C. CAIN	2-11-69
DRAWN	by W. MARTIN	2-12-69
CHECKED	by R. GABRIEL	3-20-69

Approval Recommended by Charles E. Flow, Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

STATE OF CALIFORNIA
TRANSPORTATION AGENCY
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BALL ROAD OVEROSSING

LOG OF TEST BORINGS

BRIDGE NO.	POST MILE	DRAWING NO.	SHEET	OF
55-524	13.4		11	11

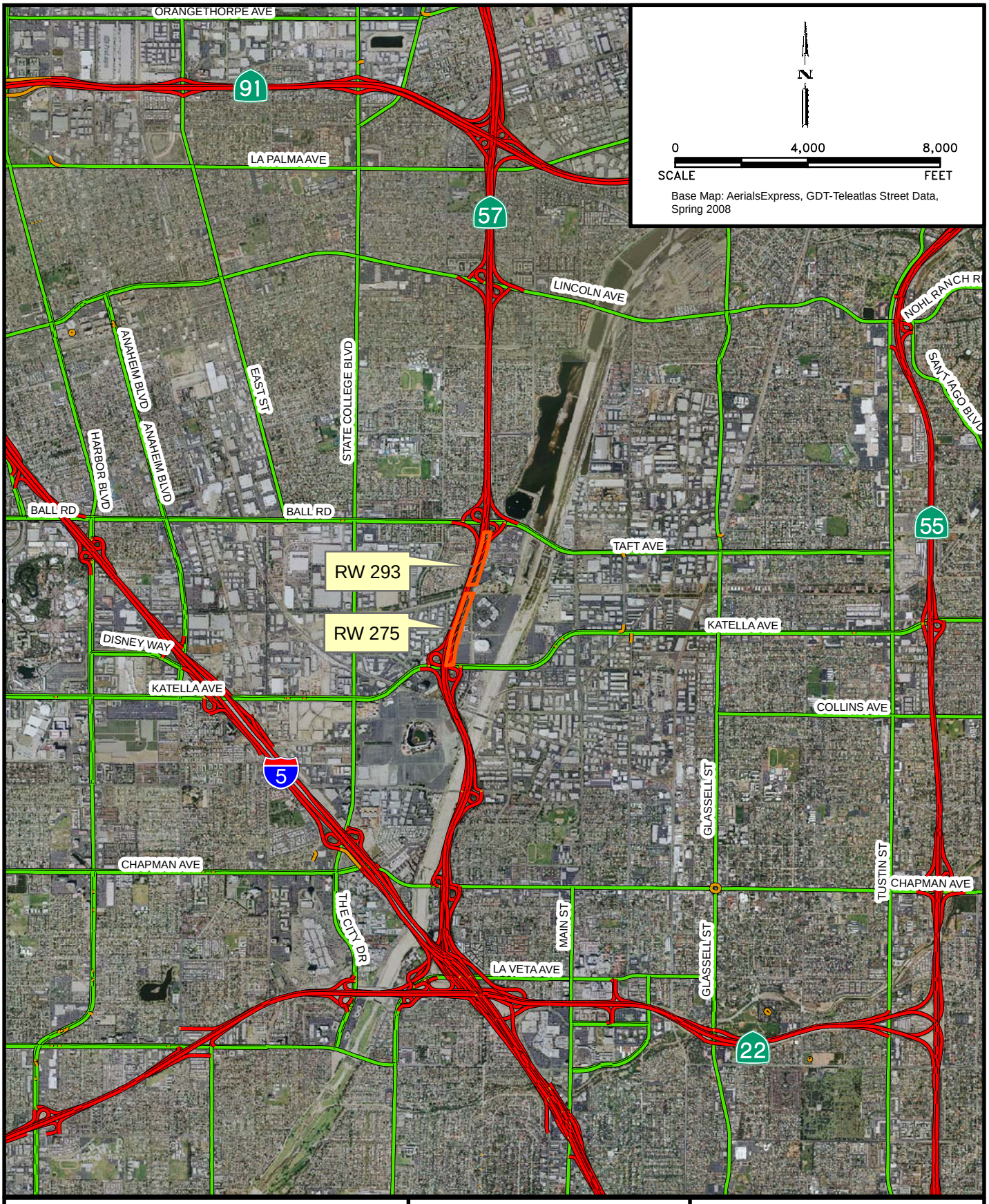
REVISION DATES (PRELIMINARY STAGE ONLY)

WO 032021
CU 07208

Disregard points bearing a date later than today's date

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

DATE 10-10-74 SIGNATURE [illegible] TITLE Materials Engineer



Proposed Type 1 Retaining Walls
Katella Avenue to Ball Road
SR-57 Northbound Widening
Orange County, California

SITE LOCATION MAP

Project No.
602231-002

Date
January 2010

Figure 1

\\geomatics\data2\Drafting\602231\002\GIS\of_2010-01-22\Figure1-SiteLocationMap.mxd

APPENDIX A

TABLE A-1
SUMMARY OF LABORATORY TEST RESULTS

				Gradation				Atterberg Limits		Shear Strength									
										Peak		Ultimate		Chemical Analyses					
Boring No.	Sample Type	Top of Sample (ft)	Bottom of Sample (ft)	Gravel (%)	Sand (%)	Silt (%)	Clay <5μm (%)	LL:PL:PI	Sand Equivalent	ϕ' (deg)	C' (psf)	ϕ' (deg)	C' (psf)	pH	Sulfate (ppm)	Chloride (ppm)	Resistivity (Ω-cm)	Expansion Index of Soil	R-Value
A-09-101	BULK	1	5											8.1	58	33	5600		
	RING	5	6.5																
	RING	10.0	11.5							41	125	28	100						
	SPT	35.0	36.5	95		5													
	RING	40.0	41.5	0	19	81				19	420	17	230						
	SPT	45.0	46.5	0	60	40													
	SPT	50.0	51.5	37		63													
	SPT	55.0	56.5					26:15:11											
A-09-102	BULK	1	5											7.7	55	31	12143		
	RING	5	6.5							31	180	30	10						
	RING	20.0	21.5							49	0	34	0						
	SPT	35.0	36.5	82		18													
	SPT	40.0	41.5	65		35													
	SPT	50.0	51.5	0	69	31													
	SPT	55.0	56.5	92		8													
	SPT	60.0	61.5	7	44	49													
	SPT	65.0	66.5	14		86													
A-09-103	BULK	1	5											7.5	81	41	3171		
	RING	5	6.5																
	RING	20.0	21.5							36	230	33	30						
	RING	30.0	31.5							31	950	30	350						
	SPT	35.0	36.5	95		5													
	RING	40.0	41.5	83		17													
	SPT	45.0	46.5	92		8													
	SPT	50.0	51.5	90		10													
	SPT	55.0	56.5	94		6													
	SPT	60.0	61.5	76		24													

NOTE: The laboratory tests were performed in general accordance with the following standards:

Sieve Analysis - ASTM D 422

Atterberg Limits - ASTM D 4318

Direct Shear Test - ASTM D 3080

Corrosivity Tests - DOT CA 532/643 - pH, DOT CA 417 - soluble sulfates, DOT CA 422 - chlorides, DOT CA 643- minimum resistivity

Leighton Consulting, Inc.

SR-57 Widening

Project No: 602231-002

Sheet 1 of 1

Boring No.	A-09-101	A-09-101	A-09-102	A-09-102
Sample No.	S-3	`	S-3	R-5
Depth (ft.)	35	50	35	40
Sample Type	SPT	SPT	SPT	Drive
Soil Identification	Light yellowish brown poorly-graded sand (SP)	Dark brown sandy silt s(ML)	Light brown silty sand (SM)	Light brown silty sand (SM)
Moisture Correction				
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00
Weight of Container (g)	1.00	1.00	1.00	1.00
Moisture Content (%)	0.00	0.00	0.00	0.00
Sample Dry Weight Determination				
Weight of Sample + Container (g)	749.34	557.20	604.39	652.82
Weight of Container (g)	249.66	148.15	137.88	140.95
Weight of Dry Sample (g)	499.68	409.05	466.51	511.87
Container No.:				
After Wash				
Method (A or B)	B	B	B	B
Dry Weight of Sample + Cont. (g)	725.16	299.45	521.58	471.85
Weight of Container (g)	249.66	148.15	137.88	140.95
Dry Weight of Sample (g)	475.50	151.30	383.70	330.90
% Passing No. 200 Sieve	**4.8**	**63.0**	**17.8**	**35.4**
% Retained No. 200 Sieve	95.2	37.0	82.2	64.6

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

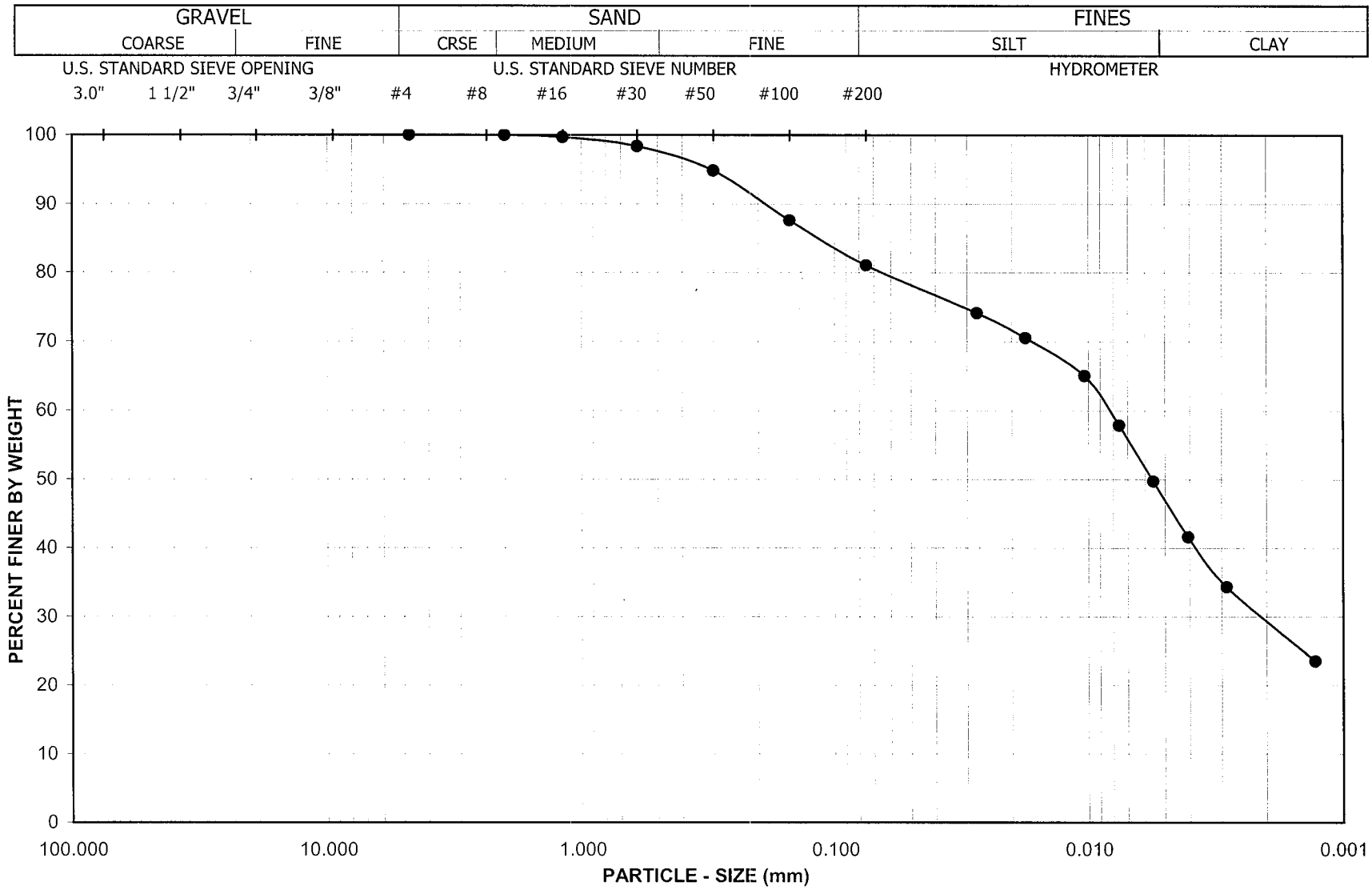
Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/05/09

Boring No.	A-09-102	A-09-102	A-09-103	A-09-103	A-09-103	A-09-103	A-09-103	A-09-103
Sample No.	S-6	S-8	S-3	R-5	S-4	S-5	S-6	S-7
Depth (ft.)	55	65	35	40	45	50	55	60
Sample Type	SPT	SPT	SPT	Drive	SPT	SPT	SPT	SPT
Soil Identification	Light brown poorly-graded sand with silt (SP)	Dark brown silty clay (CL)	Light brown poorly-graded sand (SP)	Light brown silty sand (SM)	Light brown sand with silt (SP)	Light brown sand with silt (SP)	Light brown sand with silt (SP)	Yellowish red clayey sand (SC)
Moisture Correction								
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weight of Container (g)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Moisture Content (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sample Dry Weight Determination								
Weight of Sample + Container (g)	451.63	528.55	478.85	471.90	597.67	586.82	481.88	523.52
Weight of Container (g)	126.67	154.70	138.57	133.06	140.12	144.88	135.75	137.82
Weight of Dry Sample (g)	324.96	373.85	340.28	338.84	457.55	441.94	346.13	385.70
Container No.:								
After Wash								
Method (A or B)	B	B	B	B	B	B	B	B
Dry Weight of Sample + Cont. (g)	426.17	206.00	460.57	414.26	560.02	544.28	460.55	429.72
Weight of Container (g)	126.67	154.70	138.57	133.06	140.12	144.88	135.75	137.82
Dry Weight of Sample (g)	299.50	51.30	322.00	281.20	419.90	399.40	324.80	291.90
% Passing No. 200 Sieve	**7.8**	**86.3**	**5.4**	**17.0**	**8.2**	**9.6**	**6.2**	**24.3**
% Retained No. 200 Sieve	92.2	13.7	94.6	83.0	91.8	90.4	93.8	75.7

Leighton

PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: SR-57 Widening
Project No.: 602231-002
Client Name: LCI / Irvine
Tested By: S. Felter Date: 03/04/09



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-101 Sample No.: R-5

Depth (feet) : 40.0 Soil Type : (CL)s

Soil Identification: Dark brown silty clay with sand (CL)s

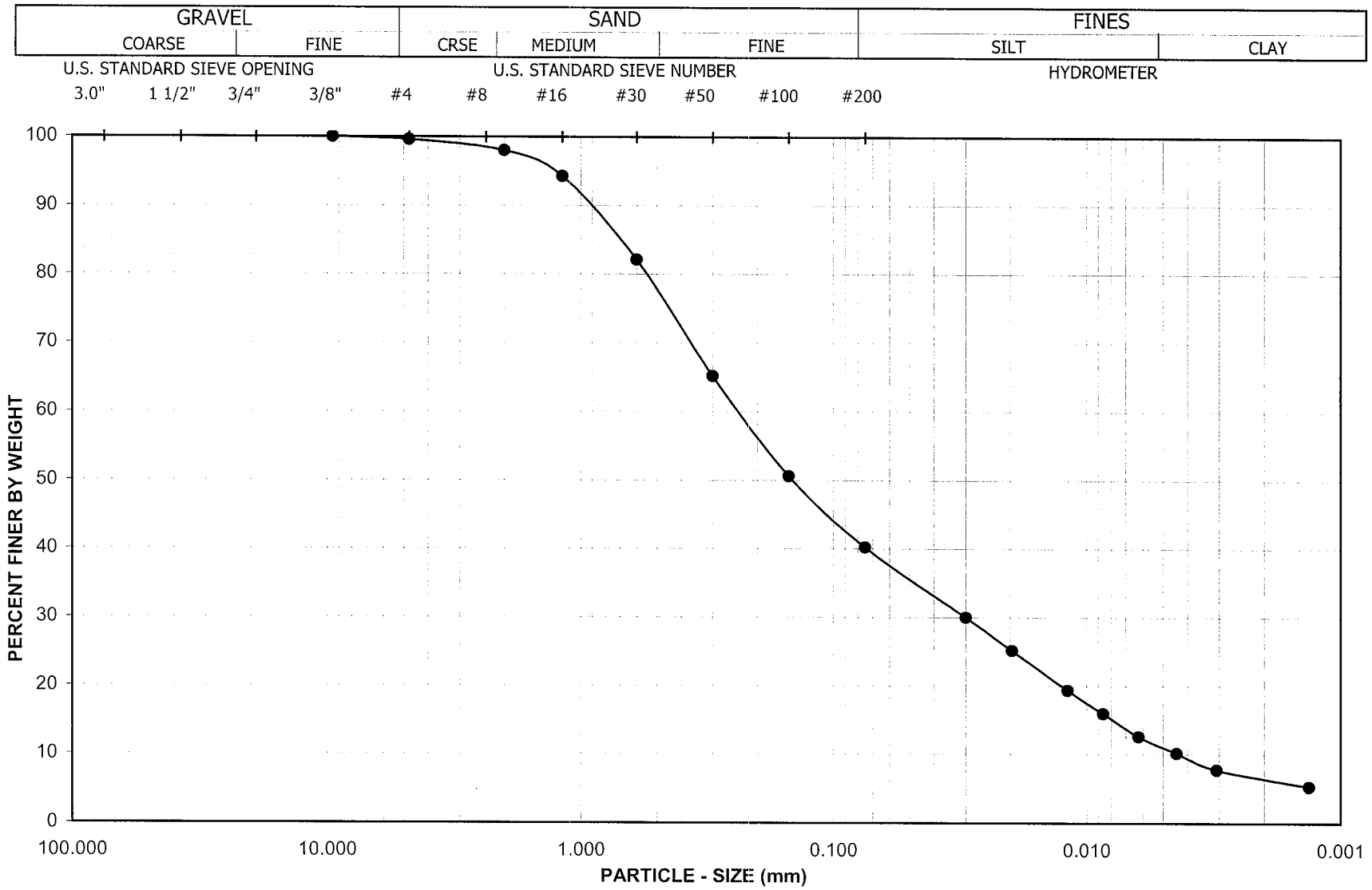
GR:SA:FI : (%) 0 : 19 : 81

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Oct-09

S&H RW-1 R-5.xls



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-101 Sample No.: S-4

Depth (feet) : 45.0 Soil Type : SM

Soil Identification: Dark brown silty sand (SM)

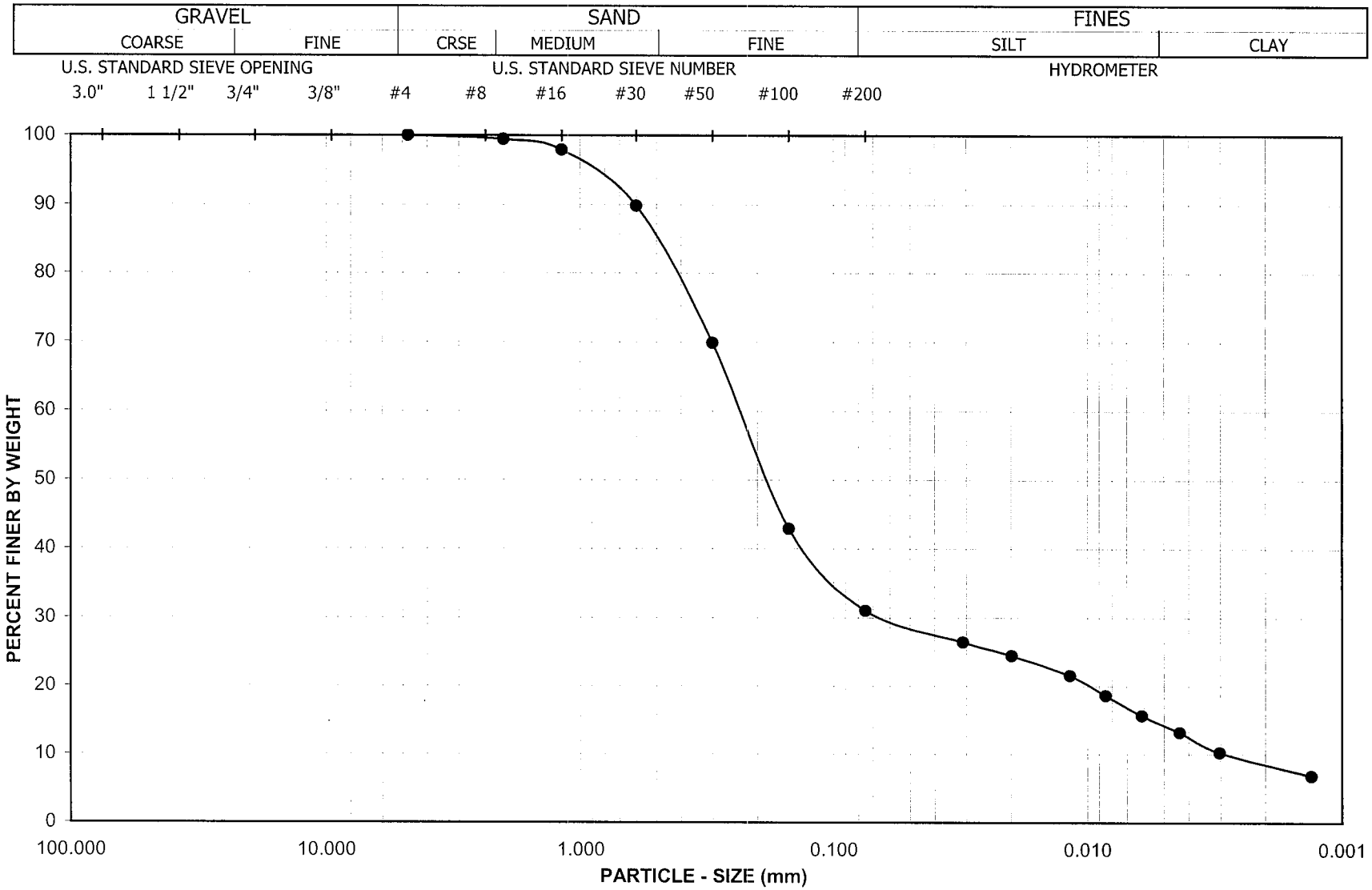
GR:SA:FI : (%) 0 : 60 : 40

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Oct-09

S&H RW-1 S-4.xls



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-102 Sample No.: S-5

Depth (feet) : 50.0 Soil Type : SC

Soil Identification: Light brown clayey sand (SC)

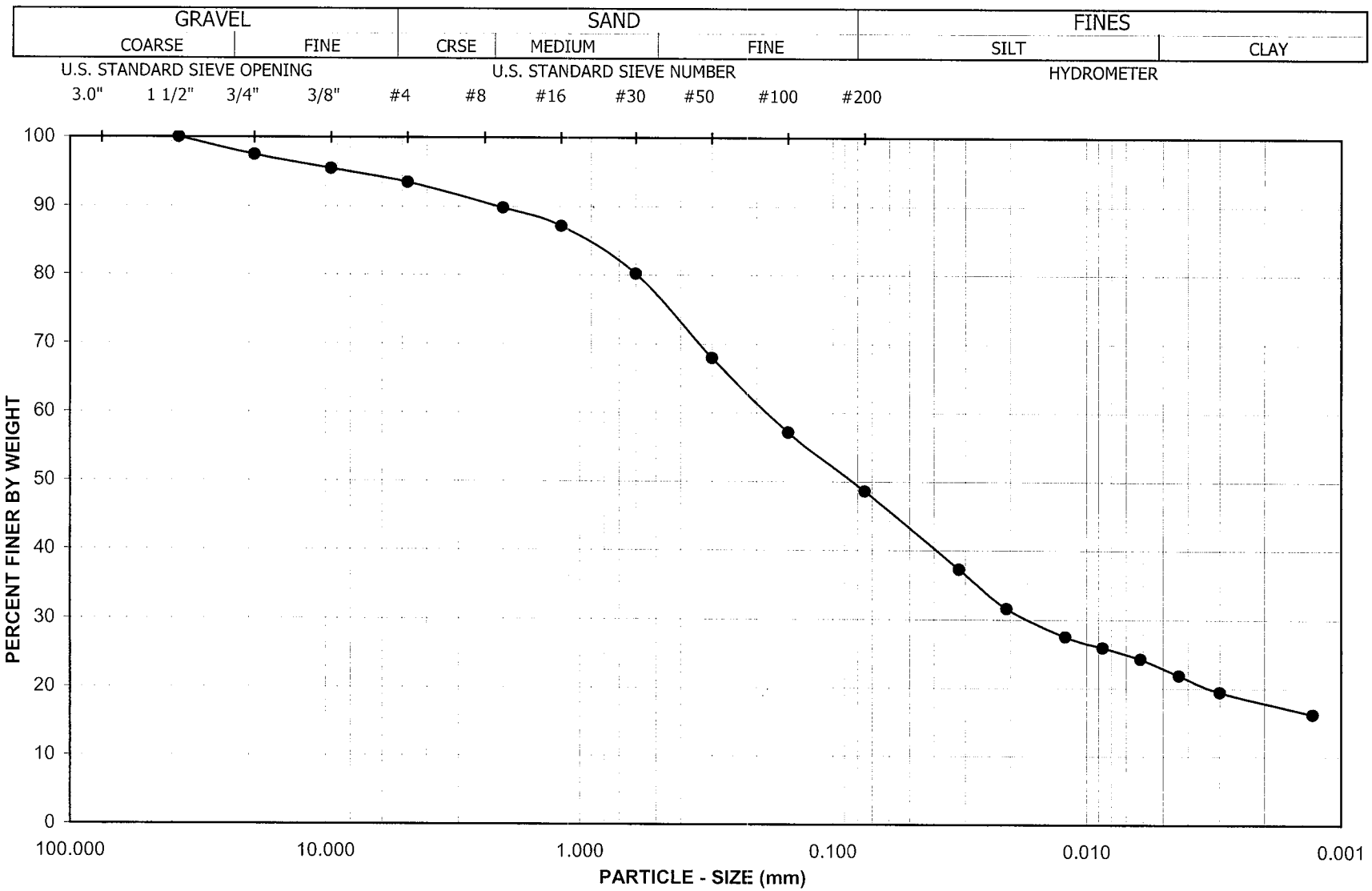
GR:SA:FI : (%) 0 : 69 : 31

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Oct-09

S&H RW-2 S-5.xls



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-102 Sample No.: S-7

Depth (feet) : 60.0 Soil Type : SM

Soil Identification: Dark brown silty sand (SM)

GR:SA:FI : (%) 7 : 44 : 49

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PARTICLE - SIZE DISTRIBUTION ASTM D 422

Oct-09

S&H RW-2 S-7.xls

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ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	03/20/09
Project No. :	602231-002	Input By:	J. Ward	Date:	03/23/09
Boring No.:	A-09-101	Checked By:	J. Ward		
Sample No.:	S-6	Depth (ft.)	55.0		
Soil Identification:	Light reddish brown silty clay (CL)				

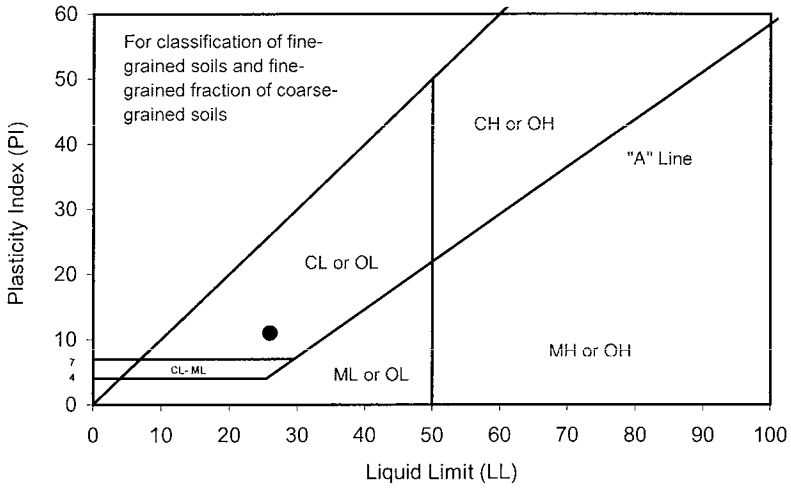
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			29	25	18	
Wet Wt. of Soil + Cont. (g)	10.16	11.10	22.52	22.82	22.15	
Dry Wt. of Soil + Cont. (g)	8.97	9.78	18.11	18.27	17.55	
Wt. of Container (g)	1.05	1.02	1.04	1.06	1.08	
Moisture Content (%) [Wn]	15.03	15.07	25.83	26.44	27.93	

Liquid Limit	**26**
Plastic Limit	**15**
Plasticity Index	**11**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 4.38

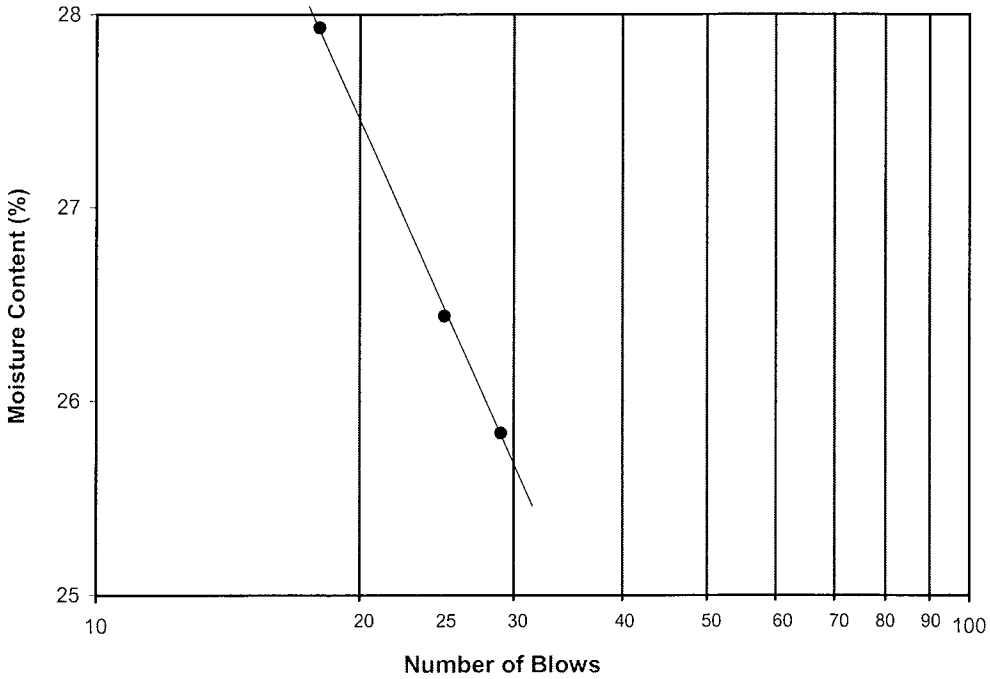
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$

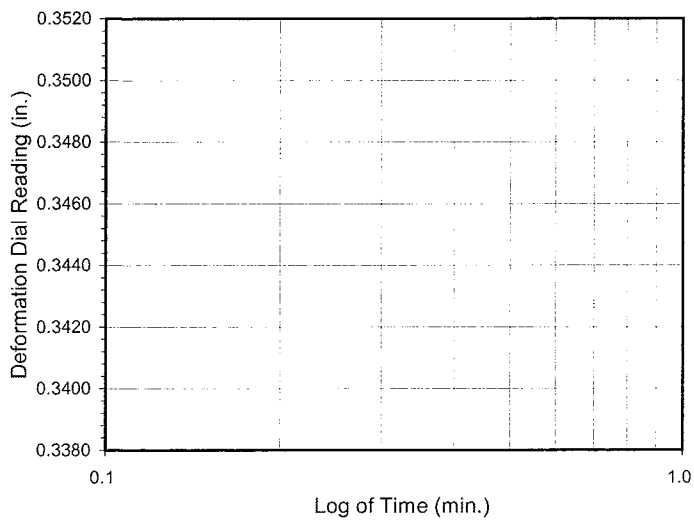


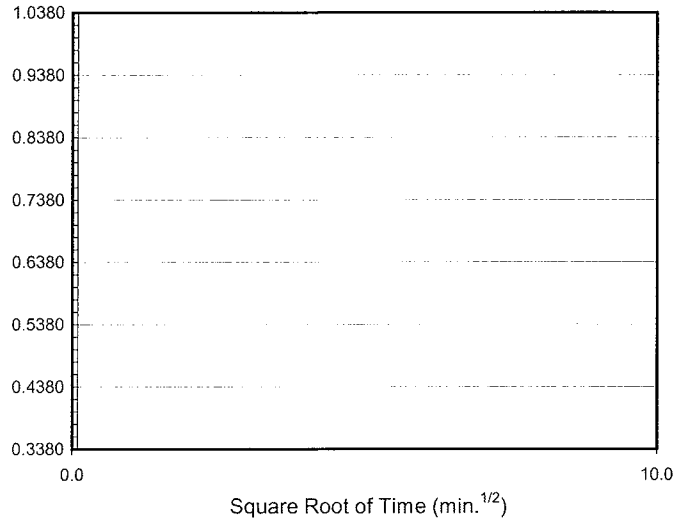
PROCEDURES USED

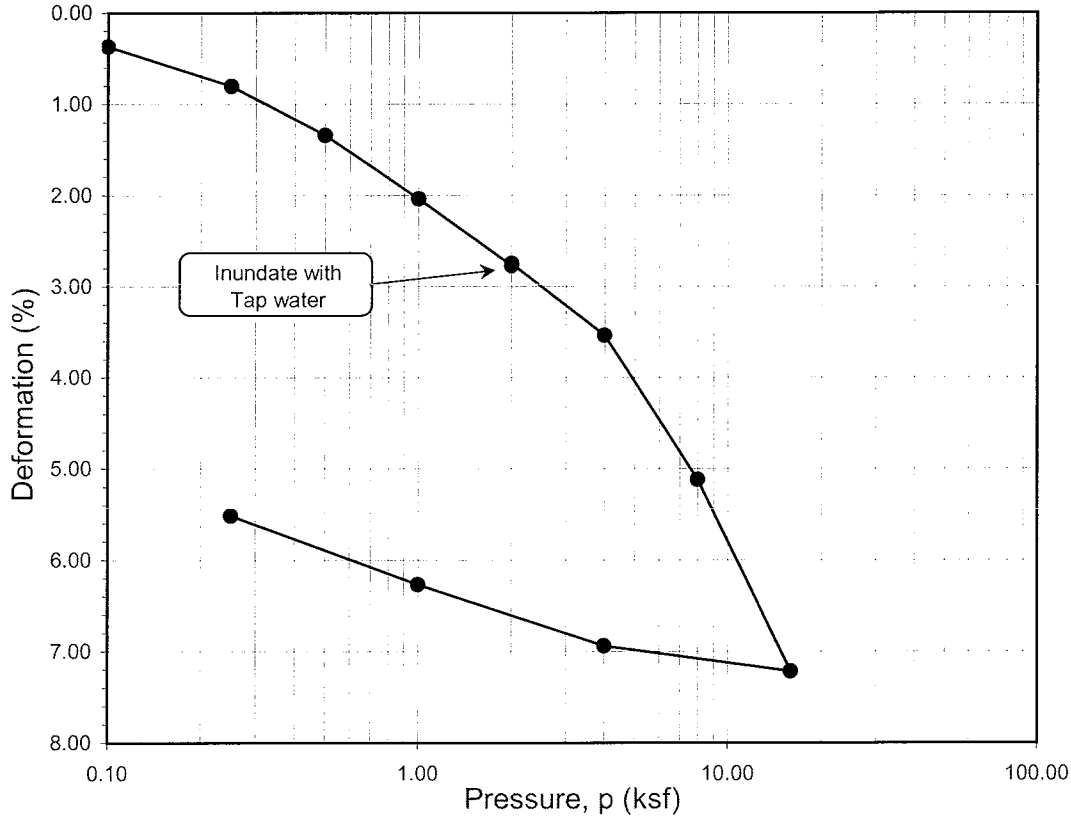
- [ ] Wet Preparation
  Multipoint - Wet
- [x] Dry Preparation
  Multipoint - Dry
- [x] Procedure A
  Multipoint Test
- [ ] Procedure B
  One-point Test



No Time Readings





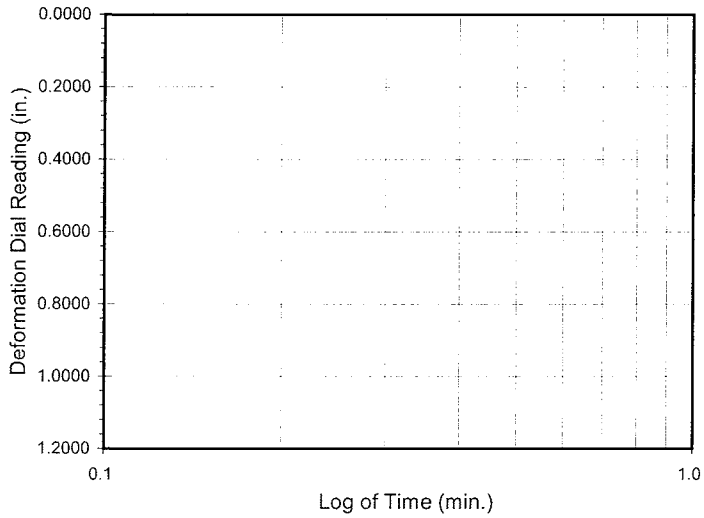


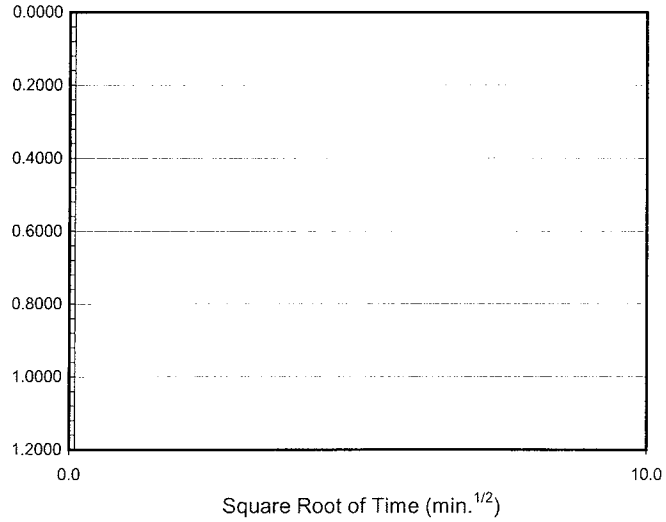
Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
A-09-101	**R-1**	**5.0**	**21.9**	**17.5**	**104.0**	**111.9**	**0.621**	**0.531**	**95**	**93**

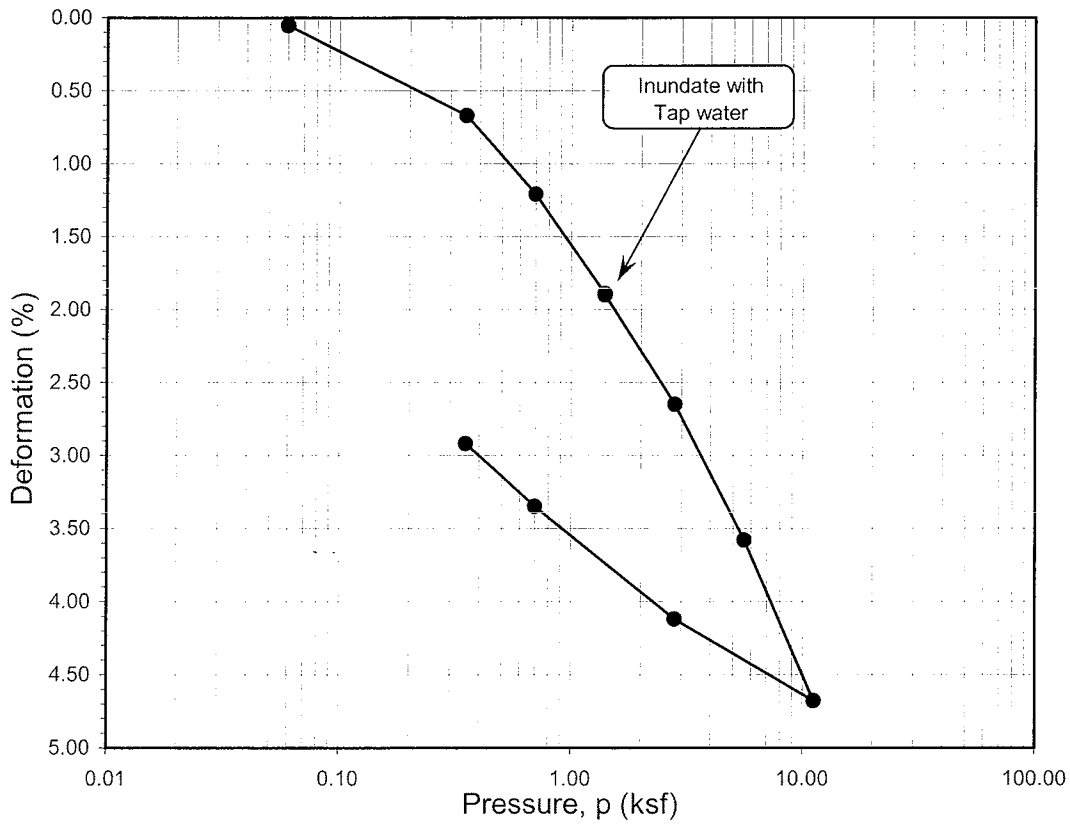
Soil Identification: Dark brown silty clay (CL)

Leighton	**ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS** **(ASTM D 2435)**	Project No.: 602231-002 SR-57 Widening 03-09

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
A-09-103	**R-1**	**5**	**8.2**	**24.6**	**111.4**	**102.9**	**0.513**	**0.469**	**43**	**104**

Soil Identification: Light brown poorly-graded sand (SP)

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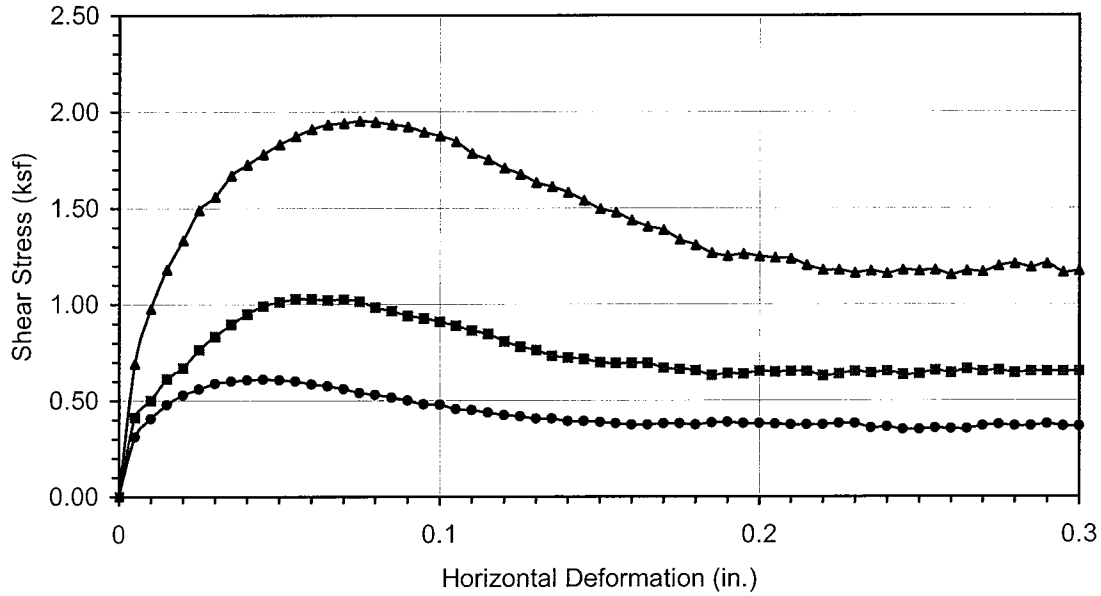
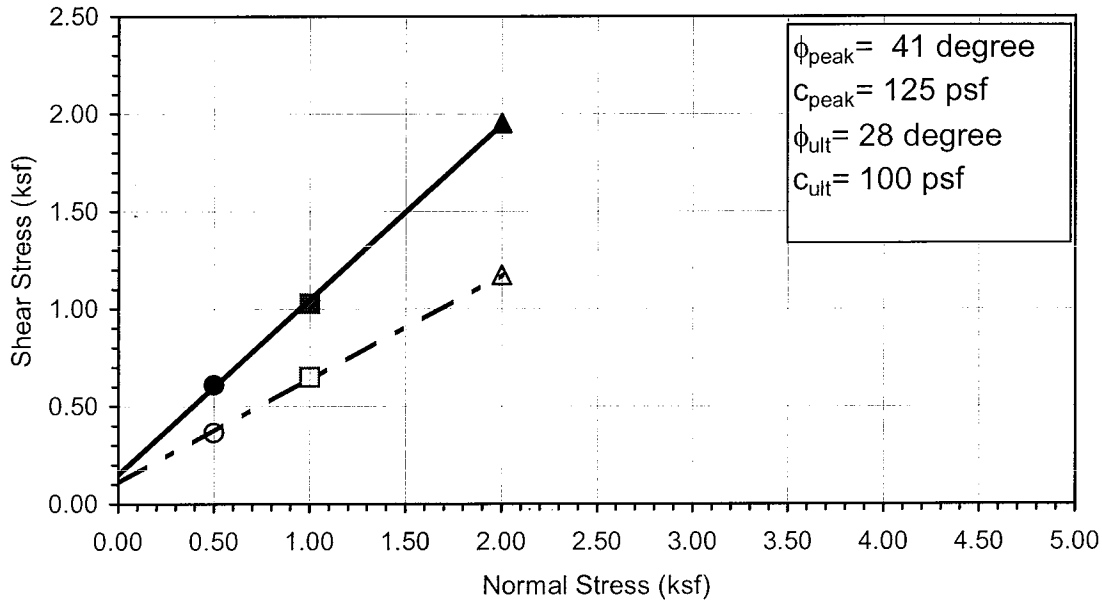
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 602231-002

SR-57 Widening

10-09





Boring No.	**A-09-101**
Sample No.	**R-2**
Depth (ft)	**10**

Sample Type:

Drive

Soil Identification:
Light yellowish brown poorly-graded sand (SP)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.610	■ 1.028	▲ 1.952
Shear Stress @ End of Test (ksf)	○ 0.365	□ 0.651	△ 1.173
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	3.27	3.27	3.27
Dry Density (pcf)	103.3	103.2	102.0
Saturation (%)	14.0	13.9	13.5
Soil Height Before Shearing (in.)	0.9929	0.9873	0.9886
Final Moisture Content (%)	20.6	20.7	21.4

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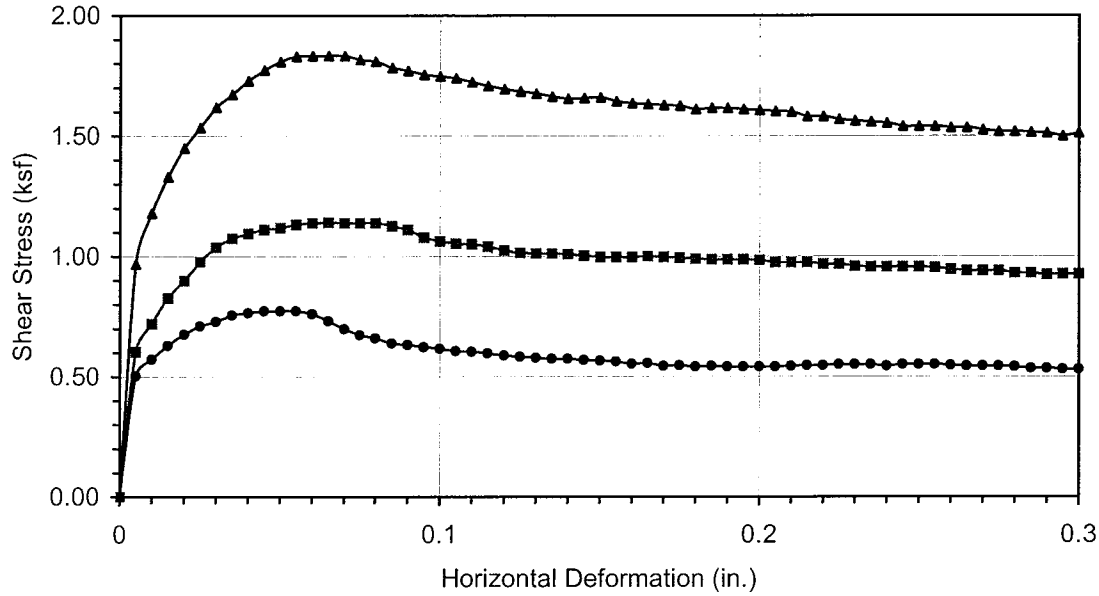
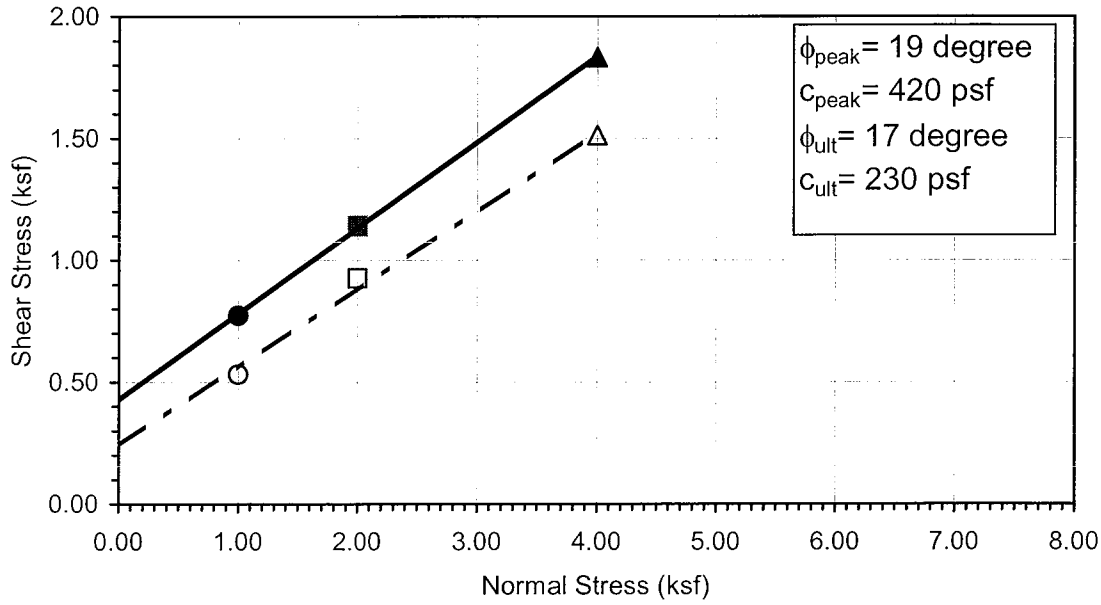
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09





Boring No.	**A-09-101**
Sample No.	**R-5**
Depth (ft)	**40**

Sample Type:

Drive

Soil Identification:
Dark brown silty clay (CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.773	■ 1.141	▲ 1.833
Shear Stress @ End of Test (ksf)	○ 0.531	□ 0.927	△ 1.512
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	28.73	28.73	28.73
Dry Density (pcf)	88.0	87.8	89.9
Saturation (%)	84.8	84.3	88.6
Soil Height Before Shearing (in.)	0.9925	0.9708	0.9430
Final Moisture Content (%)	42.3	44.0	37.7

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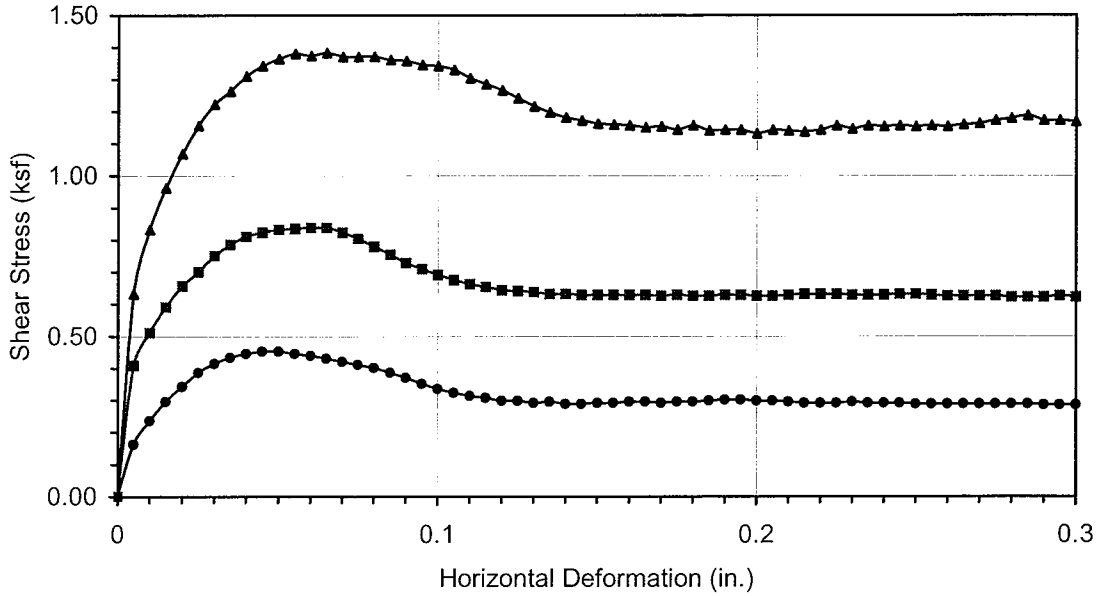
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

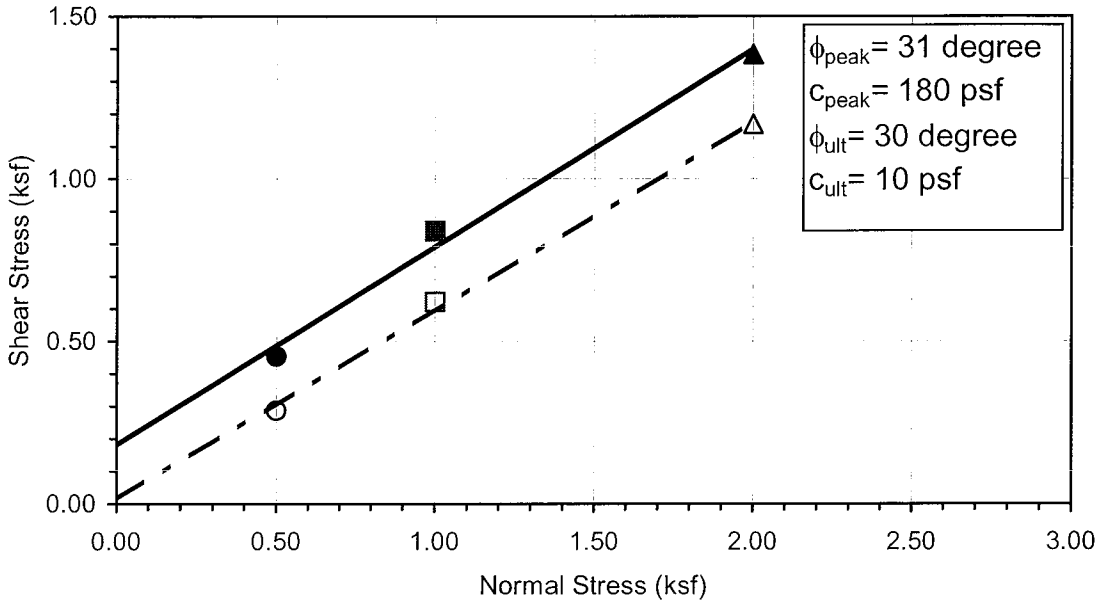
Project No.: 602231-002

SR-57 Widening

03-09

DS RW-1 R-5.xls





Boring No.	**A-09-102**
Sample No.	**R-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Light yellowish brown-poorly graded sand (SP)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.453	■ 0.839	▲ 1.383
Shear Stress @ End of Test (ksf)	○ 0.286	□ 0.622	△ 1.169
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	1.41	1.41	1.41
Dry Density (pcf)	97.0	101.1	101.5
Saturation (%)	5.2	5.7	5.8
Soil Height Before Shearing (in.)	0.9955	0.9895	0.9823
Final Moisture Content (%)	23.9	23.7	25.1

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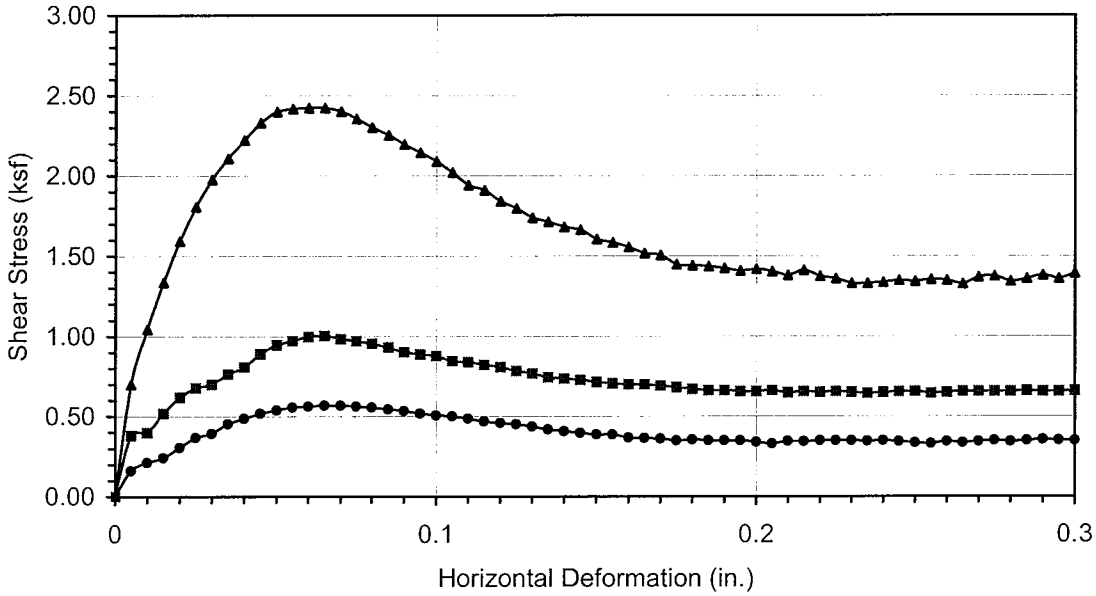
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

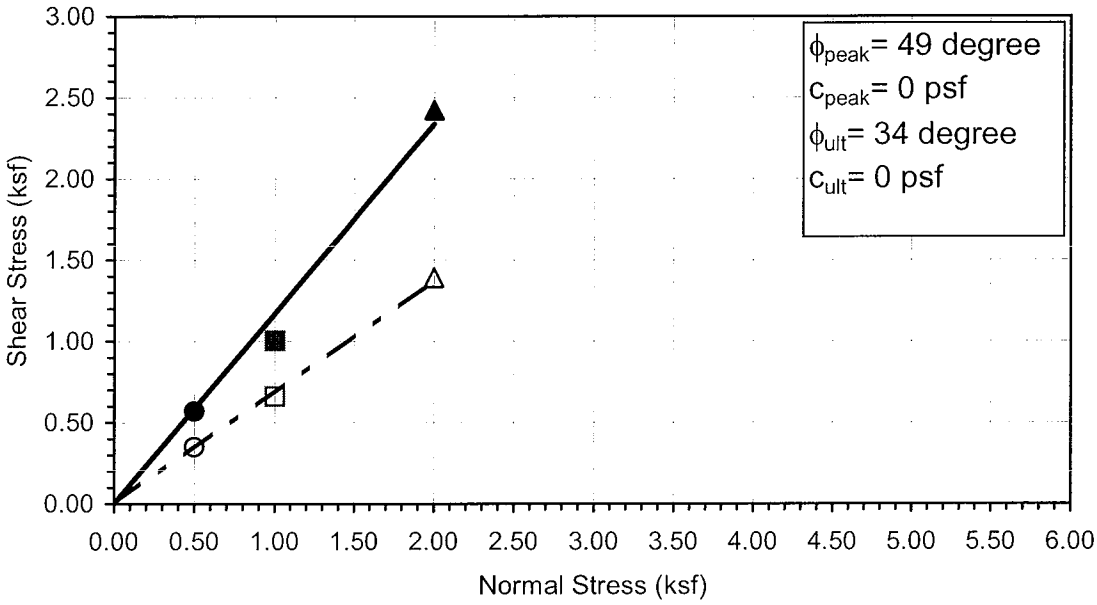
Project No.: 602231-002

SR-57 Widening

03-09

DS RW-2 R-1.xls





Boring No.	**A-09-102**
Sample No.	**R-3**
Depth (ft)	**20**

Sample Type:

Drive

Soil Identification:
Light yellowish brown poorly-graded sand (SP)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.569	■ 1.003	▲ 2.424
Shear Stress @ End of Test (ksf)	○ 0.349	□ 0.660	△ 1.393
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	1.33	1.33	1.33
Dry Density (pcf)	102.9	105.3	110.0
Saturation (%)	5.6	6.0	6.7
Soil Height Before Shearing (in.)	0.9915	0.9825	0.9794
Final Moisture Content (%)	22.3	20.6	17.5

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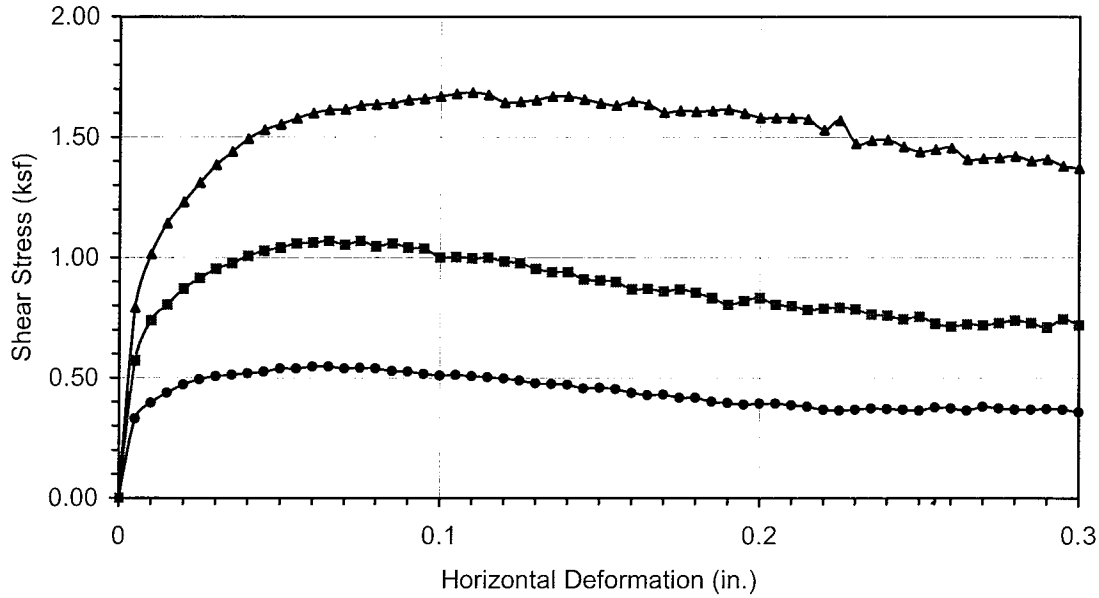
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

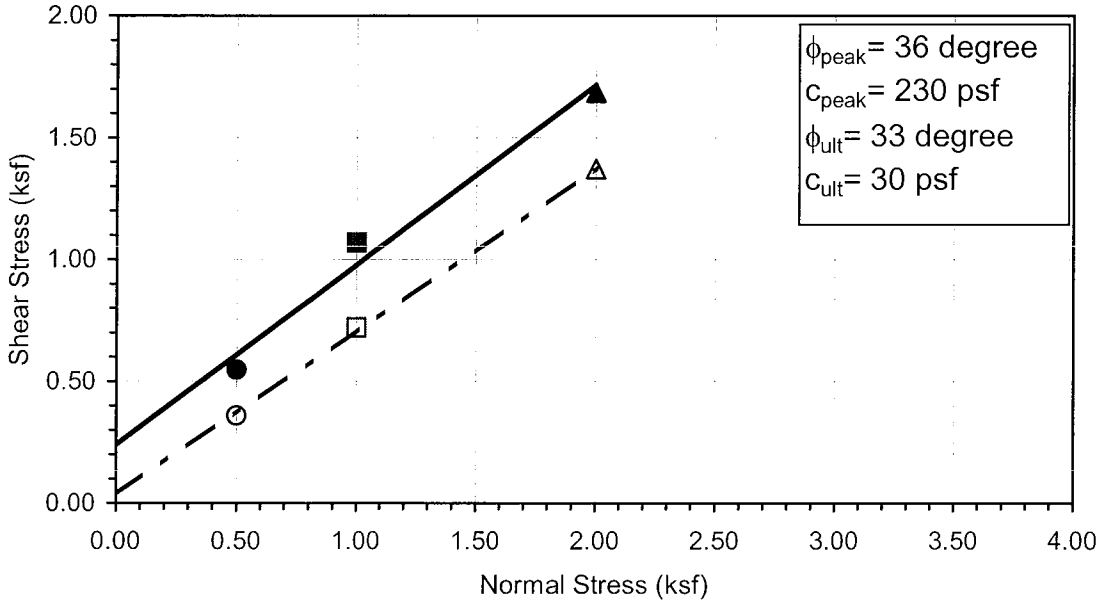
Project No.: 602231-002

SR-57 Widening

03-09

DS RW-2 R-3.xls





Boring No.	**A-09-103**
Sample No.	**R-3**
Depth (ft)	**20**

Sample Type:

Drive

Soil Identification:
Light yellowish brown poorly-graded sand (SP)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 0.547	■ 1.069	▲ 1.685
Shear Stress @ End of Test (ksf)	○ 0.358	□ 0.720	△ 1.371
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	4.61	4.61	4.61
Dry Density (pcf)	104.4	106.2	108.8
Saturation (%)	20.2	21.2	22.7
Soil Height Before Shearing (in.)	0.9970	0.9916	0.9914
Final Moisture Content (%)	18.8	18.1	17.4

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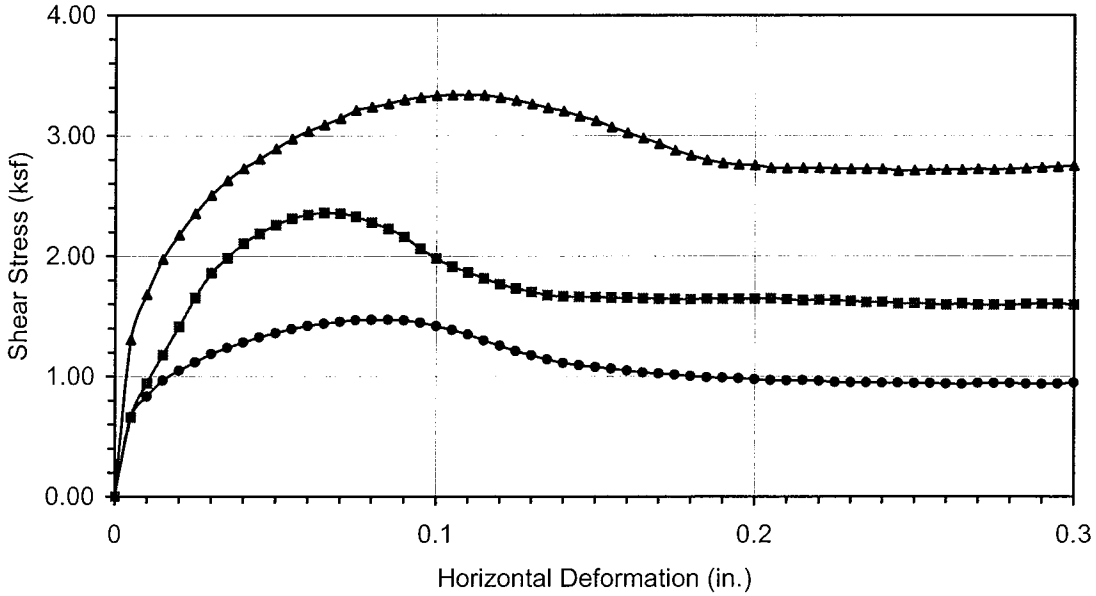
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

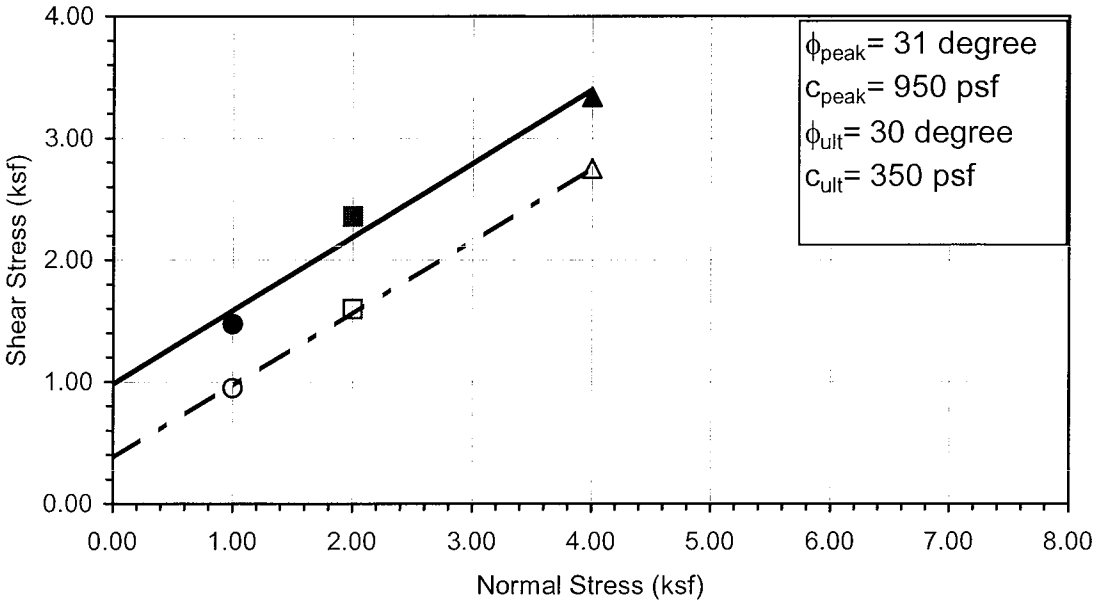
Project No.: 602231-002

SR-57 Widening

03-09

DS RW-3 R-3.xls





Boring No.	**A-09-103**
Sample No.	**R-4**
Depth (ft)	**30**

Sample Type:

Drive

Soil Identification:
Light brown poorly-graded sand (SP)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.471	■ 2.358	▲ 3.339
Shear Stress @ End of Test (ksf)	○ 0.946	□ 1.597	△ 2.751
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.79	12.79	12.79
Dry Density (pcf)	121.0	121.9	122.6
Saturation (%)	87.8	90.3	92.2
Soil Height Before Shearing (in.)	0.9927	0.9852	0.9708
Final Moisture Content (%)	16.9	16.0	16.3

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DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09

DS RW-3 R-4.xls

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TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 03/05/09

Project No. : 602231-002 | Data Input By: J. Ward | Date: 03/19/09

Boring No.	A-09-101	A-09-102	A-09-103
Sample No.	Bag-1	Bag-1	Bag-1
Sample Depth (ft)	1-5	1-5	1-5
Soil Identification:	Light brown silty sand (SM)	Light yellowish brown poorly-graded sand	Light brown poorly-graded sand (SP)
Wet Weight of Soil + Container (g)	185.20	179.10	163.20
Dry Weight of Soil + Container (g)	175.80	174.70	159.20
Weight of Container (g)	56.60	38.70	36.80
Moisture Content (%)	7.89	3.24	3.27
Weight of Soaked Soil (g)	100.30	100.90	100.60

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	10	11	12
Crucible No.	27	31	32
Furnace Temperature (°C)	830	830	830
Time In / Time Out	7:20 / 8:05	7:20 / 8:05	7:20 / 8:05
Duration of Combustion (min)	45	45	45
Wt. of Crucible + Residue (g)	17.6395	18.9778	19.1657
Wt. of Crucible (g)	17.6382	18.9765	19.1638
Wt. of Residue (g) (A)	0.0013	0.0013	0.0019
PPM of Sulfate (A) x 41150	53.50	53.49	78.19
PPM of Sulfate, Dry Weight Basis	**58**	**55**	**81**

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30	30
ml of AgNO3 Soln. Used in Titration (C)	0.5	0.5	0.6
PPM of Chloride (C -0.2) * 100 * 30 / B	30	30	40
PPM of Chloride, Dry Wt. Basis	**33**	**31**	**41**

pH TEST, DOT California Test 532/643

pH Value	**8.07**	**7.68**	**7.50**
Temperature °C	19.6	19.6	19.7

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SOIL RESISTIVITY TEST

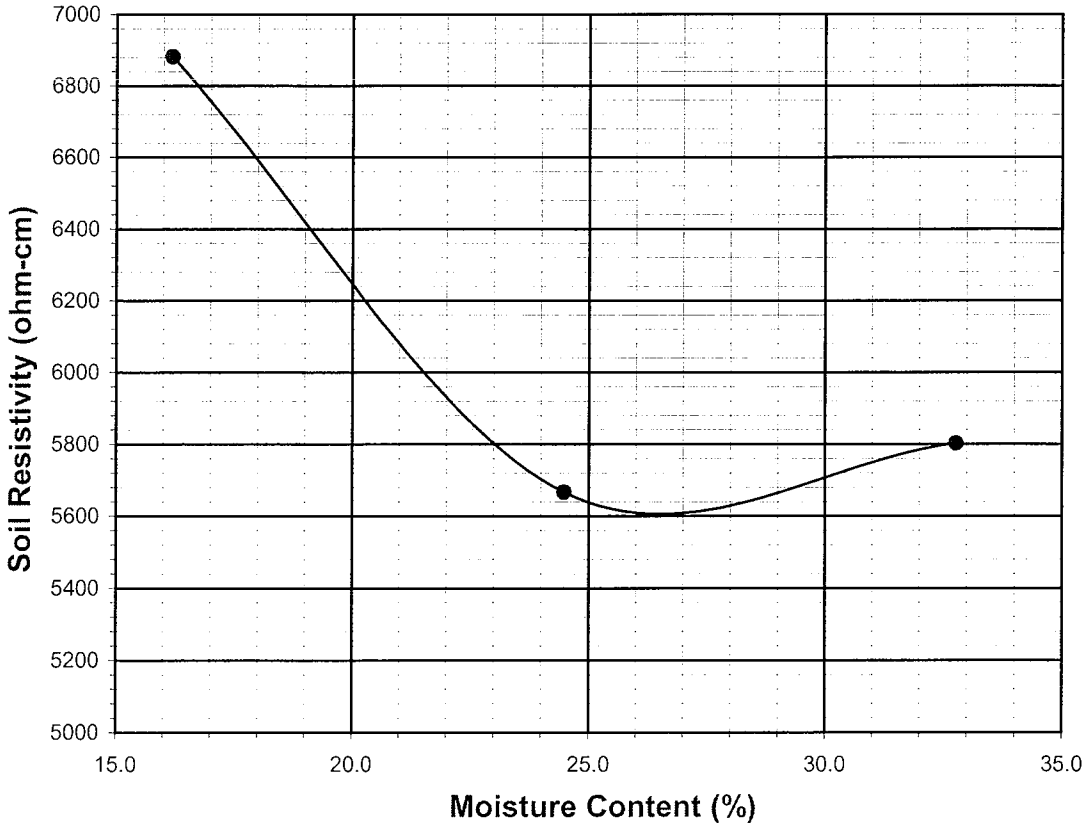
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/10/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/19/09
Boring No.:	A-09-101	Depth (ft.) :	1-5		
Sample No. :	Bag-1				
Soil Identification:	Light brown silty sa				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	16.18	1020	6881
2	200	24.48	840	5667
3	300	32.78	860	5802
4				
5				

Moisture Content (%) (MCi)	7.89
Wet Wt. of Soil + Cont. (g)	185.20
Dry Wt. of Soil + Cont. (g)	175.80
Wt. of Container (g)	56.60
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
5600	**26.6**	**58**	**33**	**8.07**	**19.6**



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SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

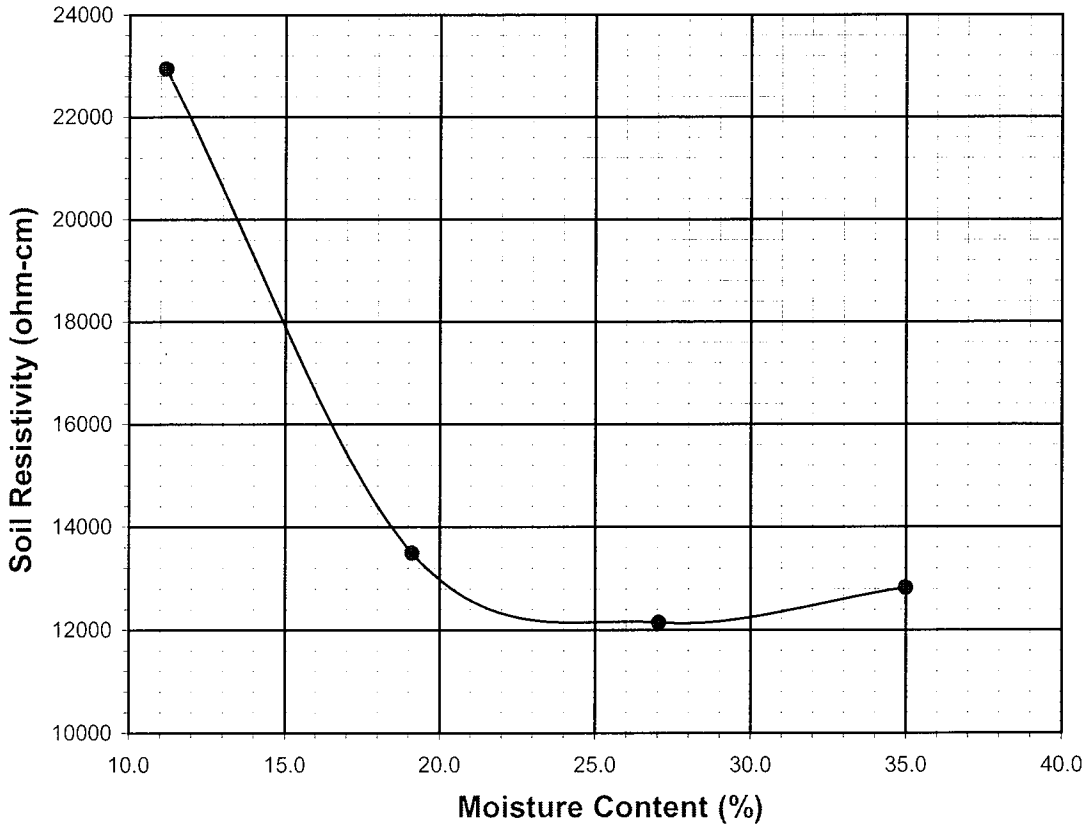
Project Name: SR-57 Widening
Project No. : 602231-002
Boring No.: A-09-102
Sample No. : Bag-1
Soil Identification: Light yellowish brown poo

Tested By : V. Juliano Date: 03/10/09
Data Input By: J. Ward Date: 03/19/09
Depth (ft.) : 1-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	11.18	3400	22936
2	200	19.12	2000	13492
3	300	27.06	1800	12143
4	400	35.00	1900	12817
5				

Moisture Content (%) (MCi)	3.24
Wet Wt. of Soil + Cont. (g)	179.10
Dry Wt. of Soil + Cont. (g)	174.70
Wt. of Container (g)	38.70
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
12143	**27.1**	**55**	**31**	**7.68**	**19.6**



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SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: SR-57 Widening
Project No. : 602231-002
Boring No.: A-09-103
Sample No. : Bag-1
Soil Identification: Light brown poorly-

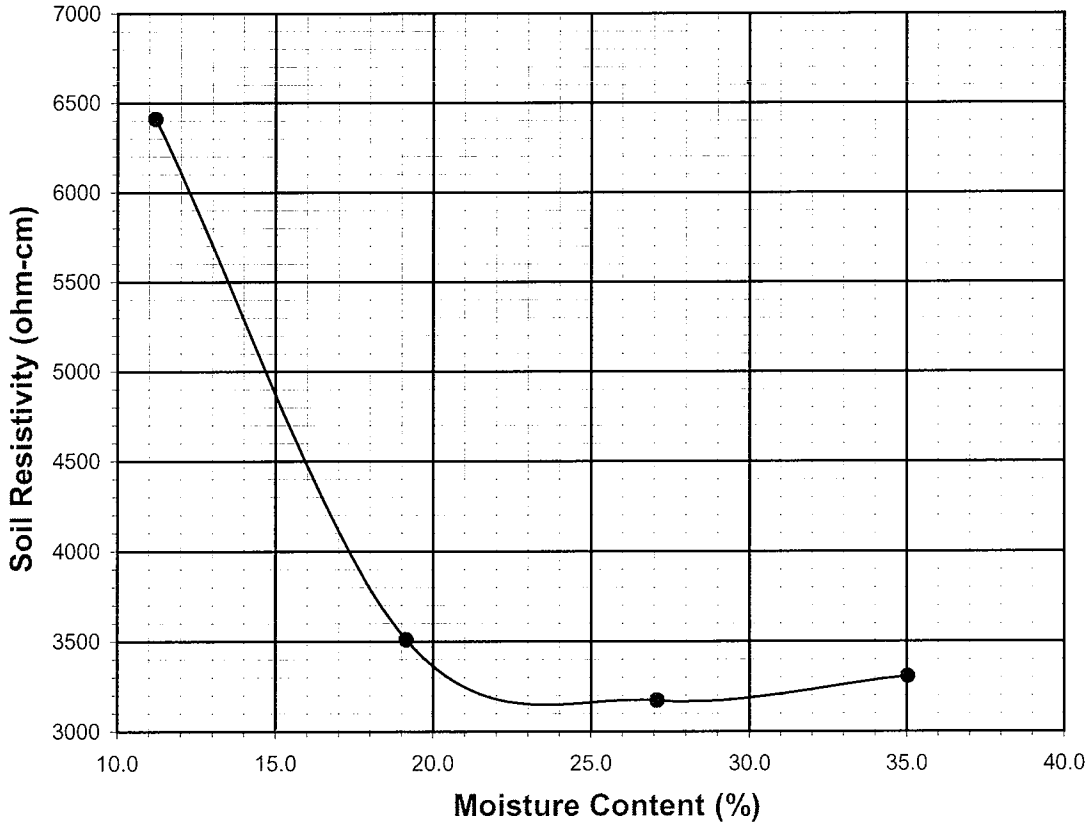
Tested By : V. Juliano Date: 03/10/09
Data Input By: J. Ward Date: 03/19/09
Depth (ft.) : 1-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	11.21	950	6409
2	200	19.16	520	3508
3	300	27.10	470	3171
4	400	35.04	490	3306
5				

Moisture Content (%) (MCi)	3.27
Wet Wt. of Soil + Cont. (g)	163.20
Dry Wt. of Soil + Cont. (g)	159.20
Wt. of Container (g)	36.80
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746

MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
3171	**27.1**	**81**	**41**	**7.50**	**19.7**



APPENDIX B

Lateral Earth Pressure Calculation

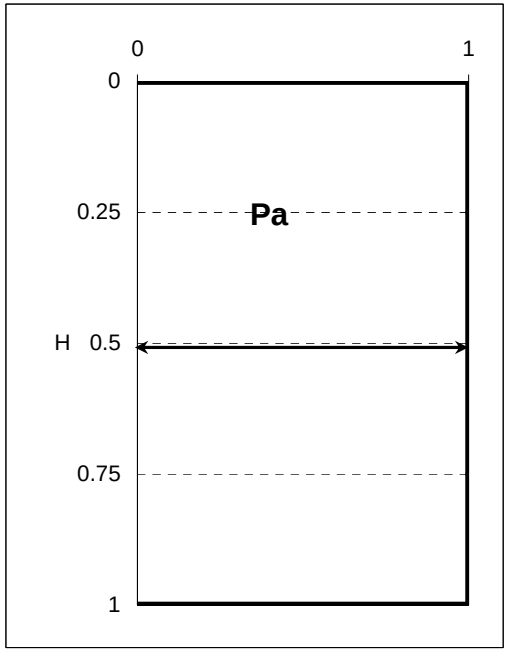
ϕ (degree)	34		
γ (pcf)	120.0		
Factor of Safety	1.0		
	Level Backfill	Both Back and Front slope	
H, Horizontal		2	
V, Vertical		1	
Friction resistance	0.45		
K_p	3.54	1.34	
K_0	0.44	0.65	
K_a	0.28	0.42	
P_p (pcf)	**424.5**	**161.1**	
P_0 (pcf)	**52.9**	**77.9**	
P_a (pcf)	**33.9**	**50.0**	

Temporary Excavation - Braced Cut

	1	2	3	
	Sand	Soft & Medium Clay	Stiff Clay	

Soil Type: 1

Soil Pressure (psf): **22**



Assumption: Wall friction (δ) assumed to be 0.
Passive Pressure: Rankine Theory
Active Pressure: Rankine Theory for Level Backfill and NAVFAC DM 7.02 Ch3 for Sloping Backfill.
At rest condition: empirical relationship by Jaky 1944

Jaky, J., 1944, The Coefficient of Earth Pressure at Rest," Journal of the Society of Hungarian Architects and Engineers, Vol 7, 355-358

NAVFAC Figure 33, Passive pressure distribution for solider piles, p7.2-112

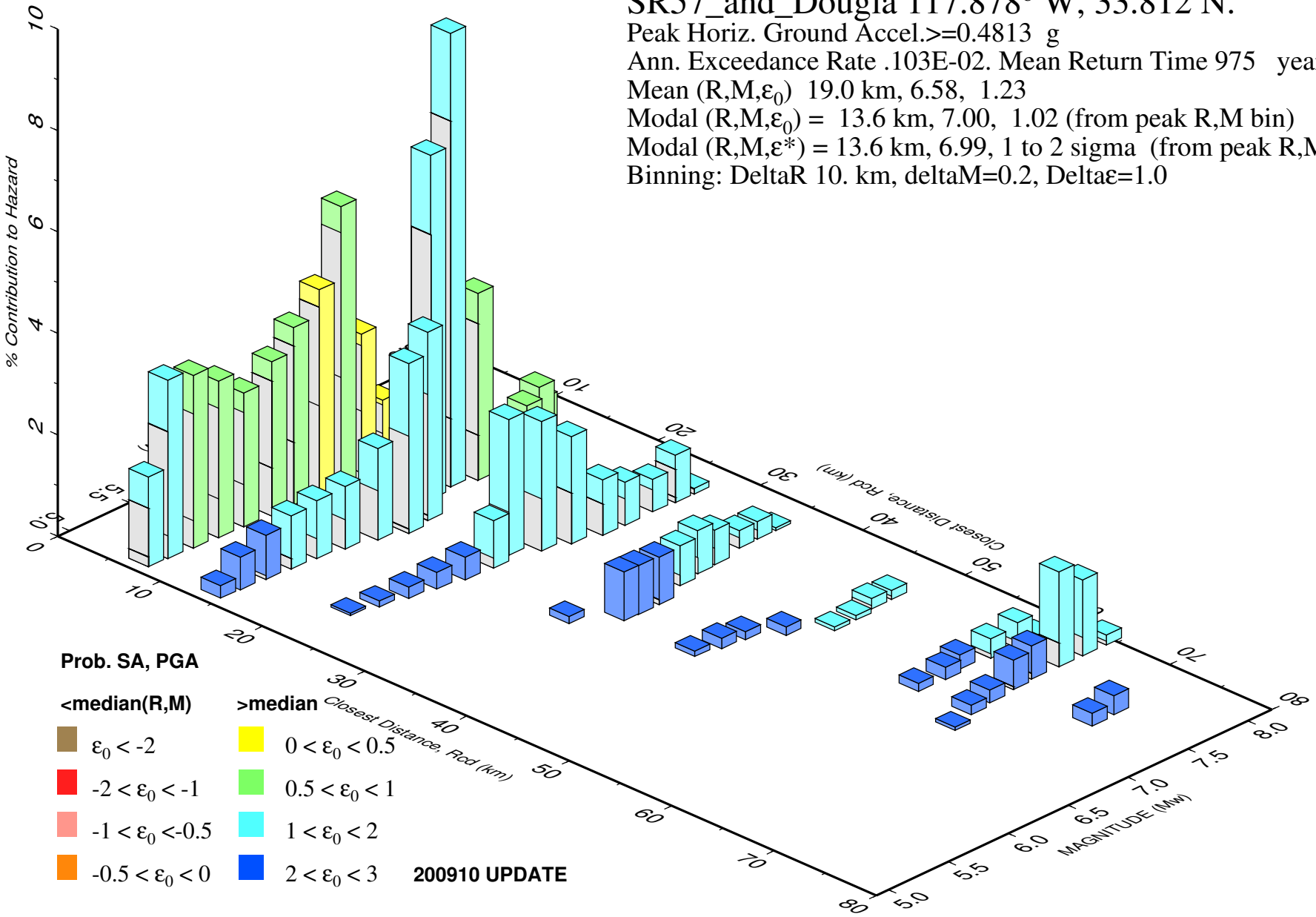
LATERAL EARTH PRESSURES-STATIC CONDITION
SR-57 TYPE 1 RETAINING WALL NOS 275 AND 293
BETWEEN KATELLA AVENUE AND BALL ROAD
ANAHEIM, CALIFORNIA

PROJECT NAME : SR-57/Type 1 RW 275 & 293
PROJECT NO: 602231-001
DESIGNED BY: TK
CHECKED BY: DJC
DATE: 2/1/2010

Figure B1

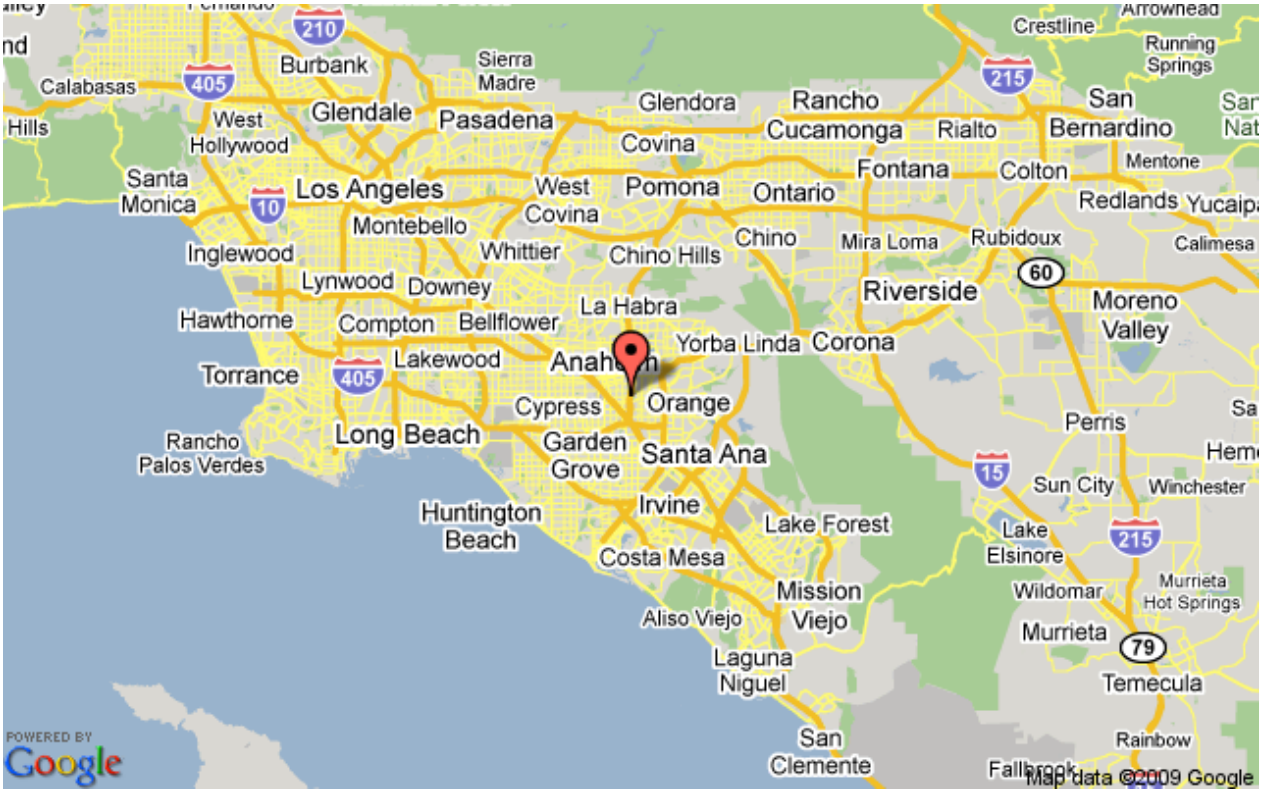
PSH Deaggregation on NEHRP D soil
SR57_and_Dougla 117.878° W, 33.812 N.

Peak Horiz. Ground Accel.>=0.4813 g
Ann. Exceedance Rate .103E-02. Mean Return Time 975 years
Mean (R,M,ε_0) 19.0 km, 6.58, 1.23
Modal (R,M,ε_0) = 13.6 km, 7.00, 1.02 (from peak R,M bin)
Modal (R,M,ε*) = 13.6 km, 6.99, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 10. km, deltaM=0.2, Deltaε=1.0

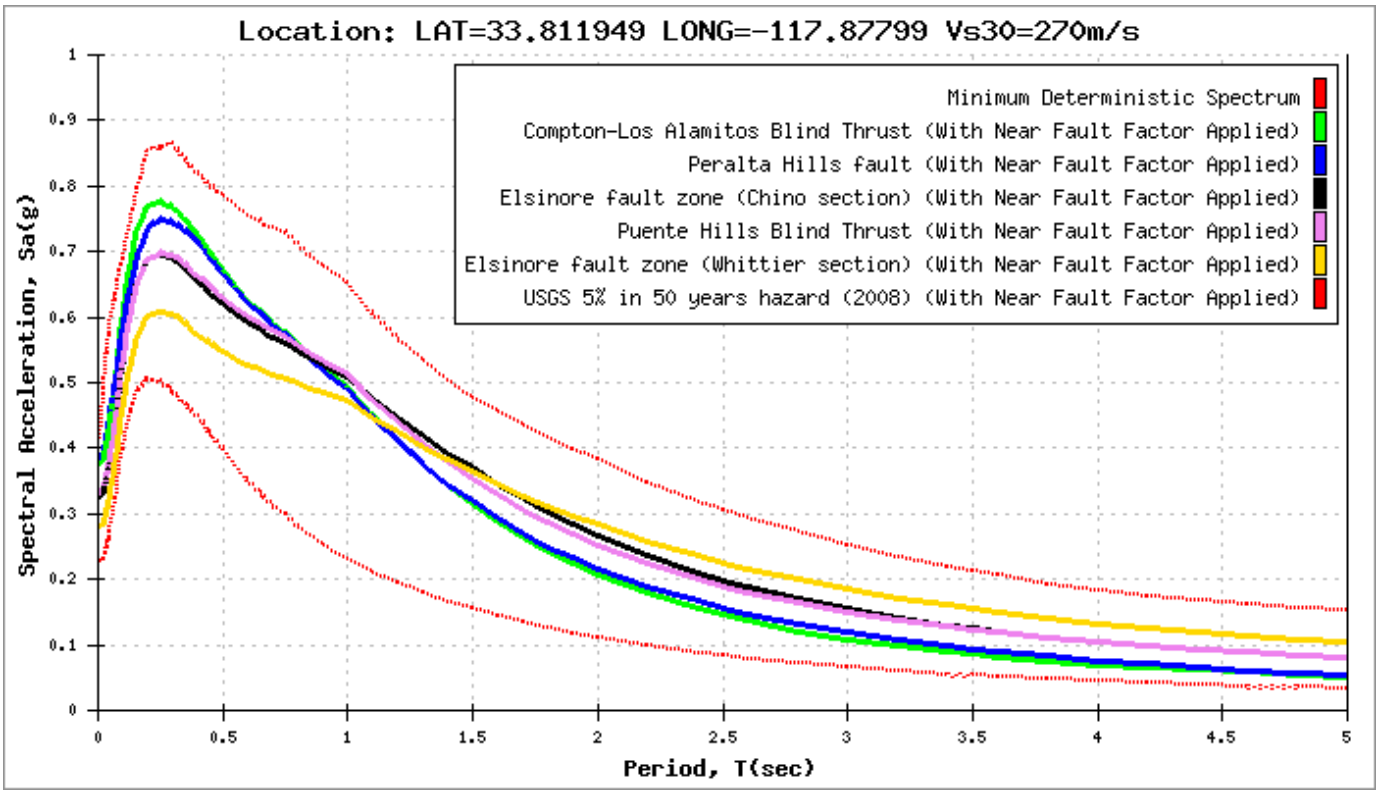


GMT 2009 Dec 8 20:06:33 **Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 270. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted**

SELECT SITE LOCATION



CALCULATED SPECTRA



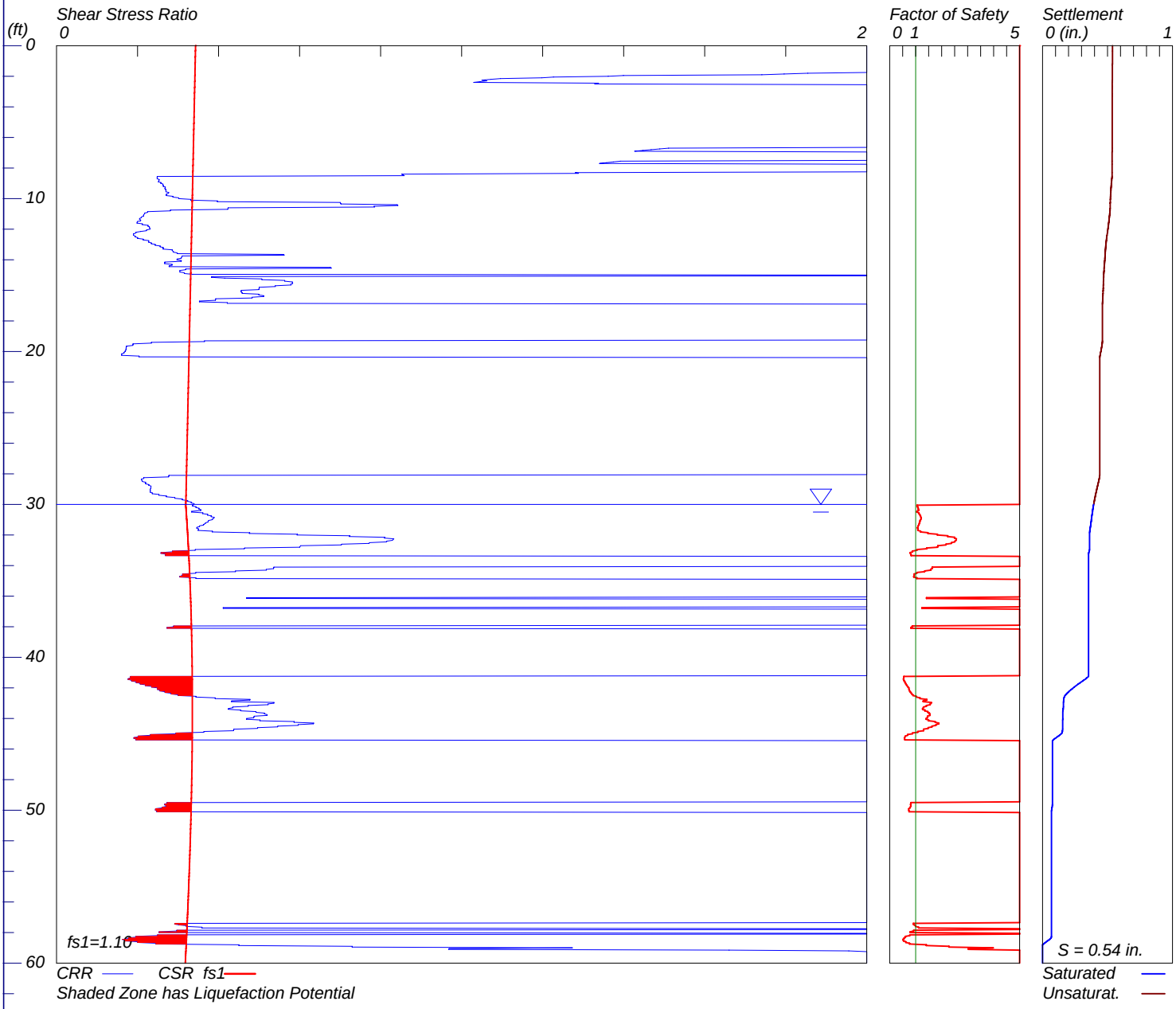
SITE DATA

LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/RW No 275

Hole No.=CPT-09-104 Water Depth=30 ft Surface Elev.=165

Magnitude=6.6
Acceleration=0.48g



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LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/RW No 275

Hole No.=CPT-09-108 Water Depth=30 ft Surface Elev.=175

Magnitude=6.6
Acceleration=0.48g

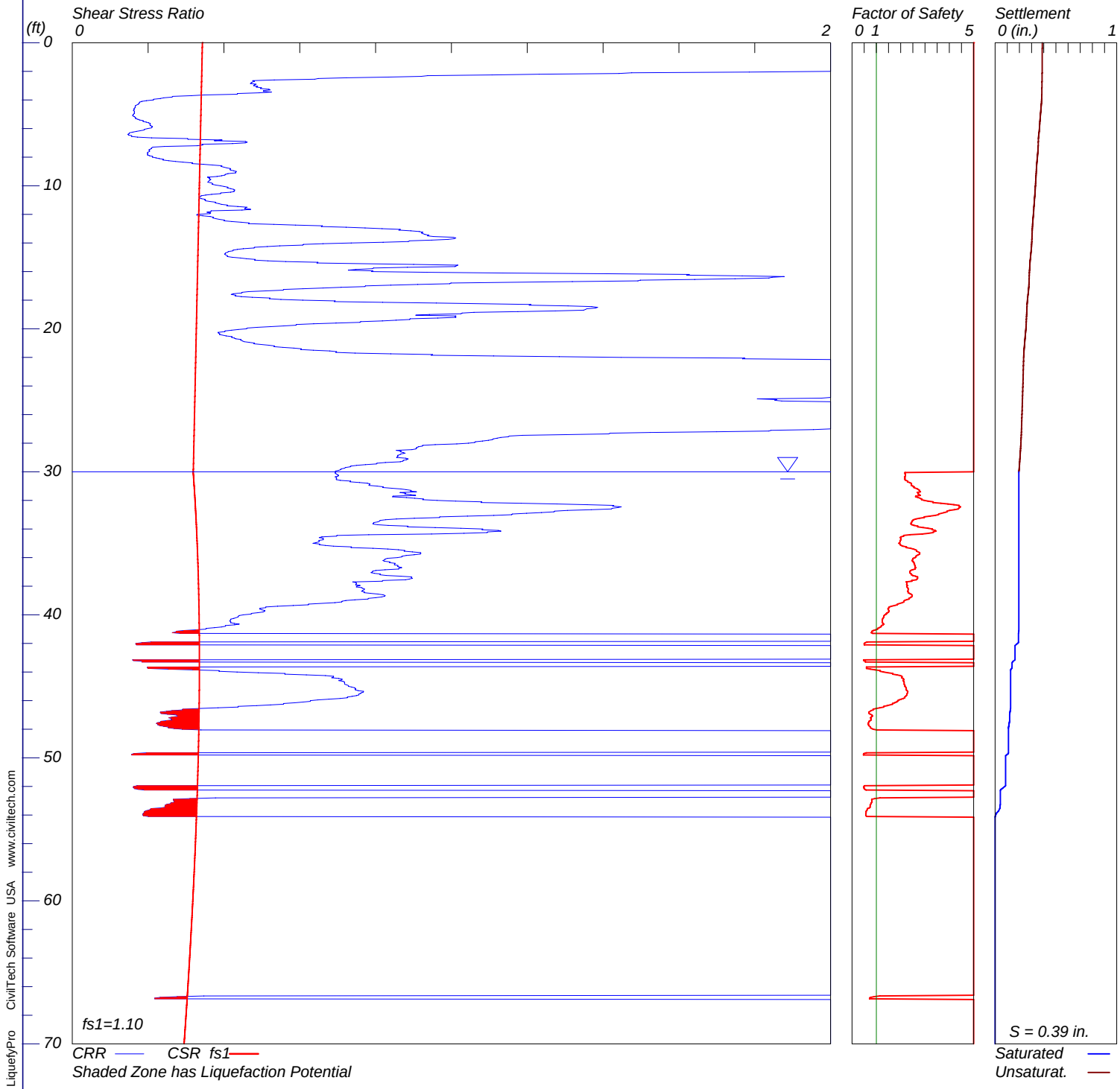

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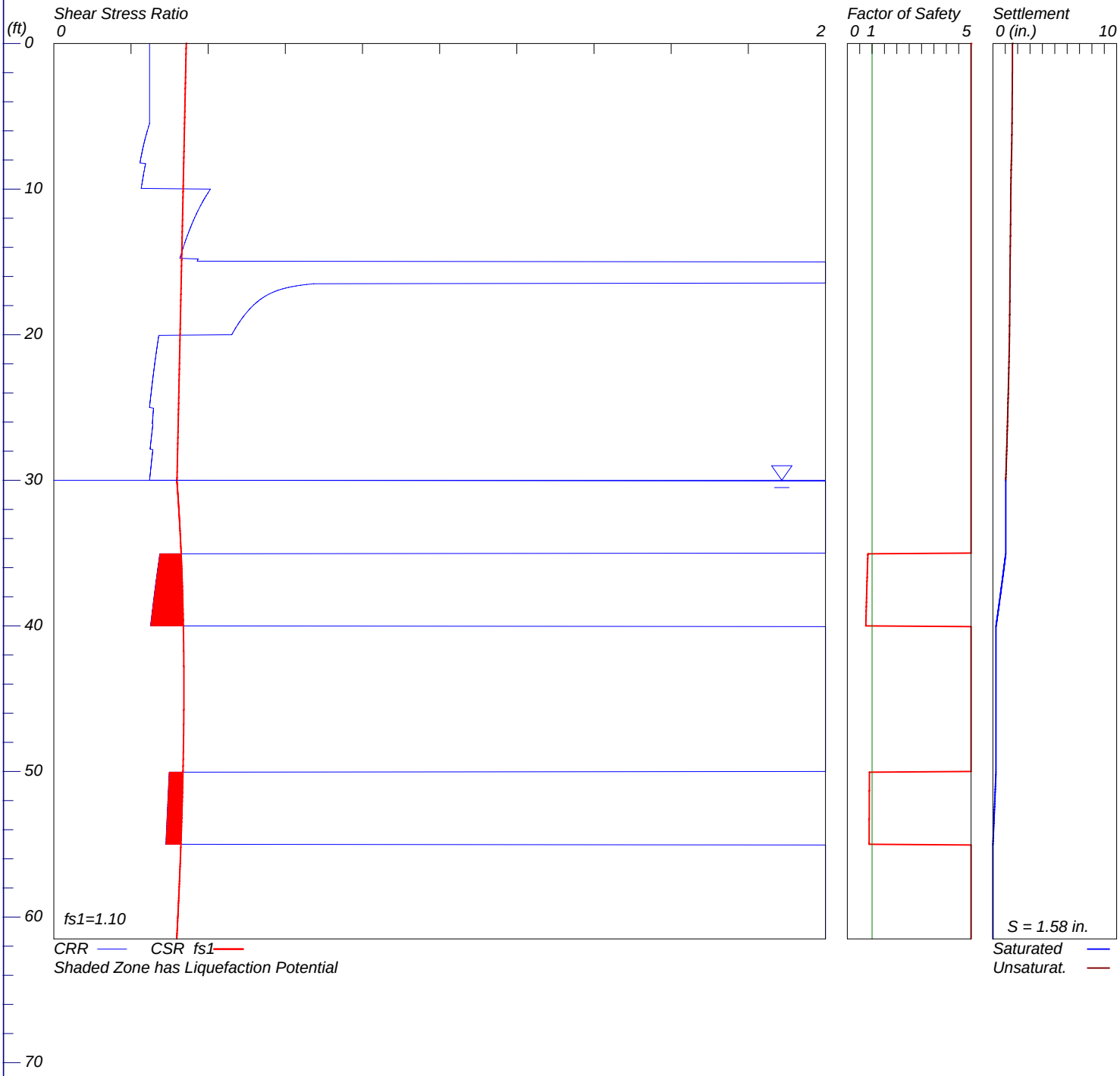
Figure B3

LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/RW No 275

Hole No.=A-09-101 Water Depth=30 ft Surface Elev.=167

Magnitude=6.6
Acceleration=0.48g



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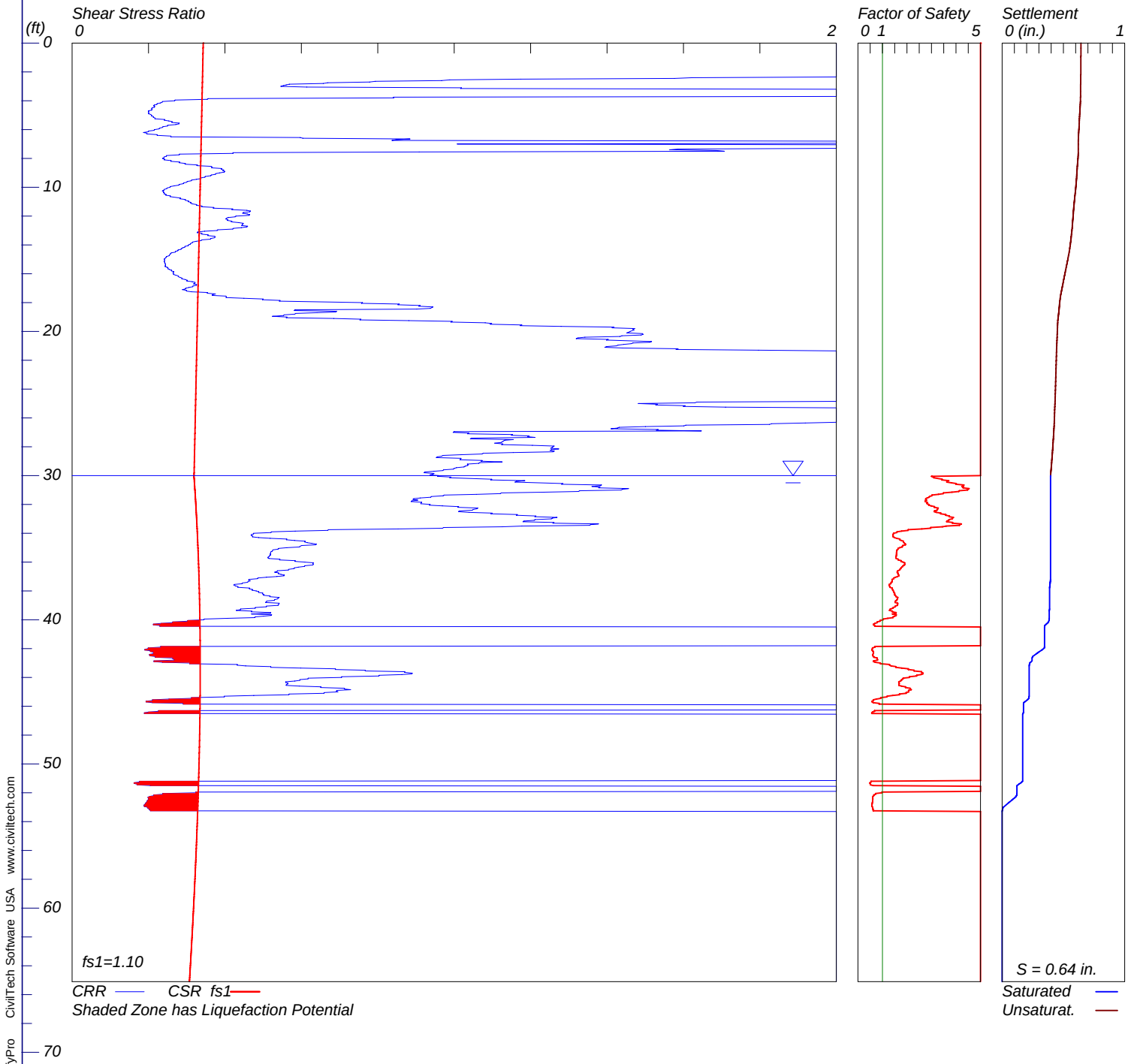
LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/RW No 275

Hole No.=CPT-09-105 Water Depth=30 ft Surface Elev.=168

Magnitude=6.6
Acceleration=0.48g

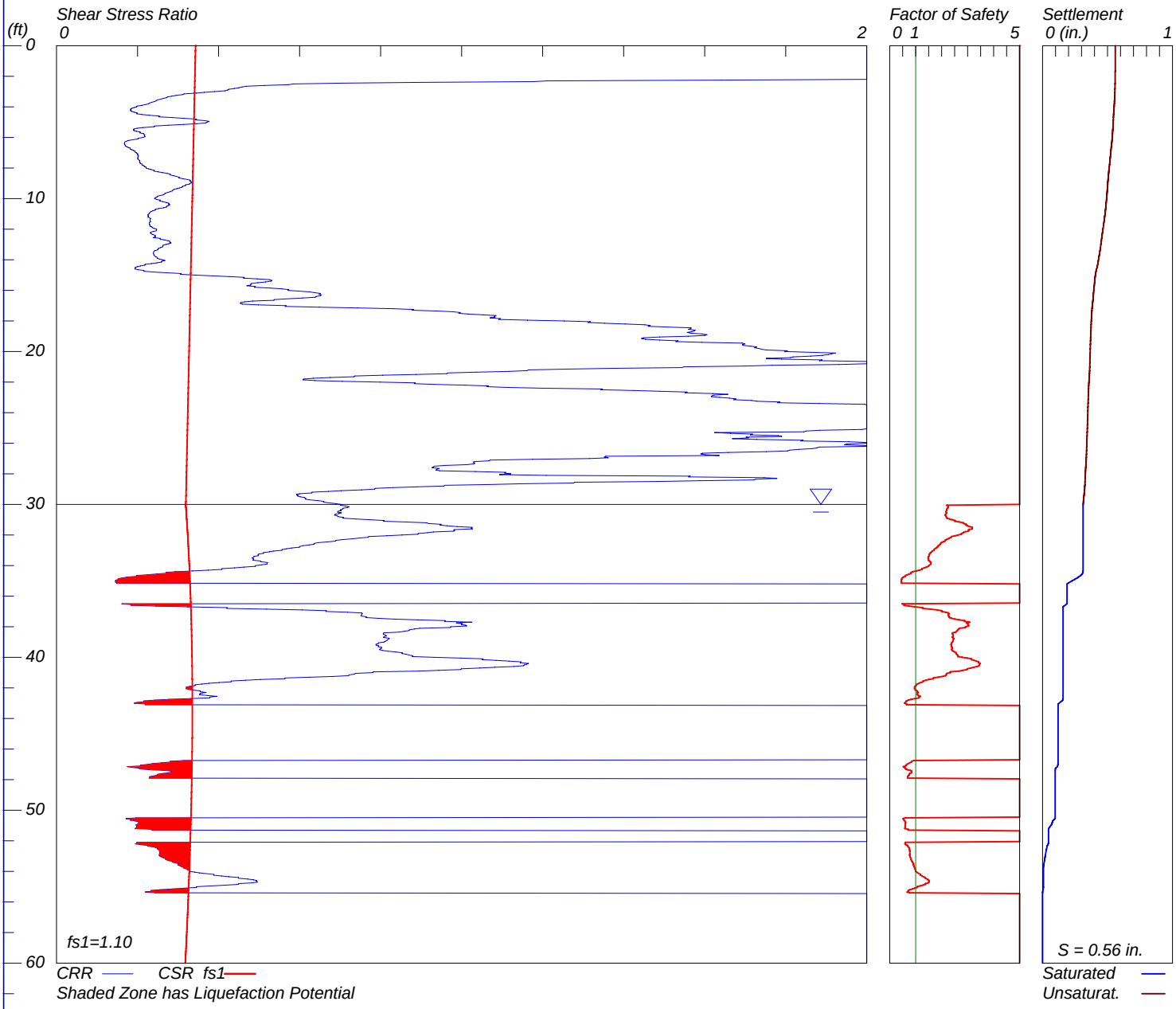


LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/RW No 275

Hole No.=CPT-09-109 Water Depth=30 ft Surface Elev.=169.5

Magnitude=6.6
Acceleration=0.48g



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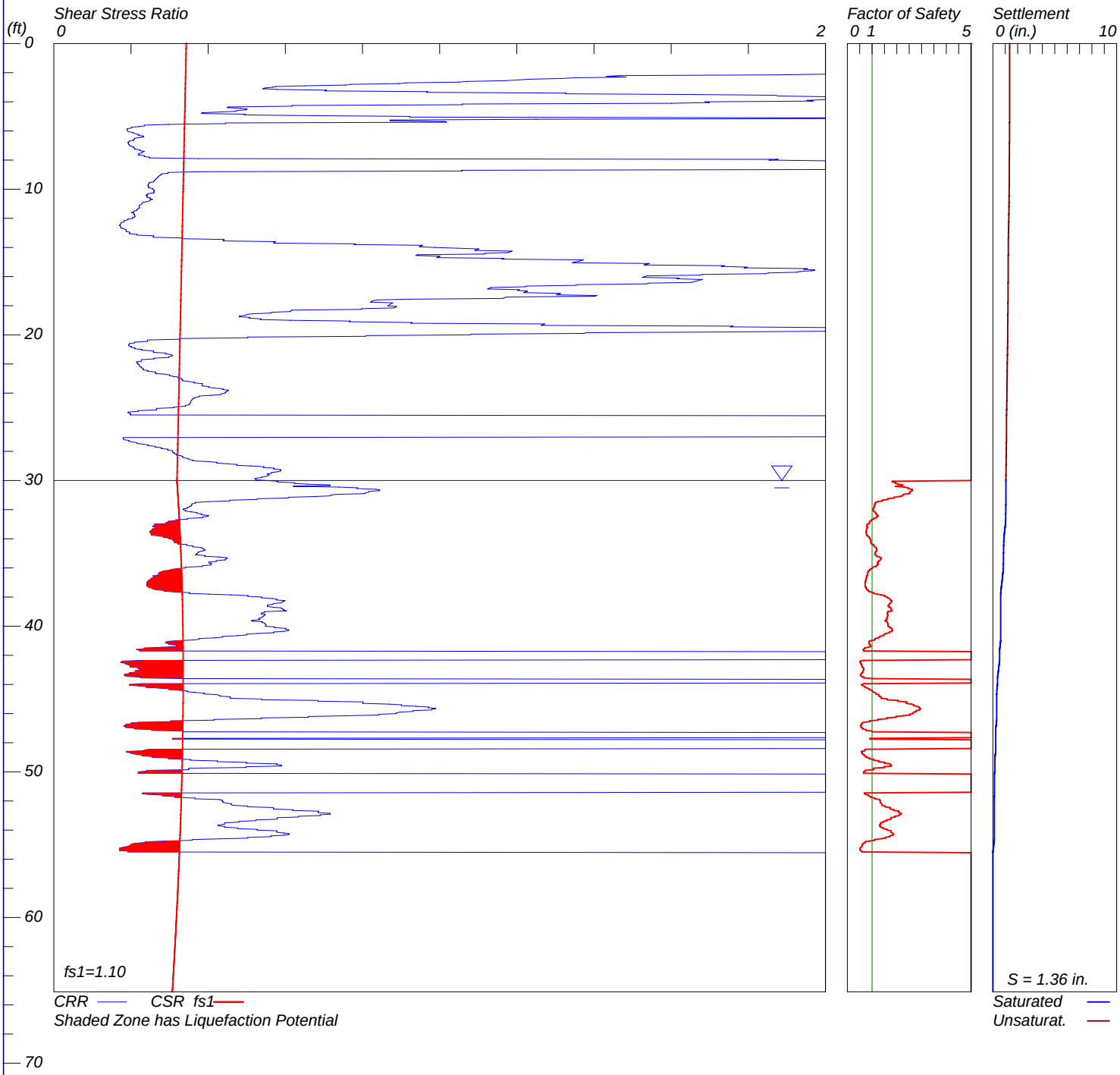
LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/RW No 293

Hole No.=CPT-09-106 Water Depth=30 ft Surface Elev.=173

Magnitude=6.6
Acceleration=0.48g



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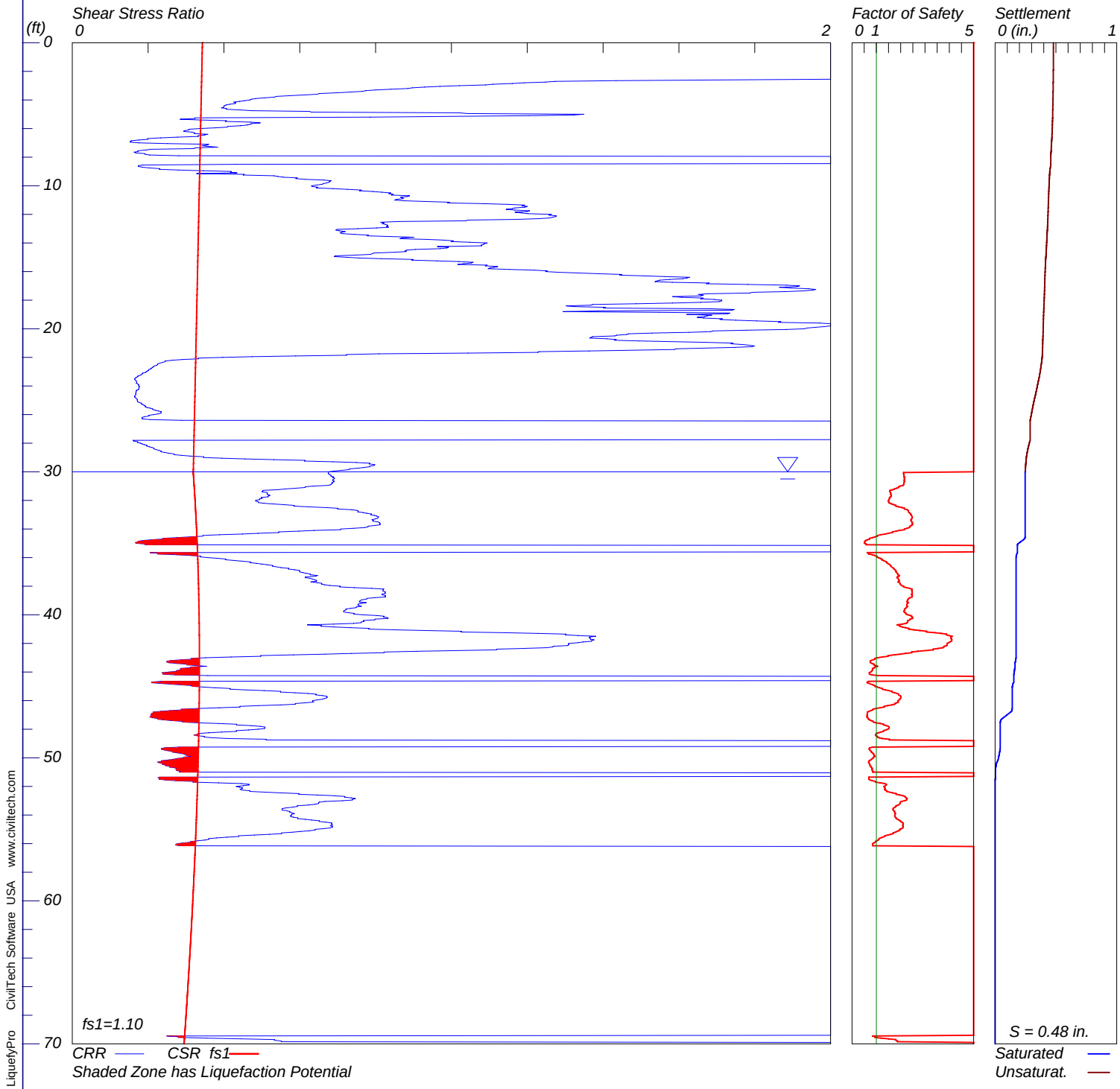
LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/RW No 293

Hole No.=CPT-09-110 Water Depth=30 ft Surface Elev.=175

Magnitude=6.6
Acceleration=0.48g



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602231-002

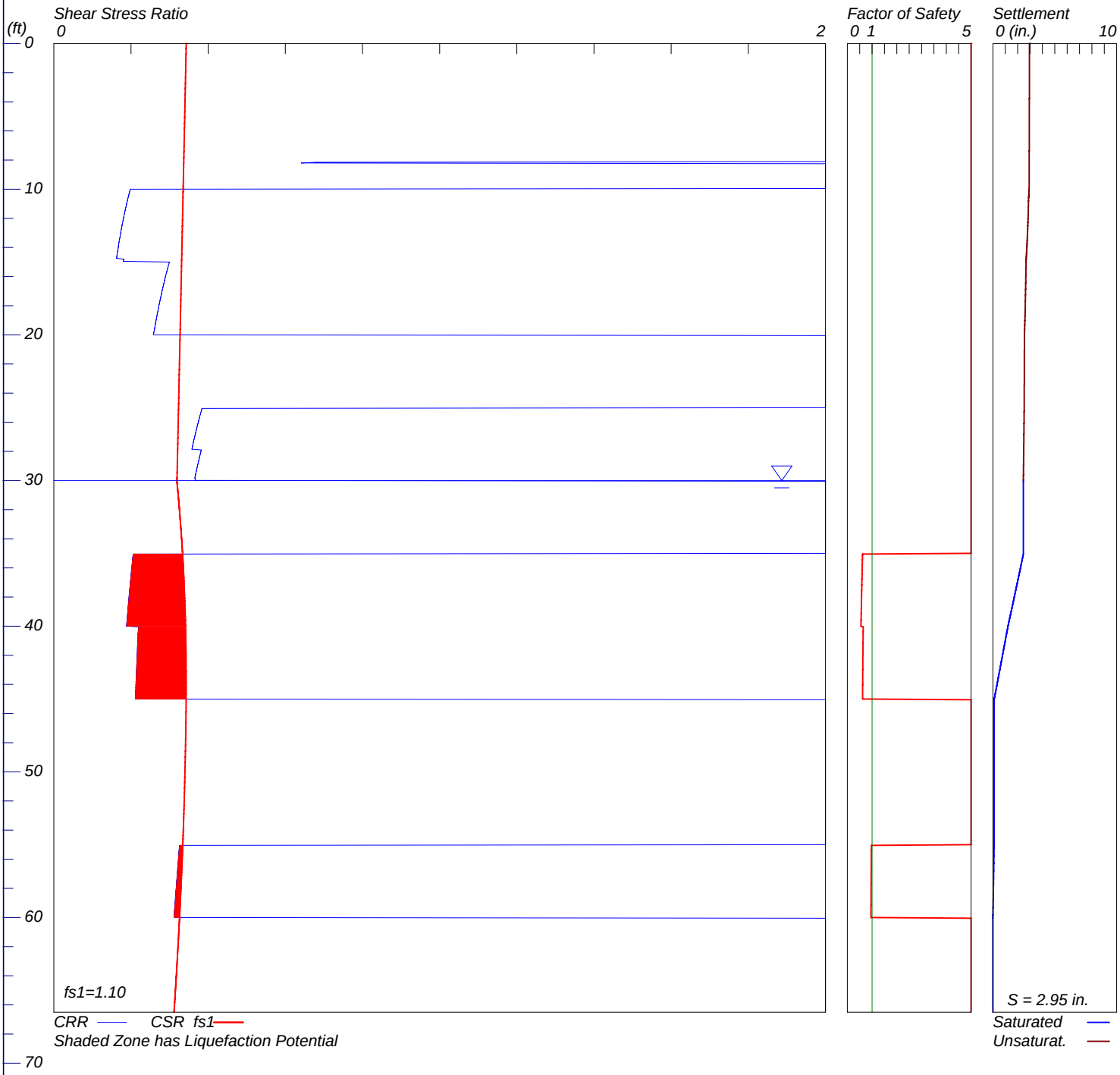
Figure B8

LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/RW No 293

Hole No.=A-09-102 Water Depth=30 ft Surface Elev.=175

Magnitude=6.6
Acceleration=0.48g

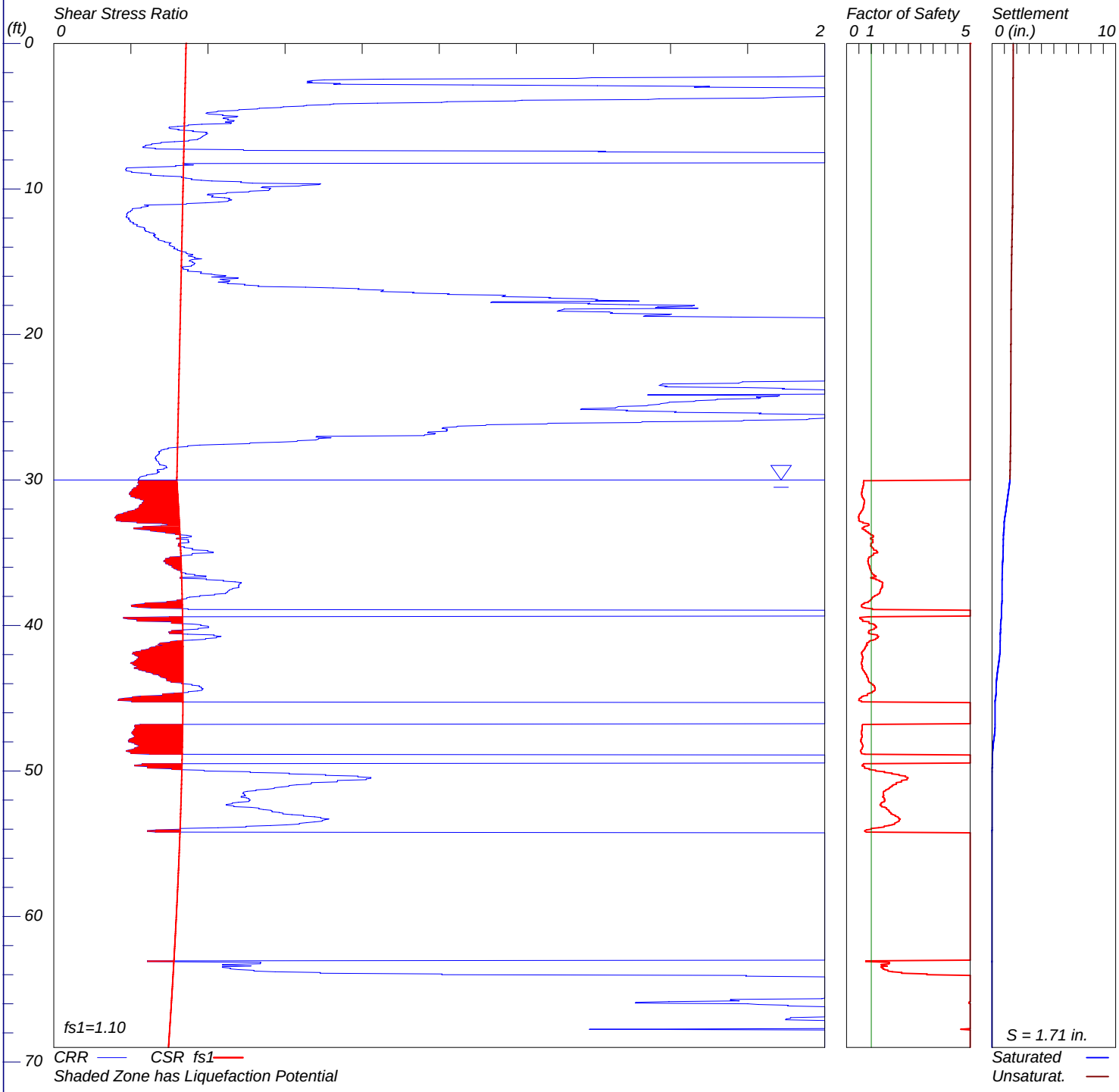


LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/RW No 293

Hole No.=CPT-09-107 Water Depth=30 ft Surface Elev.=177.5

Magnitude=6.6
Acceleration=0.48g

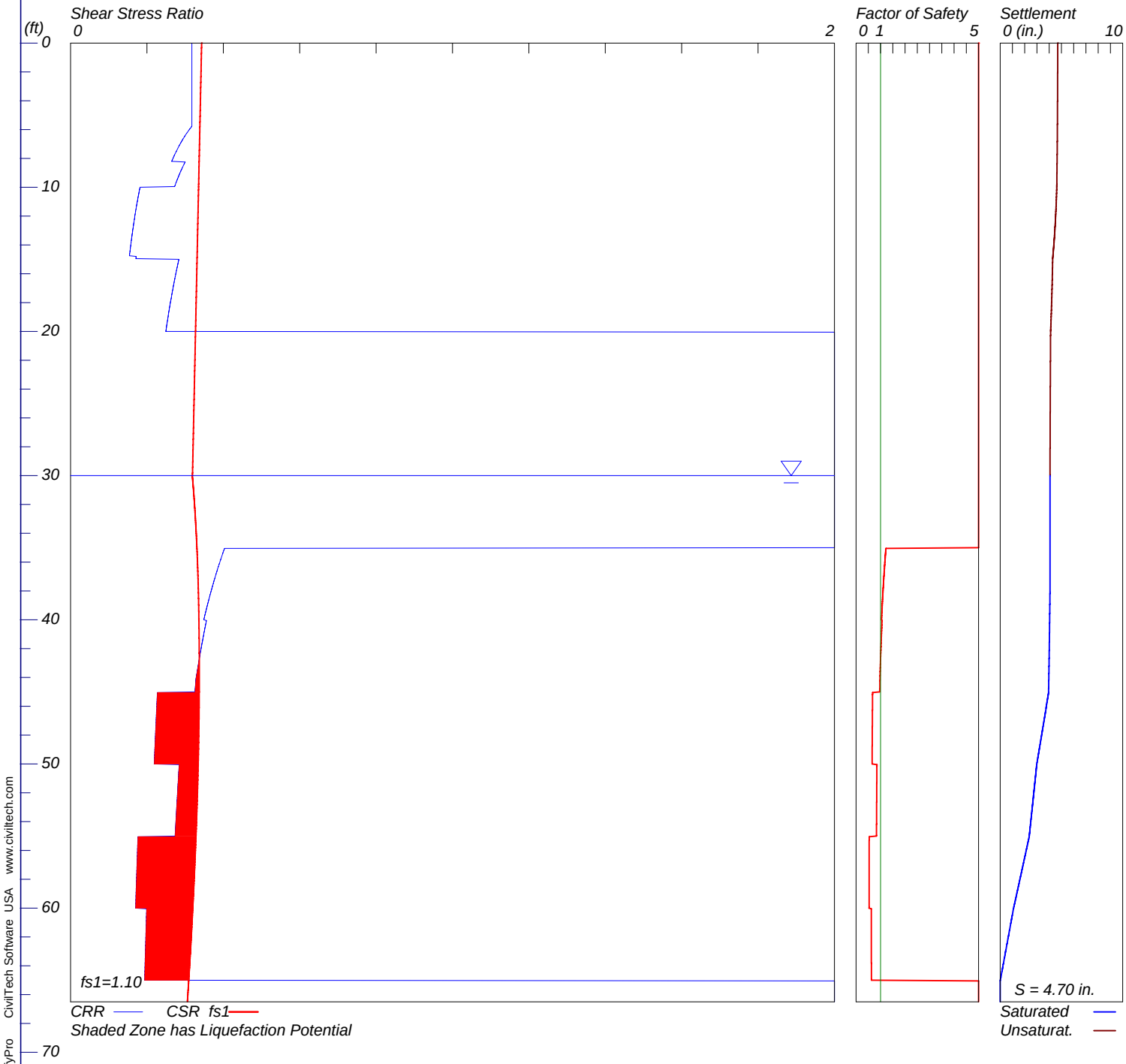


LIQUEFACTION ANALYSIS

SR-57 Northbound Widening/ RW No 293

Hole No.=A-09-103 Water Depth=30 ft Surface Elev.=178

Magnitude=6.6
Acceleration=0.48g



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Title: SR-57 Northbound Widening/RW No 275
Subtitle: 602231-002
Surface Elev.=167
Hole No.=A-09-101
Depth of Hole= 61.50 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:

Surface Elev.=167
Hole No.=A-09-101
Depth of Hole=61.50 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60
1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.333
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	4.00	126.00	50.00
10.00	13.00	106.00	5.00
15.00	17.00	106.00	5.00
20.00	9.00	125.00	20.00
25.00	7.00	120.00	50.00
30.00	36.00	114.00	5.00
35.00	15.00	114.00	4.80
40.00	5.00	114.00	NoLiq
45.00	9.00	115.00	NoLiq
50.00	13.00	115.00	63.00
55.00	13.00	115.00	NoLiq
60.00	100.00	115.00	20.00

Output Results:

Settlement of Saturated Sands=1.04 in.
Settlement of Unsaturated Sands=0.55 in.
Total Settlement of Saturated and Unsaturated Sands=1.58 in.
Differential Settlement=0.791 to 1.044 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.25	0.34	5.00	1.04	0.55	1.58
5.00	0.25	0.34	5.00	1.04	0.51	1.55
10.00	0.41	0.34	5.00	1.04	0.41	1.45
15.00	2.77	0.33	5.00	1.04	0.36	1.39
20.00	0.46	0.33	5.00	1.04	0.31	1.34
25.00	0.25	0.32	5.00	1.04	0.18	1.21
30.00	0.25	0.32	5.00	1.04	0.00	1.04
35.00	2.65	0.33	5.00	1.04	0.00	1.04
40.00	0.25	0.34	0.75*	0.26	0.00	0.26
45.00	2.00	0.34	5.00	0.25	0.00	0.25
50.00	2.00	0.33	5.00	0.25	0.00	0.25
55.00	0.29	0.33	0.88*	0.00	0.00	0.00
60.00	2.00	0.32	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

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Title: SR-57 Northbound Widening/RW No 293
Subtitle: 602231-002
Surface Elev.=175
Hole No.=A-09-102
Depth of Hole= 66.50 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 40.50 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:

Surface Elev.=175
Hole No.=A-09-102
Depth of Hole=66.50 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 40.50 ft
Max. Acceleration=0.48 g

Earthquake Magnitude=6.60
1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.333
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options
In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	14.00	101.00	5.00
10.00	6.00	104.00	5.00
15.00	10.00	104.00	5.00
20.00	24.00	104.00	5.00
25.00	16.00	104.00	5.00
30.00	46.00	106.00	5.00
35.00	8.00	120.00	17.80
40.00	6.50	131.00	35.40
45.00	53.00	131.00	35.00
50.00	20.00	120.00	NoLiq
55.00	20.00	120.00	7.80
60.00	11.00	120.00	NoLiq
65.00	9.00	120.00	NoLiq

Output Results:
Settlement of Saturated Sands=2.46 in.
Settlement of Unsaturated Sands=0.49 in.
Total Settlement of Saturated and Unsaturated Sands=2.95 in.
Differential Settlement=1.476 to 1.948 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.77	0.34	5.00	2.46	0.49	2.95
5.00	2.77	0.34	5.00	2.46	0.48	2.94
10.00	0.20	0.34	5.00	2.46	0.47	2.93
15.00	0.30	0.33	5.00	2.46	0.22	2.68
20.00	0.26	0.33	5.00	2.46	0.09	2.55
25.00	2.77	0.32	5.00	2.46	0.07	2.53
30.00	0.37	0.32	5.00	2.46	0.00	2.46
35.00	2.71	0.33	5.00	2.46	0.00	2.46
40.00	0.19	0.34	0.55*	1.22	0.00	1.22
45.00	0.21	0.34	0.62*	0.11	0.00	0.11
50.00	2.55	0.34	5.00	0.10	0.00	0.10
55.00	2.00	0.33	5.00	0.10	0.00	0.10
60.00	0.31	0.33	0.96*	0.00	0.00	0.00
65.00	2.00	0.32	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf,
Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)
CRRm Cyclic resistance ratio from soils
CSRsf Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S. Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat Settlement from saturated sands
S_dry Settlement from Unsaturated Sands
S_all Total Settlement from Saturated and Unsaturated Sands
NoLiq No-Liquefy Soils

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Title: SR-57 Northbound Widening/ RW No 293
Subtitle: 602231-002
Surface Elev.=178
Hole No.=A-09-103
Depth of Hole= 66.50 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 44.00 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60
Input Data:
Surface Elev.=178
Hole No.=A-09-103
Depth of Hole=66.50 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 44.00 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60
1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.333
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.2
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options
In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	9.00	120.00	5.00
10.00	6.00	100.00	5.00
15.00	10.00	100.00	5.00
20.00	22.00	111.00	5.00
25.00	28.00	111.00	5.00
30.00	27.00	135.00	5.00
35.00	20.00	135.00	5.40

40.00	18.00	121.00	17.00
45.00	14.00	120.00	8.20
50.00	18.00	120.00	9.60
55.00	12.00	120.00	6.20
60.00	10.00	120.00	24.30
65.00	69.00	120.00	5.00

Ourput Results:

Settlement of Saturated Sands=4.07 in.
Settlement of Unsaturated Sands=0.63 in.
Total Settlement of Saturated and Unsaturated Sands=4.70 in.
Differential Settlement=2.348 to 3.100 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	0.32	0.34	5.00	4.07	0.63	4.70
5.00	0.32	0.34	5.00	4.07	0.61	4.68
10.00	0.18	0.34	5.00	4.07	0.55	4.62
15.00	0.28	0.33	5.00	4.07	0.22	4.28
20.00	0.25	0.33	5.00	4.07	0.05	4.12
25.00	2.77	0.32	5.00	4.07	0.02	4.09
30.00	2.76	0.32	5.00	4.07	0.00	4.07
35.00	2.67	0.33	5.00	4.07	0.00	4.07
40.00	0.35	0.34	1.04	4.04	0.00	4.04
45.00	0.33	0.34	0.97*	3.95	0.00	3.95
50.00	0.22	0.33	0.66*	2.99	0.00	2.99
55.00	0.27	0.33	0.83*	2.37	0.00	2.37
60.00	0.17	0.32	0.53*	1.10	0.00	1.10
65.00	0.19	0.31	0.63*	0.01	0.00	0.01

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf,
Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

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Title: SR-57 Northbound Widening/RW No 275
Subtitle: 602231-002
Surface Elev.=165
Hole No.=CPT-09-104
Depth of Hole= 60.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:

Surface Elev.=165
Hole No.=CPT-09-104
Depth of Hole=60.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60
1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	qc atm	fs atm	gamma pcf	Fines %	D50 mm
0.00	0.00	0.00	120.00	0.00	0.50
0.17	3.00	0.00	120.00	0.00	0.50
0.25	274.40	0.00	120.00	0.00	0.50
0.33	391.70	0.25	120.00	0.00	0.50
0.39	431.20	0.24	120.00	0.00	0.50
0.46	384.80	0.28	120.00	0.00	0.50
0.53	322.90	0.33	120.00	0.00	0.50
0.62	240.80	0.38	120.00	0.00	0.50
0.69	157.10	0.50	120.00	0.00	0.50
0.77	145.20	0.49	120.00	0.00	0.50
0.84	132.40	0.54	120.00	0.00	0.50
0.91	132.90	0.54	120.00	0.00	0.50
1.00	133.70	0.54	120.00	0.00	0.50
1.08	133.60	0.56	120.00	0.00	0.50
1.19	144.10	0.53	120.00	0.00	0.50
1.32	144.40	0.61	120.00	0.00	0.50
1.43	132.20	0.68	120.00	0.00	0.50
1.56	104.90	0.85	120.00	0.00	0.50
1.68	86.90	0.91	120.00	0.00	0.50
1.79	71.90	1.08	120.00	0.00	0.50
1.92	61.40	1.18	120.00	0.00	0.50
2.03	54.50	1.28	120.00	0.00	0.50
2.15	51.30	1.27	120.00	0.00	0.50
2.28	41.40	1.41	120.00	0.00	0.50
2.41	33.60	1.49	120.00	0.00	0.50
2.53	27.80	1.66	120.00	0.00	0.50
2.60	19.50	2.25	120.00	0.00	0.50
2.69	22.40	1.92	120.00	0.00	0.50
2.78	21.10	2.04	120.00	0.00	0.50
2.87	20.70	2.06	120.00	0.00	0.50
2.98	20.60	1.99	120.00	0.00	0.50

3.11	20.60	1.79	120.00	0.00	0.50
3.17	20.00	1.68	120.00	0.00	0.50
3.30	18.70	1.62	120.00	0.00	0.50
3.43	17.40	1.86	120.00	0.00	0.50
3.56	15.30	2.33	120.00	0.00	0.50
3.69	14.60	2.50	120.00	0.00	0.50
3.82	13.30	2.60	120.00	0.00	0.50
3.95	10.80	3.08	120.00	0.00	0.50
4.08	9.50	2.96	120.00	0.00	0.50
4.21	8.90	2.86	120.00	0.00	0.50
4.33	9.80	2.58	120.00	0.00	0.50
4.46	8.40	2.81	120.00	0.00	0.50
4.59	9.10	2.39	120.00	0.00	0.50
4.72	9.50	1.93	120.00	0.00	0.50
4.85	10.40	1.50	120.00	0.00	0.50
4.92	11.10	1.32	120.00	0.00	0.50
5.05	12.00	1.13	120.00	0.00	0.50
5.17	13.20	1.32	120.00	0.00	0.50
5.30	16.30	1.14	120.00	0.00	0.50
5.43	17.40	1.37	120.00	0.00	0.50
5.56	18.70	1.38	120.00	0.00	0.50
5.65	14.80	1.83	120.00	0.00	0.50
5.76	18.80	1.44	120.00	0.00	0.50
5.88	18.50	1.45	120.00	0.00	0.50
6.00	18.50	1.49	120.00	0.00	0.50
6.12	20.00	1.33	120.00	0.00	0.50
6.24	20.30	1.30	120.00	0.00	0.50
6.35	21.30	1.34	120.00	0.00	0.50
6.47	22.10	1.28	120.00	0.00	0.50
6.58	22.90	1.27	120.00	0.00	0.50
6.70	23.40	1.20	120.00	0.00	0.50
6.82	23.40	1.14	120.00	0.00	0.50
6.93	23.30	1.34	120.00	0.00	0.50
7.05	22.40	1.59	120.00	0.00	0.50
7.17	21.60	1.73	120.00	0.00	0.50
7.29	22.20	1.68	120.00	0.00	0.50
7.40	24.10	1.50	120.00	0.00	0.50
7.52	24.70	1.19	120.00	0.00	0.50
7.63	24.70	1.22	120.00	0.00	0.50
7.75	26.70	1.51	120.00	0.00	0.50
7.86	27.70	1.70	120.00	0.00	0.50
7.98	27.50	1.84	120.00	0.00	0.50
8.08	24.20	2.16	120.00	0.00	0.50
8.17	30.80	1.77	120.00	0.00	0.50
8.27	34.20	1.42	120.00	0.00	0.50
8.39	33.50	1.25	120.00	0.00	0.50
8.50	49.10	0.73	120.00	0.00	0.50
8.61	56.50	0.64	120.00	0.00	0.50
8.73	60.10	0.61	120.00	0.00	0.50
8.80	59.70	0.62	120.00	0.00	0.50
8.90	62.00	0.62	120.00	0.00	0.50
9.02	61.50	0.67	120.00	0.00	0.50
9.13	59.60	0.72	120.00	0.00	0.50
9.24	57.40	0.79	120.00	0.00	0.50
9.36	54.90	0.84	120.00	0.00	0.50
9.47	50.70	0.88	120.00	0.00	0.50
9.58	47.80	0.92	120.00	0.00	0.50
9.69	45.80	0.90	120.00	0.00	0.50
9.81	43.90	0.95	120.00	0.00	0.50
9.92	43.30	0.99	120.00	0.00	0.50
10.03	42.00	1.05	120.00	0.00	0.50
10.14	41.60	1.17	120.00	0.00	0.50
10.25	41.10	1.48	120.00	0.00	0.50
10.37	41.40	1.58	120.00	0.00	0.50
10.48	42.20	1.58	120.00	0.00	0.50
10.59	47.00	1.34	120.00	0.00	0.50
10.71	51.30	0.99	120.00	0.00	0.50
10.82	54.40	0.69	120.00	0.00	0.50
10.93	54.90	0.64	120.00	0.00	0.50
11.05	52.40	0.66	120.00	0.00	0.50
11.16	49.00	0.66	120.00	0.00	0.50
11.28	46.60	0.65	120.00	0.00	0.50
11.39	46.80	0.67	120.00	0.00	0.50
11.50	50.80	0.59	120.00	0.00	0.50
11.62	58.10	0.60	120.00	0.00	0.50
11.73	65.30	0.59	120.00	0.00	0.50
11.84	67.10	0.59	120.00	0.00	0.50
11.94	70.10	0.55	120.00	0.00	0.50
12.02	68.10	0.53	120.00	0.00	0.50
12.11	62.20	0.53	120.00	0.00	0.50
12.20	54.50	0.56	120.00	0.00	0.50
12.30	48.40	0.58	120.00	0.00	0.50
12.41	42.90	0.63	120.00	0.00	0.50
12.52	41.20	0.66	120.00	0.00	0.50
12.64	41.90	0.73	120.00	0.00	0.50
12.75	43.30	0.80	120.00	0.00	0.50
12.86	44.80	0.84	120.00	0.00	0.50
12.97	46.00	0.89	120.00	0.00	0.50
13.08	47.30	0.95	120.00	0.00	0.50
13.19	48.50	0.99	120.00	0.00	0.50
13.31	49.10	1.08	120.00	0.00	0.50
13.42	50.10	1.10	120.00	0.00	0.50
13.53	50.50	1.14	120.00	0.00	0.50
13.61	42.30	1.38	120.00	0.00	0.50
13.71	50.30	1.18	120.00	0.00	0.50
13.81	49.10	1.16	120.00	0.00	0.50
13.93	49.20	1.13	120.00	0.00	0.50
14.04	47.60	1.14	120.00	0.00	0.50
14.14	46.40	1.00	120.00	0.00	0.50
14.26	45.20	1.04	120.00	0.00	0.50
14.37	44.60	1.01	120.00	0.00	0.50
14.48	36.80	1.20	120.00	0.00	0.50
14.59	42.20	1.06	120.00	0.00	0.50
14.70	42.20	1.03	120.00	0.00	0.50
14.81	42.50	1.06	120.00	0.00	0.50
14.92	43.30	1.12	120.00	0.00	0.50
14.98	36.30	1.41	120.00	0.00	0.50
15.07	44.00	1.22	120.00	0.00	0.50
15.16	44.70	1.29	120.00	0.00	0.50
15.25	44.90	1.41	120.00	0.00	0.50
15.34	45.80	1.50	120.00	0.00	0.50
15.45	46.90	1.56	120.00	0.00	0.50
15.56	48.60	1.62	120.00	0.00	0.50
15.67	50.70	1.65	120.00	0.00	0.50
15.78	52.40	1.65	120.00	0.00	0.50
15.89	53.10	1.67	120.00	0.00	0.50
16.00	54.70	1.64	120.00	0.00	0.50
16.11	54.50	1.64	120.00	0.00	0.50
16.22	53.10	1.67	120.00	0.00	0.50
16.33	51.90	1.65	120.00	0.00	0.50

16.44	51.30	1.59	120.00	0.00	0.50
16.55	51.50	1.44	120.00	0.00	0.50
16.66	50.00	1.32	120.00	0.00	0.50
16.77	43.80	1.26	120.00	0.00	0.50
16.88	36.30	1.28	120.00	0.00	0.50
16.99	29.80	1.50	120.00	0.00	0.50
17.10	24.10	2.18	120.00	0.00	0.50
17.21	21.10	2.83	120.00	0.00	0.50
17.32	20.20	2.92	120.00	0.00	0.50
17.43	19.00	2.93	120.00	0.00	0.50
17.54	22.40	2.29	120.00	0.00	0.50
17.65	25.00	1.86	120.00	0.00	0.50
17.76	25.50	1.86	120.00	0.00	0.50
17.87	25.50	2.13	120.00	0.00	0.50
17.98	25.10	2.68	120.00	0.00	0.50
18.09	24.70	3.12	120.00	0.00	0.50
18.18	26.80	3.03	120.00	0.00	0.50
18.28	28.70	2.78	120.00	0.00	0.50
18.39	30.50	2.31	120.00	0.00	0.50
18.50	32.40	1.83	120.00	0.00	0.50
18.61	34.60	1.45	120.00	0.00	0.50
18.72	35.10	1.25	120.00	0.00	0.50
18.83	34.50	1.23	120.00	0.00	0.50
18.94	33.20	1.43	120.00	0.00	0.50
19.05	35.80	1.50	120.00	0.00	0.50
19.16	38.80	1.38	120.00	0.00	0.50
19.27	43.30	1.15	120.00	0.00	0.50
19.38	47.00	0.94	120.00	0.00	0.50
19.49	50.00	0.74	120.00	0.00	0.50
19.60	52.20	0.62	120.00	0.00	0.50
19.71	53.20	0.61	120.00	0.00	0.50
19.82	53.00	0.61	120.00	0.00	0.50
19.92	51.00	0.60	120.00	0.00	0.50
20.03	48.00	0.58	120.00	0.00	0.50
20.14	44.40	0.53	120.00	0.00	0.50
20.25	40.70	0.73	120.00	0.00	0.50
20.36	37.20	1.06	120.00	0.00	0.50
20.47	28.50	1.84	120.00	0.00	0.50
20.57	26.60	2.49	120.00	0.00	0.50
20.67	28.10	2.61	120.00	0.00	0.50
20.78	26.30	2.95	120.00	0.00	0.50
20.89	26.70	3.05	120.00	0.00	0.50
21.01	24.20	3.24	120.00	0.00	0.50
21.12	19.80	3.99	120.00	0.00	0.50
21.20	14.10	5.58	120.00	0.00	0.50
21.28	16.50	4.56	120.00	0.00	0.50
21.38	15.40	4.43	120.00	0.00	0.50
21.48	16.00	3.75	120.00	0.00	0.50
21.58	18.10	2.85	120.00	0.00	0.50
21.68	23.10	2.02	120.00	0.00	0.50
21.80	29.50	1.52	120.00	0.00	0.50
21.91	34.50	1.28	120.00	0.00	0.50
22.03	35.00	1.13	120.00	0.00	0.50
22.14	36.00	1.07	120.00	0.00	0.50
22.25	36.60	1.07	120.00	0.00	0.50
22.37	36.40	1.05	120.00	0.00	0.50
22.48	35.90	1.03	120.00	0.00	0.50
22.59	36.30	0.98	120.00	0.00	0.50
22.71	36.70	0.96	120.00	0.00	0.50
22.82	36.00	1.09	120.00	0.00	0.50
22.94	35.20	1.36	120.00	0.00	0.50
23.05	34.80	1.69	120.00	0.00	0.50
23.17	34.20	2.02	120.00	0.00	0.50
23.28	34.00	2.25	120.00	0.00	0.50
23.39	33.70	2.32	120.00	0.00	0.50
23.51	32.80	2.30	120.00	0.00	0.50
23.62	32.70	2.26	120.00	0.00	0.50
23.74	30.20	2.48	120.00	0.00	0.50
23.85	27.70	2.95	120.00	0.00	0.50
23.96	25.50	3.38	120.00	0.00	0.50
24.08	24.20	3.31	120.00	0.00	0.50
24.19	24.00	3.49	120.00	0.00	0.50
24.29	20.60	4.26	120.00	0.00	0.50
24.36	25.40	3.60	120.00	0.00	0.50
24.44	24.60	3.75	120.00	0.00	0.50
24.53	25.40	3.39	120.00	0.00	0.50
24.64	27.50	2.83	120.00	0.00	0.50
24.75	31.30	2.25	120.00	0.00	0.50
24.86	28.80	2.12	120.00	0.00	0.50
24.98	30.10	1.80	120.00	0.00	0.50
25.09	32.10	1.64	120.00	0.00	0.50
25.20	32.90	1.72	120.00	0.00	0.50
25.32	33.20	2.03	120.00	0.00	0.50
25.43	31.50	2.56	120.00	0.00	0.50
25.54	30.00	2.68	120.00	0.00	0.50
25.65	31.40	2.29	120.00	0.00	0.50
25.77	34.20	2.01	120.00	0.00	0.50
25.88	31.80	2.19	120.00	0.00	0.50
25.99	23.90	3.06	120.00	0.00	0.50
26.10	20.00	3.98	120.00	0.00	0.50
26.22	18.00	4.61	120.00	0.00	0.50
26.33	17.80	4.90	120.00	0.00	0.50
26.44	17.20	4.62	120.00	0.00	0.50
26.56	16.40	4.79	120.00	0.00	0.50
26.67	20.80	3.97	120.00	0.00	0.50
26.79	21.40	4.04	120.00	0.00	0.50
26.90	19.00	4.84	120.00	0.00	0.50
27.01	17.30	4.96	120.00	0.00	0.50
27.13	16.80	3.41	120.00	0.00	0.50
27.24	18.40	3.34	120.00	0.00	0.50
27.35	28.60	2.75	120.00	0.00	0.50
27.42	33.90	2.78	120.00	0.00	0.50
27.53	34.30	3.29	120.00	0.00	0.50
27.64	31.70	3.83	120.00	0.00	0.50
27.75	32.40	3.93	120.00	0.00	0.50
27.86	41.00	3.14	120.00	0.00	0.50
27.97	52.20	2.41	120.00	0.00	0.50
28.09	69.80	1.51	120.00	0.00	0.50
28.20	81.60	1.09	120.00	0.00	0.50
28.31	90.60	0.93	120.00	0.00	0.50
28.43	98.20	0.83	120.00	0.00	0.50
28.54	104.10	0.83	120.00	0.00	0.50
28.65	108.80	0.84	120.00	0.00	0.50
28.76	111.20	0.86	120.00	0.00	0.50
28.87	111.80	0.85	120.00	0.00	0.50
28.98	110.40	0.87	120.00	0.00	0.50
29.09	109.90	0.89	120.00	0.00	0.50
29.20	112.60	0.90	120.00	0.00	0.50
29.32	122.40	0.88	120.00	0.00	0.50
29.43	132.10	0.86	120.00	0.00	0.50

29.54	141.90	0.84	120.00	0.00	0.50
29.64	150.00	0.82	120.00	0.00	0.50
29.74	155.40	0.81	120.00	0.00	0.50
29.83	158.50	0.82	120.00	0.00	0.50
29.93	160.80	0.83	120.00	0.00	0.50
30.03	162.60	0.75	120.00	0.00	0.50
30.13	165.70	0.71	120.00	0.00	0.50
30.22	167.70	0.75	120.00	0.00	0.50
30.32	169.10	0.78	120.00	0.00	0.50
30.41	160.40	0.84	120.00	0.00	0.50
30.51	170.80	0.79	120.00	0.00	0.50
30.60	173.80	0.77	120.00	0.00	0.50
30.71	176.10	0.78	120.00	0.00	0.50
30.82	177.90	0.78	120.00	0.00	0.50
30.93	177.40	0.79	120.00	0.00	0.50
31.04	175.60	0.82	120.00	0.00	0.50
31.15	174.10	0.85	120.00	0.00	0.50
31.26	172.40	0.87	120.00	0.00	0.50
31.37	168.50	0.90	120.00	0.00	0.50
31.48	166.70	0.90	120.00	0.00	0.50
31.59	169.70	0.86	120.00	0.00	0.50
31.70	180.00	0.80	120.00	0.00	0.50
31.81	198.40	0.75	120.00	0.00	0.50
31.92	218.00	0.73	120.00	0.00	0.50
32.03	236.20	0.73	120.00	0.00	0.50
32.14	247.20	0.73	120.00	0.00	0.50
32.24	250.20	0.75	120.00	0.00	0.50
32.36	248.90	0.74	120.00	0.00	0.50
32.46	244.20	0.72	120.00	0.00	0.50
32.57	235.90	0.71	120.00	0.00	0.50
32.69	222.10	0.71	120.00	0.00	0.50
32.80	199.70	0.73	120.00	0.00	0.50
32.91	174.20	0.79	120.00	0.00	0.50
33.01	148.10	0.94	120.00	0.00	0.50
33.13	116.50	1.35	120.00	0.00	0.50
33.24	86.80	1.71	120.00	0.00	0.50
33.35	59.50	3.04	120.00	0.00	0.50
33.45	48.70	3.96	120.00	0.00	0.50
33.55	50.50	3.76	120.00	0.00	0.50
33.66	47.60	4.05	120.00	0.00	0.50
33.76	44.20	4.62	120.00	0.00	0.50
33.87	55.80	4.09	120.00	0.00	0.50
33.98	77.80	3.25	120.00	0.00	0.50
34.09	97.00	3.07	120.00	0.00	0.50
34.20	98.90	3.05	120.00	0.00	0.50
34.31	97.10	2.74	120.00	0.00	0.50
34.42	97.60	2.27	120.00	0.00	0.50
34.53	92.10	2.05	120.00	0.00	0.50
34.65	83.00	1.94	120.00	0.00	0.50
34.76	79.00	2.06	120.00	0.00	0.50
34.86	71.40	2.55	120.00	0.00	0.50
34.98	51.70	4.01	120.00	0.00	0.50
35.09	33.30	5.72	120.00	0.00	0.50
35.20	26.90	5.83	120.00	0.00	0.50
35.30	26.70	5.37	120.00	0.00	0.50
35.41	36.60	3.90	120.00	0.00	0.50
35.53	49.70	2.98	120.00	0.00	0.50
35.63	58.00	2.70	120.00	0.00	0.50
35.74	66.40	2.56	120.00	0.00	0.50
35.85	72.20	2.48	120.00	0.00	0.50
35.96	73.90	2.42	120.00	0.00	0.50
36.07	75.00	2.33	120.00	0.00	0.50
36.18	74.20	2.40	120.00	0.00	0.50
36.29	73.00	2.33	120.00	0.00	0.50
36.40	70.70	2.11	120.00	0.00	0.50
36.51	69.00	2.32	120.00	0.00	0.50
36.59	62.10	2.66	120.00	0.00	0.50
36.70	75.10	2.20	120.00	0.00	0.50
36.81	69.50	2.32	120.00	0.00	0.50
36.92	66.30	2.26	120.00	0.00	0.50
37.03	59.80	2.39	120.00	0.00	0.50
37.13	52.90	2.70	120.00	0.00	0.50
37.24	47.20	3.27	120.00	0.00	0.50
37.35	44.70	3.69	120.00	0.00	0.50
37.46	43.60	3.72	120.00	0.00	0.50
37.57	45.00	3.43	120.00	0.00	0.50
37.68	51.30	2.62	120.00	0.00	0.50
37.79	62.80	1.90	120.00	0.00	0.50
37.90	67.00	1.63	120.00	0.00	0.50
38.00	66.50	1.56	120.00	0.00	0.50
38.11	62.70	1.86	120.00	0.00	0.50
38.22	57.90	2.24	120.00	0.00	0.50
38.33	54.50	2.51	120.00	0.00	0.50
38.44	49.40	2.77	120.00	0.00	0.50
38.55	39.30	3.13	120.00	0.00	0.50
38.66	24.00	4.39	120.00	0.00	0.50
38.77	17.20	4.88	120.00	0.00	0.50
38.87	11.50	5.32	120.00	0.00	0.50
38.99	9.80	4.83	120.00	0.00	0.50
39.10	10.40	3.74	120.00	0.00	0.50
39.21	9.20	3.94	120.00	0.00	0.50
39.32	8.20	3.55	120.00	0.00	0.50
39.43	6.90	4.35	120.00	0.00	0.50
39.54	8.20	3.94	120.00	0.00	0.50
39.65	8.80	3.64	120.00	0.00	0.50
39.72	8.50	3.95	120.00	0.00	0.50
39.80	8.80	4.77	120.00	0.00	0.50
39.89	9.00	5.42	120.00	0.00	0.50
39.98	12.80	4.08	120.00	0.00	0.50
40.07	16.20	3.37	120.00	0.00	0.50
40.15	16.10	3.80	120.00	0.00	0.50
40.24	18.40	3.74	120.00	0.00	0.50
40.33	28.40	2.58	120.00	0.00	0.50
40.41	46.70	1.77	120.00	0.00	0.50
40.50	59.70	1.55	120.00	0.00	0.50
40.60	62.30	1.62	120.00	0.00	0.50
40.70	55.60	1.86	120.00	0.00	0.50
40.81	45.70	2.31	120.00	0.00	0.50
40.92	34.80	3.40	120.00	0.00	0.50
41.02	27.80	3.71	120.00	0.00	0.50
41.13	37.80	2.47	120.00	0.00	0.50
41.24	78.60	1.17	120.00	0.00	0.50
41.35	106.40	0.88	120.00	0.00	0.50
41.45	122.50	0.74	120.00	0.00	0.50
41.56	134.10	0.69	120.00	0.00	0.50
41.67	143.20	0.65	120.00	0.00	0.50
41.78	152.50	0.63	120.00	0.00	0.50
41.89	162.20	0.62	120.00	0.00	0.50
41.99	169.50	0.64	120.00	0.00	0.50
42.10	170.90	0.70	120.00	0.00	0.50

42.21	174.90	0.77	120.00	0.00	0.50
42.32	180.70	0.82	120.00	0.00	0.50
42.42	188.90	0.69	120.00	0.00	0.50
42.53	202.00	0.38	120.00	0.00	0.50
42.64	214.60	0.44	120.00	0.00	0.50
42.74	234.10	0.48	120.00	0.00	0.50
42.83	224.40	0.52	120.00	0.00	0.50
42.92	246.10	0.47	120.00	0.00	0.50
43.02	243.50	0.48	120.00	0.00	0.50
43.12	233.80	0.52	120.00	0.00	0.50
43.21	225.70	0.57	120.00	0.00	0.50
43.31	223.30	0.61	120.00	0.00	0.50
43.41	230.30	0.62	120.00	0.00	0.50
43.52	238.40	0.62	120.00	0.00	0.50
43.63	242.80	0.60	120.00	0.00	0.50
43.73	244.20	0.54	120.00	0.00	0.50
43.84	237.90	0.47	120.00	0.00	0.50
43.95	234.30	0.41	120.00	0.00	0.50
44.05	241.30	0.40	120.00	0.00	0.50
44.16	257.30	0.40	120.00	0.00	0.50
44.27	265.70	0.40	120.00	0.00	0.50
44.37	259.40	0.41	120.00	0.00	0.50
44.48	250.40	0.42	120.00	0.00	0.50
44.58	240.90	0.44	120.00	0.00	0.50
44.69	228.50	0.46	120.00	0.00	0.50
44.80	210.60	0.46	120.00	0.00	0.50
44.91	190.30	0.47	120.00	0.00	0.50
45.01	167.10	0.52	120.00	0.00	0.50
45.12	143.60	0.66	120.00	0.00	0.50
45.23	127.10	0.85	120.00	0.00	0.50
45.33	102.50	1.31	120.00	0.00	0.50
45.44	67.80	2.52	120.00	0.00	0.50
45.55	41.00	3.89	120.00	0.00	0.50
45.66	27.80	4.59	120.00	0.00	0.50
45.77	24.60	5.38	120.00	0.00	0.50
45.87	18.30	6.18	120.00	0.00	0.50
45.97	14.90	6.66	120.00	0.00	0.50
46.04	11.00	7.70	120.00	0.00	0.50
46.12	11.10	6.11	120.00	0.00	0.50
46.20	9.50	6.25	120.00	0.00	0.50
46.27	9.40	5.60	120.00	0.00	0.50
46.36	10.00	4.74	120.00	0.00	0.50
46.47	10.40	4.28	120.00	0.00	0.50
46.58	12.80	3.38	120.00	0.00	0.50
46.68	13.00	3.17	120.00	0.00	0.50
46.79	10.50	3.76	120.00	0.00	0.50
46.90	10.50	3.63	120.00	0.00	0.50
47.00	9.40	4.04	120.00	0.00	0.50
47.11	10.20	3.79	120.00	0.00	0.50
47.22	10.00	3.87	120.00	0.00	0.50
47.33	9.70	4.08	120.00	0.00	0.50
47.44	11.20	3.79	120.00	0.00	0.50
47.54	10.60	4.17	120.00	0.00	0.50
47.65	10.50	4.36	120.00	0.00	0.50
47.76	11.60	4.34	120.00	0.00	0.50
47.87	11.00	4.87	120.00	0.00	0.50
47.98	10.80	5.20	120.00	0.00	0.50
48.08	10.60	6.66	120.00	0.00	0.50
48.19	16.00	6.18	120.00	0.00	0.50
48.30	34.20	3.59	120.00	0.00	0.50
48.41	45.60	3.86	120.00	0.00	0.50
48.51	51.60	4.39	120.00	0.00	0.50
48.62	49.60	4.40	120.00	0.00	0.50
48.73	44.90	3.27	120.00	0.00	0.50
48.84	36.20	4.57	120.00	0.00	0.50
48.94	30.60	6.09	120.00	0.00	0.50
49.05	38.80	5.34	120.00	0.00	0.50
49.15	38.70	5.58	120.00	0.00	0.50
49.26	47.40	4.16	120.00	0.00	0.50
49.36	66.20	3.09	120.00	0.00	0.50
49.47	107.30	2.18	120.00	0.00	0.50
49.57	136.80	1.91	120.00	0.00	0.50
49.68	142.30	1.87	120.00	0.00	0.50
49.78	141.90	1.75	120.00	0.00	0.50
49.89	132.00	1.70	120.00	0.00	0.50
50.00	106.70	1.96	120.00	0.00	0.50
50.10	73.10	2.62	120.00	0.00	0.50
50.21	48.30	3.21	120.00	0.00	0.50
50.32	29.80	4.42	120.00	0.00	0.50
50.42	21.40	4.89	120.00	0.00	0.50
50.53	19.30	4.52	120.00	0.00	0.50
50.64	17.90	5.12	120.00	0.00	0.50
50.75	22.90	4.78	120.00	0.00	0.50
50.85	34.50	3.81	120.00	0.00	0.50
50.96	39.80	4.23	120.00	0.00	0.50
51.07	31.40	5.85	120.00	0.00	0.50
51.17	23.70	7.28	120.00	0.00	0.50
51.28	22.20	6.80	120.00	0.00	0.50
51.38	21.60	6.05	120.00	0.00	0.50
51.49	21.00	5.72	120.00	0.00	0.50
51.60	17.50	6.83	120.00	0.00	0.50
51.70	17.00	6.45	120.00	0.00	0.50
51.81	16.30	5.52	120.00	0.00	0.50
51.92	24.00	4.13	120.00	0.00	0.50
52.03	27.80	4.03	120.00	0.00	0.50
52.09	23.40	5.10	120.00	0.00	0.50
52.19	31.90	4.09	120.00	0.00	0.50
52.30	33.50	4.15	120.00	0.00	0.50
52.41	33.30	4.27	120.00	0.00	0.50
52.51	31.20	4.49	120.00	0.00	0.50
52.62	27.70	5.06	120.00	0.00	0.50
52.72	25.70	5.57	120.00	0.00	0.50
52.83	25.10	5.98	120.00	0.00	0.50
52.94	23.70	6.48	120.00	0.00	0.50
53.04	23.40	6.47	120.00	0.00	0.50
53.15	24.40	5.91	120.00	0.00	0.50
53.25	26.30	5.45	120.00	0.00	0.50
53.36	26.20	5.85	120.00	0.00	0.50
53.46	26.20	6.17	120.00	0.00	0.50
53.57	26.00	6.51	120.00	0.00	0.50
53.68	24.50	6.79	120.00	0.00	0.50
53.78	24.00	6.57	120.00	0.00	0.50
53.89	21.90	6.60	120.00	0.00	0.50
53.99	21.70	5.91	120.00	0.00	0.50
54.10	23.50	4.69	120.00	0.00	0.50
54.20	25.20	3.93	120.00	0.00	0.50
54.31	26.90	3.91	120.00	0.00	0.50
54.41	27.80	4.29	120.00	0.00	0.50
54.52	31.20	4.09	120.00	0.00	0.50
54.63	33.70	4.20	120.00	0.00	0.50

54.73	37.10	4.61	120.00	0.00	0.50
54.84	39.30	4.86	120.00	0.00	0.50
54.94	42.70	4.95	120.00	0.00	0.50
55.05	44.30	5.49	120.00	0.00	0.50
55.15	45.00	5.89	120.00	0.00	0.50
55.26	48.20	5.79	120.00	0.00	0.50
55.36	49.00	6.04	120.00	0.00	0.50
55.47	48.90	6.30	120.00	0.00	0.50
55.57	48.70	6.38	120.00	0.00	0.50
55.68	49.20	6.53	120.00	0.00	0.50
55.78	49.70	6.68	120.00	0.00	0.50
55.89	50.50	6.84	120.00	0.00	0.50
56.00	56.00	6.58	120.00	0.00	0.50
56.10	65.80	5.64	120.00	0.00	0.50
56.20	60.10	5.87	120.00	0.00	0.50
56.31	52.40	6.46	120.00	0.00	0.50
56.41	46.80	6.85	120.00	0.00	0.50
56.52	49.60	5.82	120.00	0.00	0.50
56.62	49.00	5.52	120.00	0.00	0.50
56.73	46.10	5.36	120.00	0.00	0.50
56.83	42.00	5.32	120.00	0.00	0.50
56.94	39.50	5.08	120.00	0.00	0.50
57.04	36.40	5.37	120.00	0.00	0.50
57.15	37.40	7.21	120.00	0.00	0.50
57.25	47.30	6.36	120.00	0.00	0.50
57.35	136.30	2.41	120.00	0.00	0.50
57.45	167.20	2.06	120.00	0.00	0.50
57.54	114.40	2.70	120.00	0.00	0.50
57.63	96.20	2.66	120.00	0.00	0.50
57.72	89.00	2.42	120.00	0.00	0.50
57.83	89.30	2.23	120.00	0.00	0.50
57.93	93.10	2.03	120.00	0.00	0.50
58.04	78.00	2.24	120.00	0.00	0.50
58.14	86.60	1.92	120.00	0.00	0.50
58.24	96.90	1.53	120.00	0.00	0.50
58.32	91.30	1.31	120.00	0.00	0.50
58.40	100.90	1.03	120.00	0.00	0.50
58.49	120.40	0.90	120.00	0.00	0.50
58.59	151.50	0.86	120.00	0.00	0.50
58.68	188.80	0.19	120.00	0.00	0.50
58.78	252.60	0.26	120.00	0.00	0.50
58.87	307.00	0.34	120.00	0.00	0.50
58.96	377.70	0.44	120.00	0.00	0.50
59.03	341.90	0.54	120.00	0.00	0.50
59.10	415.60	0.48	120.00	0.00	0.50
59.17	440.40	0.53	120.00	0.00	0.50
59.24	476.00	0.57	120.00	0.00	0.50
59.31	492.50	0.58	120.00	0.00	0.50
59.40	516.70	0.54	120.00	0.00	0.50
59.48	501.30	0.53	120.00	0.00	0.50
59.56	525.70	0.46	120.00	0.00	0.50
59.64	553.60	0.37	120.00	0.00	0.50
59.72	545.90	0.38	120.00	0.00	0.50
59.81	566.30	0.00	120.00	0.00	0.50
59.87	576.50	0.00	120.00	0.00	0.50
59.95	568.00	0.00	120.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.39 in.
Settlement of Unsaturated Sands=0.15 in.
Total Settlement of Saturated and Unsaturated Sands=0.54 in.
Differential Settlement=0.269 to 0.355 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.34	5.00	0.39	0.15	0.54
5.00	2.00	0.34	5.00	0.39	0.14	0.54
10.00	0.30	0.34	5.00	0.39	0.13	0.52
15.00	2.00	0.33	5.00	0.39	0.08	0.47
20.00	0.17	0.33	5.00	0.39	0.06	0.45
25.00	2.00	0.32	5.00	0.39	0.05	0.44
30.00	0.34	0.32	5.00	0.39	0.00	0.39
35.00	2.00	0.33	5.00	0.35	0.00	0.35
40.00	2.00	0.33	5.00	0.35	0.00	0.35
45.00	0.29	0.34	0.88*	0.14	0.00	0.14
50.00	0.24	0.33	0.73*	0.07	0.00	0.07
55.00	2.00	0.33	5.00	0.07	0.00	0.07
60.00	2.00	0.32	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

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LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\CPT-09-102.liq
Title: SR-57 Northbound Widening/RW No 275
Subtitle: 602231-002
Surface Elev.=168
Hole No.=CPT-09-105
Depth of Hole= 65.10 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:

Surface Elev.=168
Hole No.=CPT-09-105
Depth of Hole=65.10 ft

Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60
1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options
In-Situ Test Data:

Depth ft	qc atm	fs atm	gamma pcf	Fines %	D50 mm
0.00	0.00	0.00	120.00	0.00	0.50
0.16	208.00	0.00	120.00	0.00	0.50
0.23	522.70	0.00	120.00	0.00	0.50
0.31	522.20	0.26	120.00	0.00	0.50
0.38	493.10	0.34	120.00	0.00	0.50
0.46	434.20	0.45	120.00	0.00	0.50
0.53	380.70	0.58	120.00	0.00	0.50
0.61	314.80	0.70	120.00	0.00	0.50
0.69	274.20	0.78	120.00	0.00	0.50
0.78	240.00	0.84	120.00	0.00	0.50
0.86	216.00	0.87	120.00	0.00	0.50
0.94	196.20	0.96	120.00	0.00	0.50
1.03	174.90	1.04	120.00	0.00	0.50
1.11	162.10	1.08	120.00	0.00	0.50
1.19	153.90	1.02	120.00	0.00	0.50
1.28	144.70	1.00	120.00	0.00	0.50
1.37	137.10	1.01	120.00	0.00	0.50
1.45	129.00	0.99	120.00	0.00	0.50
1.53	120.50	0.96	120.00	0.00	0.50
1.62	116.10	0.92	120.00	0.00	0.50
1.68	114.90	0.87	120.00	0.00	0.50
1.76	114.70	0.82	120.00	0.00	0.50
1.85	115.30	0.76	120.00	0.00	0.50
1.93	114.30	0.74	120.00	0.00	0.50
2.02	110.60	0.72	120.00	0.00	0.50
2.11	101.40	0.68	120.00	0.00	0.50
2.20	96.90	0.68	120.00	0.00	0.50
2.29	92.80	0.64	120.00	0.00	0.50
2.38	86.20	0.66	120.00	0.00	0.50
2.46	76.80	0.73	120.00	0.00	0.50
2.55	70.50	0.74	120.00	0.00	0.50
2.65	62.00	0.79	120.00	0.00	0.50
2.73	56.10	0.80	120.00	0.00	0.50
2.82	47.90	0.86	120.00	0.00	0.50
2.91	41.00	0.97	120.00	0.00	0.50
3.00	35.60	1.08	120.00	0.00	0.50
3.10	30.80	1.28	120.00	0.00	0.50
3.19	26.70	1.64	120.00	0.00	0.50
3.28	23.50	2.17	120.00	0.00	0.50
3.37	21.60	2.42	120.00	0.00	0.50
3.46	18.70	2.58	120.00	0.00	0.50
3.56	17.00	2.49	120.00	0.00	0.50
3.65	21.40	1.71	120.00	0.00	0.50
3.74	28.20	1.10	120.00	0.00	0.50
3.83	32.30	0.76	120.00	0.00	0.50
3.92	35.00	0.55	120.00	0.00	0.50
4.01	35.60	0.44	120.00	0.00	0.50
4.10	34.80	0.44	120.00	0.00	0.50
4.19	34.80	0.41	120.00	0.00	0.50
4.28	35.20	0.38	120.00	0.00	0.50
4.38	35.00	0.40	120.00	0.00	0.50
4.47	35.50	0.37	120.00	0.00	0.50
4.56	34.70	0.39	120.00	0.00	0.50
4.65	35.60	0.34	120.00	0.00	0.50
4.74	36.30	0.34	120.00	0.00	0.50
4.84	35.00	0.37	120.00	0.00	0.50
4.91	33.10	0.42	120.00	0.00	0.50
4.99	32.40	0.44	120.00	0.00	0.50
5.08	31.70	0.47	120.00	0.00	0.50
5.18	32.00	0.49	120.00	0.00	0.50
5.27	32.70	0.58	120.00	0.00	0.50
5.36	34.00	0.62	120.00	0.00	0.50
5.45	35.10	0.65	120.00	0.00	0.50
5.54	35.20	0.71	120.00	0.00	0.50
5.62	37.00	0.69	120.00	0.00	0.50
5.70	39.50	0.61	120.00	0.00	0.50
5.79	43.20	0.52	120.00	0.00	0.50
5.88	44.20	0.47	120.00	0.00	0.50
5.97	41.80	0.45	120.00	0.00	0.50
6.06	37.60	0.43	120.00	0.00	0.50
6.16	32.00	0.41	120.00	0.00	0.50
6.25	26.70	0.44	120.00	0.00	0.50
6.34	23.30	0.46	120.00	0.00	0.50
6.43	21.20	0.46	120.00	0.00	0.50
6.52	19.80	0.56	120.00	0.00	0.50
6.61	19.10	0.69	120.00	0.00	0.50
6.69	18.90	0.76	120.00	0.00	0.50
6.78	18.80	0.86	120.00	0.00	0.50
6.86	19.60	0.93	120.00	0.00	0.50
6.96	20.80	0.92	120.00	0.00	0.50
7.05	21.20	1.02	120.00	0.00	0.50
7.14	21.70	1.16	120.00	0.00	0.50
7.23	23.50	1.23	120.00	0.00	0.50
7.32	25.40	1.22	120.00	0.00	0.50
7.41	27.30	1.19	120.00	0.00	0.50
7.50	29.70	1.10	120.00	0.00	0.50
7.59	32.80	0.96	120.00	0.00	0.50
7.68	37.30	0.81	120.00	0.00	0.50
7.78	41.00	0.72	120.00	0.00	0.50
7.87	43.80	0.69	120.00	0.00	0.50
7.96	47.20	0.65	120.00	0.00	0.50
8.05	51.90	0.62	120.00	0.00	0.50
8.14	57.50	0.63	120.00	0.00	0.50
8.23	63.70	0.64	120.00	0.00	0.50
8.32	70.30	0.58	120.00	0.00	0.50
8.41	77.70	0.57	120.00	0.00	0.50
8.50	84.60	0.58	120.00	0.00	0.50
8.58	83.80	0.62	120.00	0.00	0.50
8.69	89.00	0.61	120.00	0.00	0.50
8.77	90.40	0.61	120.00	0.00	0.50

8.86	90.90	0.63	120.00	0.00	0.50
8.95	90.00	0.61	120.00	0.00	0.50
9.04	88.30	0.62	120.00	0.00	0.50
9.13	87.10	0.61	120.00	0.00	0.50
9.22	85.60	0.59	120.00	0.00	0.50
9.31	84.30	0.58	120.00	0.00	0.50
9.40	83.50	0.55	120.00	0.00	0.50
9.49	82.30	0.52	120.00	0.00	0.50
9.58	81.00	0.50	120.00	0.00	0.50
9.67	79.90	0.49	120.00	0.00	0.50
9.76	77.30	0.50	120.00	0.00	0.50
9.85	73.70	0.52	120.00	0.00	0.50
9.94	70.70	0.53	120.00	0.00	0.50
10.03	67.70	0.55	120.00	0.00	0.50
10.12	67.60	0.51	120.00	0.00	0.50
10.21	67.90	0.48	120.00	0.00	0.50
10.30	70.90	0.44	120.00	0.00	0.50
10.39	73.10	0.41	120.00	0.00	0.50
10.48	74.90	0.41	120.00	0.00	0.50
10.57	77.70	0.43	120.00	0.00	0.50
10.66	81.20	0.44	120.00	0.00	0.50
10.75	84.80	0.44	120.00	0.00	0.50
10.84	88.00	0.45	120.00	0.00	0.50
10.93	89.60	0.47	120.00	0.00	0.50
11.02	90.90	0.49	120.00	0.00	0.50
11.11	92.00	0.49	120.00	0.00	0.50
11.20	94.50	0.50	120.00	0.00	0.50
11.29	98.20	0.49	120.00	0.00	0.50
11.38	104.50	0.43	120.00	0.00	0.50
11.47	111.20	0.46	120.00	0.00	0.50
11.56	116.00	0.47	120.00	0.00	0.50
11.65	117.30	0.48	120.00	0.00	0.50
11.72	115.70	0.50	120.00	0.00	0.50
11.81	117.30	0.52	120.00	0.00	0.50
11.89	118.30	0.54	120.00	0.00	0.50
11.98	114.60	0.59	120.00	0.00	0.50
12.07	110.20	0.65	120.00	0.00	0.50
12.15	109.30	0.66	120.00	0.00	0.50
12.24	109.30	0.70	120.00	0.00	0.50
12.33	111.70	0.70	120.00	0.00	0.50
12.41	115.30	0.70	120.00	0.00	0.50
12.50	118.80	0.66	120.00	0.00	0.50
12.59	119.50	0.64	120.00	0.00	0.50
12.67	121.60	0.60	120.00	0.00	0.50
12.76	120.10	0.57	120.00	0.00	0.50
12.85	117.80	0.54	120.00	0.00	0.50
12.93	112.80	0.50	120.00	0.00	0.50
13.02	108.20	0.48	120.00	0.00	0.50
13.10	105.10	0.47	120.00	0.00	0.50
13.19	107.10	0.50	120.00	0.00	0.50
13.28	110.00	0.53	120.00	0.00	0.50
13.37	113.60	0.52	120.00	0.00	0.50
13.45	114.00	0.51	120.00	0.00	0.50
13.54	112.80	0.51	120.00	0.00	0.50
13.63	108.60	0.51	120.00	0.00	0.50
13.72	105.70	0.51	120.00	0.00	0.50
13.80	103.80	0.51	120.00	0.00	0.50
13.89	102.60	0.52	120.00	0.00	0.50
13.98	102.00	0.51	120.00	0.00	0.50
14.07	100.50	0.50	120.00	0.00	0.50
14.16	100.00	0.48	120.00	0.00	0.50
14.24	99.60	0.47	120.00	0.00	0.50
14.33	97.60	0.47	120.00	0.00	0.50
14.42	96.10	0.47	120.00	0.00	0.50
14.51	93.50	0.46	120.00	0.00	0.50
14.59	92.60	0.47	120.00	0.00	0.50
14.68	91.70	0.48	120.00	0.00	0.50
14.76	89.60	0.48	120.00	0.00	0.50
14.85	88.90	0.49	120.00	0.00	0.50
14.93	87.80	0.49	120.00	0.00	0.50
15.01	88.90	0.48	120.00	0.00	0.50
15.09	89.10	0.47	120.00	0.00	0.50
15.18	89.40	0.48	120.00	0.00	0.50
15.26	90.30	0.48	120.00	0.00	0.50
15.35	90.60	0.48	120.00	0.00	0.50
15.43	90.80	0.48	120.00	0.00	0.50
15.52	93.60	0.46	120.00	0.00	0.50
15.60	95.00	0.45	120.00	0.00	0.50
15.68	96.80	0.44	120.00	0.00	0.50
15.75	99.30	0.43	120.00	0.00	0.50
15.83	101.40	0.43	120.00	0.00	0.50
15.91	100.70	0.44	120.00	0.00	0.50
15.99	102.00	0.43	120.00	0.00	0.50
16.06	103.70	0.44	120.00	0.00	0.50
16.14	105.90	0.44	120.00	0.00	0.50
16.21	107.90	0.43	120.00	0.00	0.50
16.29	109.60	0.43	120.00	0.00	0.50
16.37	111.90	0.43	120.00	0.00	0.50
16.45	113.10	0.43	120.00	0.00	0.50
16.52	116.00	0.43	120.00	0.00	0.50
16.60	117.60	0.43	120.00	0.00	0.50
16.67	117.20	0.44	120.00	0.00	0.50
16.75	118.90	0.42	120.00	0.00	0.50
16.83	117.40	0.42	120.00	0.00	0.50
16.91	115.70	0.42	120.00	0.00	0.50
16.98	114.20	0.42	120.00	0.00	0.50
17.06	112.70	0.41	120.00	0.00	0.50
17.14	115.20	0.41	120.00	0.00	0.50
17.22	118.00	0.42	120.00	0.00	0.50
17.29	126.00	0.42	120.00	0.00	0.50
17.37	129.80	0.47	120.00	0.00	0.50
17.44	128.70	0.52	120.00	0.00	0.50
17.52	134.70	0.52	120.00	0.00	0.50
17.60	135.10	0.54	120.00	0.00	0.50
17.67	142.20	0.55	120.00	0.00	0.50
17.75	149.10	0.56	120.00	0.00	0.50
17.82	155.00	0.56	120.00	0.00	0.50
17.92	167.40	0.53	120.00	0.00	0.50
18.00	178.10	0.54	120.00	0.00	0.50
18.09	187.00	0.56	120.00	0.00	0.50
18.18	192.00	0.51	120.00	0.00	0.50
18.26	195.20	0.52	120.00	0.00	0.50
18.35	195.20	0.54	120.00	0.00	0.50
18.43	192.60	0.55	120.00	0.00	0.50
18.50	162.40	0.65	120.00	0.00	0.50
18.58	174.50	0.60	120.00	0.00	0.50
18.66	169.70	0.64	120.00	0.00	0.50
18.74	163.70	0.71	120.00	0.00	0.50
18.82	160.60	0.76	120.00	0.00	0.50
18.90	157.20	0.83	120.00	0.00	0.50

18.98	162.10	0.83	120.00	0.00	0.50
19.06	176.10	0.75	120.00	0.00	0.50
19.14	183.30	0.72	120.00	0.00	0.50
19.21	195.00	0.69	120.00	0.00	0.50
19.29	204.40	0.68	120.00	0.00	0.50
19.36	211.40	0.69	120.00	0.00	0.50
19.44	212.90	0.70	120.00	0.00	0.50
19.52	219.00	0.70	120.00	0.00	0.50
19.61	226.40	0.70	120.00	0.00	0.50
19.69	235.30	0.70	120.00	0.00	0.50
19.77	239.10	0.70	120.00	0.00	0.50
19.86	239.60	0.71	120.00	0.00	0.50
19.94	239.60	0.75	120.00	0.00	0.50
20.02	239.70	0.74	120.00	0.00	0.50
20.10	242.40	0.71	120.00	0.00	0.50
20.18	242.80	0.70	120.00	0.00	0.50
20.27	240.10	0.69	120.00	0.00	0.50
20.35	234.70	0.69	120.00	0.00	0.50
20.43	233.80	0.66	120.00	0.00	0.50
20.51	239.40	0.64	120.00	0.00	0.50
20.60	243.30	0.62	120.00	0.00	0.50
20.68	247.10	0.61	120.00	0.00	0.50
20.77	244.80	0.63	120.00	0.00	0.50
20.85	243.90	0.66	120.00	0.00	0.50
20.93	243.30	0.67	120.00	0.00	0.50
21.01	242.00	0.67	120.00	0.00	0.50
21.10	245.20	0.66	120.00	0.00	0.50
21.18	254.10	0.67	120.00	0.00	0.50
21.26	266.30	0.66	120.00	0.00	0.50
21.34	279.80	0.65	120.00	0.00	0.50
21.42	286.40	0.65	120.00	0.00	0.50
21.50	307.50	0.63	120.00	0.00	0.50
21.58	322.50	0.61	120.00	0.00	0.50
21.66	335.40	0.57	120.00	0.00	0.50
21.73	347.70	0.52	120.00	0.00	0.50
21.81	345.70	0.48	120.00	0.00	0.50
21.90	345.60	0.44	120.00	0.00	0.50
21.97	351.80	0.45	120.00	0.00	0.50
22.05	350.70	0.45	120.00	0.00	0.50
22.13	347.70	0.42	120.00	0.00	0.50
22.21	343.30	0.42	120.00	0.00	0.50
22.29	338.70	0.43	120.00	0.00	0.50
22.38	339.40	0.74	120.00	0.00	0.50
22.47	339.80	0.67	120.00	0.00	0.50
22.55	341.70	0.56	120.00	0.00	0.50
22.63	344.10	0.56	120.00	0.00	0.50
22.72	335.70	0.59	120.00	0.00	0.50
22.80	345.80	0.61	120.00	0.00	0.50
22.88	355.20	0.64	120.00	0.00	0.50
22.96	355.40	0.64	120.00	0.00	0.50
23.04	360.60	0.65	120.00	0.00	0.50
23.12	364.60	0.64	120.00	0.00	0.50
23.20	378.00	0.65	120.00	0.00	0.50
23.28	384.00	0.71	120.00	0.00	0.50
23.36	374.80	0.92	120.00	0.00	0.50
23.44	382.20	1.00	120.00	0.00	0.50
23.52	380.70	0.97	120.00	0.00	0.50
23.59	390.20	1.13	120.00	0.00	0.50
23.66	400.20	1.00	120.00	0.00	0.50
23.74	428.60	0.87	120.00	0.00	0.50
23.81	416.30	0.87	120.00	0.00	0.50
23.88	395.60	0.88	120.00	0.00	0.50
23.95	379.20	0.90	120.00	0.00	0.50
24.03	372.60	0.89	120.00	0.00	0.50
24.10	372.50	0.74	120.00	0.00	0.50
24.17	361.10	0.66	120.00	0.00	0.50
24.24	360.40	0.65	120.00	0.00	0.50
24.31	324.30	0.74	120.00	0.00	0.50
24.38	344.50	0.69	120.00	0.00	0.50
24.47	356.00	0.66	120.00	0.00	0.50
24.55	340.60	0.76	120.00	0.00	0.50
24.63	328.10	0.80	120.00	0.00	0.50
24.71	317.20	0.77	120.00	0.00	0.50
24.79	302.80	0.74	120.00	0.00	0.50
24.88	278.40	0.88	120.00	0.00	0.50
24.96	269.30	0.96	120.00	0.00	0.50
25.04	272.80	0.91	120.00	0.00	0.50
25.12	277.90	0.82	120.00	0.00	0.50
25.21	284.90	0.74	120.00	0.00	0.50
25.29	301.80	0.61	120.00	0.00	0.50
25.38	311.50	0.50	120.00	0.00	0.50
25.46	315.10	0.59	120.00	0.00	0.50
25.54	321.70	0.54	120.00	0.00	0.50
25.63	350.70	0.55	120.00	0.00	0.50
25.70	335.20	0.62	120.00	0.00	0.50
25.78	331.00	0.68	120.00	0.00	0.50
25.86	321.30	0.70	120.00	0.00	0.50
25.94	314.20	0.65	120.00	0.00	0.50
26.03	311.60	0.61	120.00	0.00	0.50
26.10	307.40	0.63	120.00	0.00	0.50
26.17	313.30	0.65	120.00	0.00	0.50
26.24	312.10	0.68	120.00	0.00	0.50
26.33	303.00	0.72	120.00	0.00	0.50
26.39	298.30	0.71	120.00	0.00	0.50
26.48	285.30	0.66	120.00	0.00	0.50
26.57	279.00	0.91	120.00	0.00	0.50
26.63	274.60	1.04	120.00	0.00	0.50
26.72	273.70	1.02	120.00	0.00	0.50
26.79	282.40	0.97	120.00	0.00	0.50
26.86	290.30	0.89	120.00	0.00	0.50
26.94	242.20	1.07	120.00	0.00	0.50
27.03	246.10	0.91	120.00	0.00	0.50
27.12	256.40	0.59	120.00	0.00	0.50
27.21	260.40	0.69	120.00	0.00	0.50
27.30	262.20	0.67	120.00	0.00	0.50
27.38	248.50	0.68	120.00	0.00	0.50
27.46	258.40	0.62	120.00	0.00	0.50
27.54	256.80	0.61	120.00	0.00	0.50
27.62	256.80	0.60	120.00	0.00	0.50
27.70	255.60	0.60	120.00	0.00	0.50
27.78	257.70	0.59	120.00	0.00	0.50
27.86	264.60	0.58	120.00	0.00	0.50
27.94	269.40	0.58	120.00	0.00	0.50
28.02	269.50	0.60	120.00	0.00	0.50
28.10	271.40	0.60	120.00	0.00	0.50
28.18	270.20	0.55	120.00	0.00	0.50
28.27	271.30	0.52	120.00	0.00	0.50
28.35	263.10	0.55	120.00	0.00	0.50
28.43	256.60	0.59	120.00	0.00	0.50
28.51	251.90	0.62	120.00	0.00	0.50

28.59	247.60	0.61	120.00	0.00	0.50
28.68	246.70	0.60	120.00	0.00	0.50
28.76	253.10	0.60	120.00	0.00	0.50
28.84	253.30	0.67	120.00	0.00	0.50
28.92	258.90	0.66	120.00	0.00	0.50
29.01	264.00	0.67	120.00	0.00	0.50
29.09	259.10	0.69	120.00	0.00	0.50
29.17	256.60	0.66	120.00	0.00	0.50
29.24	257.10	0.62	120.00	0.00	0.50
29.32	256.80	0.61	120.00	0.00	0.50
29.40	255.20	0.62	120.00	0.00	0.50
29.48	254.90	0.64	120.00	0.00	0.50
29.57	252.70	0.64	120.00	0.00	0.50
29.65	250.70	0.65	120.00	0.00	0.50
29.74	248.50	0.67	120.00	0.00	0.50
29.82	251.40	0.67	120.00	0.00	0.50
29.90	250.80	0.69	120.00	0.00	0.50
29.99	253.30	0.70	120.00	0.00	0.50
30.07	256.90	0.70	120.00	0.00	0.50
30.15	262.40	0.71	120.00	0.00	0.50
30.23	267.70	0.71	120.00	0.00	0.50
30.31	275.80	0.69	120.00	0.00	0.50
30.38	274.10	0.70	120.00	0.00	0.50
30.45	279.70	0.70	120.00	0.00	0.50
30.53	285.10	0.70	120.00	0.00	0.50
30.62	293.60	0.71	120.00	0.00	0.50
30.70	292.20	0.73	120.00	0.00	0.50
30.77	294.10	0.75	120.00	0.00	0.50
30.85	300.30	0.75	120.00	0.00	0.50
30.93	299.40	0.78	120.00	0.00	0.50
31.02	291.30	0.82	120.00	0.00	0.50
31.10	284.20	0.85	120.00	0.00	0.50
31.18	274.70	0.88	120.00	0.00	0.50
31.26	269.20	0.93	120.00	0.00	0.50
31.34	261.20	1.03	120.00	0.00	0.50
31.42	258.30	1.10	120.00	0.00	0.50
31.50	255.70	1.18	120.00	0.00	0.50
31.58	254.10	1.25	120.00	0.00	0.50
31.66	255.70	1.30	120.00	0.00	0.50
31.74	254.30	1.33	120.00	0.00	0.50
31.83	257.50	1.33	120.00	0.00	0.50
31.91	257.70	1.34	120.00	0.00	0.50
31.99	260.50	1.35	120.00	0.00	0.50
32.06	264.30	1.35	120.00	0.00	0.50
32.14	268.80	1.35	120.00	0.00	0.50
32.22	274.20	1.35	120.00	0.00	0.50
32.32	273.50	1.37	120.00	0.00	0.50
32.41	270.40	1.41	120.00	0.00	0.50
32.51	273.40	1.39	120.00	0.00	0.50
32.59	279.40	1.35	120.00	0.00	0.50
32.68	286.00	1.32	120.00	0.00	0.50
32.77	290.80	1.28	120.00	0.00	0.50
32.85	296.10	1.21	120.00	0.00	0.50
32.94	295.30	1.16	120.00	0.00	0.50
33.03	291.90	1.11	120.00	0.00	0.50
33.12	289.80	1.01	120.00	0.00	0.50
33.21	297.20	0.96	120.00	0.00	0.50
33.30	307.40	0.92	120.00	0.00	0.50
33.39	306.00	0.89	120.00	0.00	0.50
33.46	291.00	0.90	120.00	0.00	0.50
33.52	286.60	0.87	120.00	0.00	0.50
33.59	271.60	0.88	120.00	0.00	0.50
33.66	259.00	0.89	120.00	0.00	0.50
33.74	236.10	0.93	120.00	0.00	0.50
33.81	223.70	0.93	120.00	0.00	0.50
33.88	213.70	0.93	120.00	0.00	0.50
33.98	205.80	0.95	120.00	0.00	0.50
34.05	204.90	0.98	120.00	0.00	0.50
34.12	205.10	1.01	120.00	0.00	0.50
34.19	206.10	1.03	120.00	0.00	0.50
34.25	209.30	1.02	120.00	0.00	0.50
34.32	214.80	1.03	120.00	0.00	0.50
34.39	222.30	1.04	120.00	0.00	0.50
34.45	225.90	1.06	120.00	0.00	0.50
34.53	230.40	1.08	120.00	0.00	0.50
34.60	231.60	1.11	120.00	0.00	0.50
34.67	233.60	1.14	120.00	0.00	0.50
34.74	235.60	1.15	120.00	0.00	0.50
34.81	230.20	1.19	120.00	0.00	0.50
34.89	229.70	1.20	120.00	0.00	0.50
34.96	224.50	1.23	120.00	0.00	0.50
35.03	221.10	1.28	120.00	0.00	0.50
35.10	218.50	1.35	120.00	0.00	0.50
35.17	217.40	1.38	120.00	0.00	0.50
35.25	216.70	1.38	120.00	0.00	0.50
35.32	217.80	1.35	120.00	0.00	0.50
35.39	218.70	1.32	120.00	0.00	0.50
35.47	219.20	1.29	120.00	0.00	0.50
35.54	218.90	1.25	120.00	0.00	0.50
35.62	218.60	1.19	120.00	0.00	0.50
35.70	219.30	1.09	120.00	0.00	0.50
35.78	224.50	0.98	120.00	0.00	0.50
35.87	231.50	0.86	120.00	0.00	0.50
35.96	235.80	0.79	120.00	0.00	0.50
36.04	239.50	0.73	120.00	0.00	0.50
36.13	239.90	0.68	120.00	0.00	0.50
36.22	236.80	0.62	120.00	0.00	0.50
36.30	234.50	0.60	120.00	0.00	0.50
36.39	233.00	0.59	120.00	0.00	0.50
36.48	231.00	0.57	120.00	0.00	0.50
36.57	226.30	0.57	120.00	0.00	0.50
36.66	225.40	0.57	120.00	0.00	0.50
36.73	227.40	0.57	120.00	0.00	0.50
36.80	228.80	0.56	120.00	0.00	0.50
36.88	230.50	0.54	120.00	0.00	0.50
36.95	227.50	0.53	120.00	0.00	0.50
37.02	222.80	0.54	120.00	0.00	0.50
37.09	218.70	0.54	120.00	0.00	0.50
37.17	214.50	0.53	120.00	0.00	0.50
37.25	215.50	0.53	120.00	0.00	0.50
37.33	214.50	0.54	120.00	0.00	0.50
37.42	211.80	0.57	120.00	0.00	0.50
37.51	207.60	0.59	120.00	0.00	0.50
37.60	208.80	0.62	120.00	0.00	0.50
37.68	210.30	0.63	120.00	0.00	0.50
37.77	216.90	0.59	120.00	0.00	0.50
37.86	218.70	0.57	120.00	0.00	0.50
37.95	221.00	0.56	120.00	0.00	0.50
38.04	222.50	0.55	120.00	0.00	0.50
38.13	224.80	0.56	120.00	0.00	0.50

38.21	225.70	0.56	120.00	0.00	0.50
38.30	229.10	0.55	120.00	0.00	0.50
38.40	233.80	0.52	120.00	0.00	0.50
38.49	233.40	0.47	120.00	0.00	0.50
38.58	232.20	0.43	120.00	0.00	0.50
38.66	228.70	0.40	120.00	0.00	0.50
38.75	228.40	0.38	120.00	0.00	0.50
38.84	235.20	0.36	120.00	0.00	0.50
38.93	235.20	0.37	120.00	0.00	0.50
39.03	229.80	0.43	120.00	0.00	0.50
39.11	224.50	0.49	120.00	0.00	0.50
39.21	216.90	0.58	120.00	0.00	0.50
39.30	214.70	0.59	120.00	0.00	0.50
39.39	223.40	0.65	120.00	0.00	0.50
39.48	233.50	0.67	120.00	0.00	0.50
39.55	224.00	0.74	120.00	0.00	0.50
39.62	234.40	0.74	120.00	0.00	0.50
39.70	230.70	0.80	120.00	0.00	0.50
39.78	226.50	0.85	120.00	0.00	0.50
39.86	211.30	0.89	120.00	0.00	0.50
39.93	196.00	0.94	120.00	0.00	0.50
40.04	177.30	0.99	120.00	0.00	0.50
40.12	158.60	1.00	120.00	0.00	0.50
40.20	140.60	1.03	120.00	0.00	0.50
40.29	117.70	1.20	120.00	0.00	0.50
40.38	94.40	1.63	120.00	0.00	0.50
40.47	67.30	2.26	120.00	0.00	0.50
40.56	51.20	2.56	120.00	0.00	0.50
40.65	48.50	2.30	120.00	0.00	0.50
40.74	46.20	2.27	120.00	0.00	0.50
40.83	43.60	2.68	120.00	0.00	0.50
40.92	46.00	2.44	120.00	0.00	0.50
41.01	48.80	2.11	120.00	0.00	0.50
41.10	43.30	2.30	120.00	0.00	0.50
41.19	33.30	3.33	120.00	0.00	0.50
41.29	32.40	3.64	120.00	0.00	0.50
41.38	34.30	3.00	120.00	0.00	0.50
41.47	27.90	3.10	120.00	0.00	0.50
41.56	23.30	4.12	120.00	0.00	0.50
41.66	31.40	3.66	120.00	0.00	0.50
41.75	55.80	2.26	120.00	0.00	0.50
41.84	81.90	1.63	120.00	0.00	0.50
41.93	101.90	1.29	120.00	0.00	0.50
42.02	131.30	0.66	120.00	0.00	0.50
42.11	149.10	0.49	120.00	0.00	0.50
42.20	155.60	0.44	120.00	0.00	0.50
42.29	151.80	0.56	120.00	0.00	0.50
42.36	135.20	0.79	120.00	0.00	0.50
42.45	122.80	1.07	120.00	0.00	0.50
42.54	106.10	1.50	120.00	0.00	0.50
42.63	95.40	1.97	120.00	0.00	0.50
42.72	99.30	2.02	120.00	0.00	0.50
42.82	117.30	1.33	120.00	0.00	0.50
42.91	144.20	1.13	120.00	0.00	0.50
42.99	190.00	0.90	120.00	0.00	0.50
43.08	224.80	0.73	120.00	0.00	0.50
43.15	229.80	0.67	120.00	0.00	0.50
43.22	243.40	0.65	120.00	0.00	0.50
43.30	257.80	0.67	120.00	0.00	0.50
43.39	272.80	0.67	120.00	0.00	0.50
43.48	284.60	0.67	120.00	0.00	0.50
43.57	298.80	0.66	120.00	0.00	0.50
43.66	301.50	0.69	120.00	0.00	0.50
43.75	298.20	0.71	120.00	0.00	0.50
43.84	290.30	0.73	120.00	0.00	0.50
43.93	276.30	0.77	120.00	0.00	0.50
44.02	262.40	0.81	120.00	0.00	0.50
44.10	258.90	0.82	120.00	0.00	0.50
44.20	256.70	0.80	120.00	0.00	0.50
44.29	252.50	0.79	120.00	0.00	0.50
44.37	253.70	0.76	120.00	0.00	0.50
44.46	253.10	0.73	120.00	0.00	0.50
44.55	259.30	0.71	120.00	0.00	0.50
44.64	269.00	0.66	120.00	0.00	0.50
44.73	278.90	0.61	120.00	0.00	0.50
44.81	281.50	0.58	120.00	0.00	0.50
44.88	276.00	0.55	120.00	0.00	0.50
44.96	276.70	0.51	120.00	0.00	0.50
45.04	271.10	0.49	120.00	0.00	0.50
45.12	255.50	0.47	120.00	0.00	0.50
45.21	237.60	0.50	120.00	0.00	0.50
45.29	220.10	0.55	120.00	0.00	0.50
45.37	196.50	0.65	120.00	0.00	0.50
45.46	174.50	0.71	120.00	0.00	0.50
45.54	143.90	0.82	120.00	0.00	0.50
45.63	118.20	1.07	120.00	0.00	0.50
45.73	100.00	1.51	120.00	0.00	0.50
45.79	83.50	2.03	120.00	0.00	0.50
45.86	68.40	2.58	120.00	0.00	0.50
45.94	60.90	2.77	120.00	0.00	0.50
46.02	55.50	3.01	120.00	0.00	0.50
46.11	56.10	2.65	120.00	0.00	0.50
46.19	56.70	2.23	120.00	0.00	0.50
46.28	73.60	1.52	120.00	0.00	0.50
46.36	73.90	1.35	120.00	0.00	0.50
46.43	76.00	1.28	120.00	0.00	0.50
46.52	70.30	1.63	120.00	0.00	0.50
46.61	62.70	2.26	120.00	0.00	0.50
46.71	53.60	2.98	120.00	0.00	0.50
46.80	42.30	3.81	120.00	0.00	0.50
46.89	31.70	4.75	120.00	0.00	0.50
46.99	26.90	4.78	120.00	0.00	0.50
47.08	23.00	4.66	120.00	0.00	0.50
47.17	18.40	4.69	120.00	0.00	0.50
47.27	16.60	4.33	120.00	0.00	0.50
47.36	15.00	4.11	120.00	0.00	0.50
47.45	15.20	3.50	120.00	0.00	0.50
47.55	15.90	2.83	120.00	0.00	0.50
47.65	18.30	2.49	120.00	0.00	0.50
47.74	18.20	3.28	120.00	0.00	0.50
47.84	18.80	4.09	120.00	0.00	0.50
47.93	24.70	4.08	120.00	0.00	0.50
48.03	33.10	3.72	120.00	0.00	0.50
48.13	41.00	3.76	120.00	0.00	0.50
48.22	47.60	4.00	120.00	0.00	0.50
48.31	48.90	4.25	120.00	0.00	0.50
48.41	42.80	4.51	120.00	0.00	0.50
48.51	39.80	4.16	120.00	0.00	0.50
48.60	41.50	3.37	120.00	0.00	0.50
48.69	41.60	2.90	120.00	0.00	0.50

48.79	37.50	2.55	120.00	0.00	0.50
48.89	33.40	3.08	120.00	0.00	0.50
48.98	27.00	3.52	120.00	0.00	0.50
49.08	20.80	4.05	120.00	0.00	0.50
49.16	16.30	4.40	120.00	0.00	0.50
49.23	14.70	4.38	120.00	0.00	0.50
49.31	13.40	4.16	120.00	0.00	0.50
49.39	13.40	3.48	120.00	0.00	0.50
49.47	12.50	3.33	120.00	0.00	0.50
49.55	13.00	2.91	120.00	0.00	0.50
49.64	14.30	2.69	120.00	0.00	0.50
49.73	14.00	3.02	120.00	0.00	0.50
49.82	14.30	2.92	120.00	0.00	0.50
49.92	13.50	3.22	120.00	0.00	0.50
50.02	13.90	3.45	120.00	0.00	0.50
50.11	15.50	3.28	120.00	0.00	0.50
50.21	18.20	3.11	120.00	0.00	0.50
50.30	23.40	2.68	120.00	0.00	0.50
50.40	32.80	2.17	120.00	0.00	0.50
50.49	39.30	2.19	120.00	0.00	0.50
50.59	37.40	2.58	120.00	0.00	0.50
50.68	34.20	2.84	120.00	0.00	0.50
50.78	31.20	3.23	120.00	0.00	0.50
50.87	30.50	3.57	120.00	0.00	0.50
50.97	33.90	3.46	120.00	0.00	0.50
51.06	53.00	2.13	120.00	0.00	0.50
51.16	80.90	1.22	120.00	0.00	0.50
51.26	98.10	0.93	120.00	0.00	0.50
51.35	98.90	1.06	120.00	0.00	0.50
51.45	89.40	1.54	120.00	0.00	0.50
51.54	75.90	2.25	120.00	0.00	0.50
51.64	70.40	2.87	120.00	0.00	0.50
51.73	73.80	3.19	120.00	0.00	0.50
51.83	81.40	3.08	120.00	0.00	0.50
51.92	91.50	2.37	120.00	0.00	0.50
52.02	105.90	1.89	120.00	0.00	0.50
52.11	117.90	1.53	120.00	0.00	0.50
52.20	124.20	1.29	120.00	0.00	0.50
52.28	124.80	1.21	120.00	0.00	0.50
52.37	130.70	1.13	120.00	0.00	0.50
52.46	131.50	1.09	120.00	0.00	0.50
52.53	129.80	1.09	120.00	0.00	0.50
52.61	127.50	1.11	120.00	0.00	0.50
52.68	123.40	1.14	120.00	0.00	0.50
52.75	119.00	1.18	120.00	0.00	0.50
52.82	112.00	1.24	120.00	0.00	0.50
52.90	107.90	1.30	120.00	0.00	0.50
52.99	102.00	1.46	120.00	0.00	0.50
53.09	95.50	1.53	120.00	0.00	0.50
53.18	87.50	1.55	120.00	0.00	0.50
53.27	78.00	1.89	120.00	0.00	0.50
53.37	60.30	2.76	120.00	0.00	0.50
53.46	40.30	3.92	120.00	0.00	0.50
53.55	29.50	4.44	120.00	0.00	0.50
53.65	20.40	5.23	120.00	0.00	0.50
53.74	16.30	5.15	120.00	0.00	0.50
53.84	14.60	3.98	120.00	0.00	0.50
53.93	14.50	2.73	120.00	0.00	0.50
54.02	14.10	2.18	120.00	0.00	0.50
54.12	13.90	1.98	120.00	0.00	0.50
54.22	14.10	1.85	120.00	0.00	0.50
54.31	13.90	1.90	120.00	0.00	0.50
54.40	14.30	2.07	120.00	0.00	0.50
54.50	15.00	2.35	120.00	0.00	0.50
54.59	16.50	2.41	120.00	0.00	0.50
54.69	17.90	2.54	120.00	0.00	0.50
54.78	18.60	2.83	120.00	0.00	0.50
54.88	18.80	3.20	120.00	0.00	0.50
54.97	19.40	3.11	120.00	0.00	0.50
55.07	20.20	2.69	120.00	0.00	0.50
55.16	20.30	2.90	120.00	0.00	0.50
55.26	19.00	3.45	120.00	0.00	0.50
55.34	17.60	3.90	120.00	0.00	0.50
55.44	22.50	3.17	120.00	0.00	0.50
55.52	20.30	3.31	120.00	0.00	0.50
55.61	18.00	3.44	120.00	0.00	0.50
55.71	15.60	3.39	120.00	0.00	0.50
55.80	14.80	2.95	120.00	0.00	0.50
55.89	14.20	2.94	120.00	0.00	0.50
55.98	14.20	3.26	120.00	0.00	0.50
56.07	14.40	3.43	120.00	0.00	0.50
56.17	15.20	3.41	120.00	0.00	0.50
56.26	16.30	3.18	120.00	0.00	0.50
56.35	16.30	3.31	120.00	0.00	0.50
56.44	17.80	3.38	120.00	0.00	0.50
56.54	18.80	3.25	120.00	0.00	0.50
56.63	18.80	3.20	120.00	0.00	0.50
56.72	18.00	3.37	120.00	0.00	0.50
56.81	17.90	3.44	120.00	0.00	0.50
56.91	18.30	3.13	120.00	0.00	0.50
57.00	17.30	2.87	120.00	0.00	0.50
57.10	15.00	2.95	120.00	0.00	0.50
57.19	13.20	3.15	120.00	0.00	0.50
57.29	12.10	3.44	120.00	0.00	0.50
57.38	12.30	3.28	120.00	0.00	0.50
57.48	12.10	3.03	120.00	0.00	0.50
57.57	11.80	2.88	120.00	0.00	0.50
57.67	11.70	2.88	120.00	0.00	0.50
57.76	12.10	2.70	120.00	0.00	0.50
57.86	12.30	2.58	120.00	0.00	0.50
57.95	12.10	2.60	120.00	0.00	0.50
58.05	12.10	2.53	120.00	0.00	0.50
58.14	11.60	2.64	120.00	0.00	0.50
58.24	11.30	2.77	120.00	0.00	0.50
58.33	11.60	2.76	120.00	0.00	0.50
58.42	11.10	2.90	120.00	0.00	0.50
58.52	11.50	3.06	120.00	0.00	0.50
58.61	14.20	3.09	120.00	0.00	0.50
58.71	17.40	3.10	120.00	0.00	0.50
58.80	21.40	3.25	120.00	0.00	0.50
58.89	23.60	3.56	120.00	0.00	0.50
58.98	24.90	4.05	120.00	0.00	0.50
59.07	25.40	4.39	120.00	0.00	0.50
59.17	24.20	4.89	120.00	0.00	0.50
59.26	23.30	5.05	120.00	0.00	0.50
59.35	22.10	5.11	120.00	0.00	0.50
59.44	20.00	5.34	120.00	0.00	0.50
59.54	18.40	5.76	120.00	0.00	0.50
59.63	16.10	6.42	120.00	0.00	0.50
59.72	15.70	6.39	120.00	0.00	0.50

59.81	15.10	6.59	120.00	0.00	0.50
59.91	14.10	7.06	120.00	0.00	0.50
60.00	13.40	7.22	120.00	0.00	0.50
60.10	12.80	7.18	120.00	0.00	0.50
60.19	12.50	6.99	120.00	0.00	0.50
60.28	11.70	7.29	120.00	0.00	0.50
60.38	11.40	6.98	120.00	0.00	0.50
60.48	10.00	7.25	120.00	0.00	0.50
60.57	9.60	7.06	120.00	0.00	0.50
60.66	9.50	6.69	120.00	0.00	0.50
60.76	10.40	5.80	120.00	0.00	0.50
60.85	11.30	5.19	120.00	0.00	0.50
60.95	12.70	4.54	120.00	0.00	0.50
61.04	12.90	4.48	120.00	0.00	0.50
61.13	13.10	4.51	120.00	0.00	0.50
61.23	13.00	4.41	120.00	0.00	0.50
61.32	13.30	4.55	120.00	0.00	0.50
61.42	13.90	4.64	120.00	0.00	0.50
61.51	14.00	4.81	120.00	0.00	0.50
61.59	13.60	5.11	120.00	0.00	0.50
61.67	14.50	4.97	120.00	0.00	0.50
61.74	15.40	4.75	120.00	0.00	0.50
61.83	15.70	4.79	120.00	0.00	0.50
61.92	16.50	4.91	120.00	0.00	0.50
62.01	17.20	5.00	120.00	0.00	0.50
62.10	17.70	5.17	120.00	0.00	0.50
62.20	18.10	5.45	120.00	0.00	0.50
62.29	18.50	5.51	120.00	0.00	0.50
62.38	18.40	5.35	120.00	0.00	0.50
62.47	19.20	5.10	120.00	0.00	0.50
62.57	19.10	4.99	120.00	0.00	0.50
62.66	17.40	5.10	120.00	0.00	0.50
62.75	16.10	5.11	120.00	0.00	0.50
62.84	15.40	5.24	120.00	0.00	0.50
62.93	15.90	5.06	120.00	0.00	0.50
63.03	15.70	5.09	120.00	0.00	0.50
63.12	15.40	5.08	120.00	0.00	0.50
63.21	14.70	5.16	120.00	0.00	0.50
63.30	14.50	5.10	120.00	0.00	0.50
63.39	14.00	5.08	120.00	0.00	0.50
63.49	13.90	4.92	120.00	0.00	0.50
63.58	13.70	4.74	120.00	0.00	0.50
63.68	13.70	4.49	120.00	0.00	0.50
63.77	14.00	4.31	120.00	0.00	0.50
63.87	14.30	4.14	120.00	0.00	0.50
63.96	14.20	4.16	120.00	0.00	0.50
64.05	14.00	4.26	120.00	0.00	0.50
64.15	14.10	4.63	120.00	0.00	0.50
64.24	16.20	5.39	120.00	0.00	0.50
64.34	32.10	3.67	120.00	0.00	0.50
64.43	46.70	3.03	120.00	0.00	0.50
64.52	48.60	3.23	120.00	0.00	0.50
64.61	46.10	3.85	120.00	0.00	0.50
64.69	48.40	0.00	120.00	0.00	0.50
64.76	44.50	0.00	120.00	0.00	0.50
64.85	38.70	0.00	120.00	0.00	0.50
64.94	32.50	0.00	120.00	0.00	0.50
65.01	27.10	0.00	120.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.39 in.
Settlement of Unsaturated Sands=0.25 in.
Total Settlement of Saturated and Unsaturated Sands=0.64 in.
Differential Settlement=0.321 to 0.424 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.34	5.00	0.39	0.25	0.64
5.00	0.21	0.34	5.00	0.39	0.24	0.63
10.00	0.26	0.34	5.00	0.39	0.21	0.60
15.00	0.24	0.33	5.00	0.39	0.14	0.54
20.00	1.46	0.33	5.00	0.39	0.06	0.45
25.00	1.48	0.32	5.00	0.39	0.04	0.43
30.00	0.96	0.32	5.00	0.39	0.00	0.40
35.00	0.56	0.33	1.71	0.39	0.00	0.39
40.00	0.35	0.33	1.03	0.38	0.00	0.38
45.00	0.70	0.34	2.08	0.22	0.00	0.22
50.00	2.00	0.33	5.00	0.17	0.00	0.17
55.00	2.00	0.33	5.00	0.00	0.00	0.00
60.00	2.00	0.32	5.00	0.00	0.00	0.00
65.00	2.00	0.31	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf,
Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

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LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\CPT-09-103.liq
Title: SR-57 Northbound Widening/RW No 293
Subtitle: 602231-002
Surface Elev.=173
Hole No.=CPT-09-106
Depth of Hole= 65.10 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 40.50 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:

Surface Elev.=173

Hole No.=CPT-09-106
Depth of Hole=65.10 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 40.50 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60
1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options
In-Situ Test Data:

Depth ft	qc atm	fs atm	gamma pcf	Fines %	D50 mm
0.00	0.00	0.00	120.00	0.00	0.50
0.21	261.10	0.00	120.00	0.00	0.50
0.28	293.70	0.11	120.00	0.00	0.50
0.35	251.50	0.18	120.00	0.00	0.50
0.41	217.50	0.25	120.00	0.00	0.50
0.49	203.40	0.40	120.00	0.00	0.50
0.55	180.90	0.53	120.00	0.00	0.50
0.63	176.20	0.60	120.00	0.00	0.50
0.70	184.30	0.61	120.00	0.00	0.50
0.77	187.30	0.63	120.00	0.00	0.50
0.83	178.40	0.63	120.00	0.00	0.50
0.90	166.70	0.72	120.00	0.00	0.50
0.97	160.40	0.76	120.00	0.00	0.50
1.04	146.50	0.81	120.00	0.00	0.50
1.11	135.70	0.84	120.00	0.00	0.50
1.18	118.00	0.95	120.00	0.00	0.50
1.26	117.50	0.92	120.00	0.00	0.50
1.35	109.30	0.93	120.00	0.00	0.50
1.42	104.70	0.91	120.00	0.00	0.50
1.51	99.40	0.87	120.00	0.00	0.50
1.59	95.30	0.76	120.00	0.00	0.50
1.67	94.40	0.82	120.00	0.00	0.50
1.76	97.50	0.72	120.00	0.00	0.50
1.85	102.10	0.69	120.00	0.00	0.50
1.93	93.00	0.87	120.00	0.00	0.50
2.02	94.60	0.91	120.00	0.00	0.50
2.10	81.50	1.07	120.00	0.00	0.50
2.17	66.70	1.28	120.00	0.00	0.50
2.25	74.20	1.09	120.00	0.00	0.50
2.33	72.30	1.04	120.00	0.00	0.50
2.42	71.10	1.01	120.00	0.00	0.50
2.50	71.50	0.98	120.00	0.00	0.50
2.59	69.70	0.94	120.00	0.00	0.50
2.68	65.30	0.91	120.00	0.00	0.50
2.76	60.10	0.89	120.00	0.00	0.50
2.85	54.80	0.87	120.00	0.00	0.50
2.94	49.10	0.88	120.00	0.00	0.50
3.03	43.30	0.96	120.00	0.00	0.50
3.11	38.80	1.06	120.00	0.00	0.50
3.20	35.10	1.19	120.00	0.00	0.50
3.28	33.10	1.34	120.00	0.00	0.50
3.37	32.30	1.47	120.00	0.00	0.50
3.46	31.90	1.55	120.00	0.00	0.50
3.55	31.60	1.58	120.00	0.00	0.50
3.63	30.60	1.62	120.00	0.00	0.50
3.72	30.10	1.58	120.00	0.00	0.50
3.80	29.30	1.57	120.00	0.00	0.50
3.89	29.60	1.46	120.00	0.00	0.50
3.98	29.80	1.42	120.00	0.00	0.50
4.06	30.70	1.45	120.00	0.00	0.50
4.15	33.60	1.42	120.00	0.00	0.50
4.24	39.20	1.25	120.00	0.00	0.50
4.32	45.10	1.00	120.00	0.00	0.50
4.41	47.20	1.07	120.00	0.00	0.50
4.49	47.90	1.11	120.00	0.00	0.50
4.58	48.70	1.06	120.00	0.00	0.50
4.66	50.70	0.94	120.00	0.00	0.50
4.74	49.70	0.83	120.00	0.00	0.50
4.83	45.70	1.16	120.00	0.00	0.50
4.91	40.40	1.38	120.00	0.00	0.50
5.00	36.80	1.48	120.00	0.00	0.50
5.08	27.80	1.96	120.00	0.00	0.50
5.17	34.40	1.52	120.00	0.00	0.50
5.25	34.70	1.37	120.00	0.00	0.50
5.34	31.30	1.28	120.00	0.00	0.50
5.42	34.50	1.01	120.00	0.00	0.50
5.51	34.60	0.75	120.00	0.00	0.50
5.59	35.20	0.57	120.00	0.00	0.50
5.67	33.00	0.53	120.00	0.00	0.50
5.74	33.50	0.45	120.00	0.00	0.50
5.82	32.30	0.41	120.00	0.00	0.50
5.91	30.70	0.42	120.00	0.00	0.50
5.99	29.80	0.43	120.00	0.00	0.50
6.08	28.60	0.48	120.00	0.00	0.50
6.16	27.60	0.50	120.00	0.00	0.50
6.25	26.90	0.51	120.00	0.00	0.50
6.33	26.90	0.54	120.00	0.00	0.50
6.41	27.80	0.53	120.00	0.00	0.50
6.50	29.70	0.51	120.00	0.00	0.50
6.58	31.80	0.51	120.00	0.00	0.50
6.67	35.10	0.46	120.00	0.00	0.50
6.75	37.20	0.43	120.00	0.00	0.50
6.84	36.60	0.45	120.00	0.00	0.50
6.93	35.80	0.47	120.00	0.00	0.50
7.01	35.90	0.50	120.00	0.00	0.50
7.09	38.00	0.52	120.00	0.00	0.50
7.18	43.60	0.49	120.00	0.00	0.50
7.27	51.00	0.46	120.00	0.00	0.50
7.35	55.40	0.45	120.00	0.00	0.50
7.44	51.90	0.49	120.00	0.00	0.50
7.52	44.60	0.56	120.00	0.00	0.50
7.61	38.30	0.60	120.00	0.00	0.50
7.69	34.10	0.65	120.00	0.00	0.50
7.78	32.40	0.67	120.00	0.00	0.50
7.86	30.50	0.84	120.00	0.00	0.50
7.95	28.50	1.27	120.00	0.00	0.50
8.03	27.10	1.75	120.00	0.00	0.50
8.12	26.00	2.12	120.00	0.00	0.50

8.21	24.80	2.49	120.00	0.00	0.50
8.29	23.50	3.12	120.00	0.00	0.50
8.38	22.30	3.77	120.00	0.00	0.50
8.45	23.20	3.83	120.00	0.00	0.50
8.52	26.70	3.27	120.00	0.00	0.50
8.59	33.50	2.37	120.00	0.00	0.50
8.67	41.20	1.71	120.00	0.00	0.50
8.75	50.50	1.20	120.00	0.00	0.50
8.84	59.80	0.86	120.00	0.00	0.50
8.92	66.40	0.65	120.00	0.00	0.50
9.00	70.60	0.54	120.00	0.00	0.50
9.09	72.90	0.47	120.00	0.00	0.50
9.17	73.60	0.44	120.00	0.00	0.50
9.25	74.00	0.42	120.00	0.00	0.50
9.34	74.50	0.40	120.00	0.00	0.50
9.43	75.60	0.36	120.00	0.00	0.50
9.53	73.00	0.36	120.00	0.00	0.50
9.65	73.70	0.34	120.00	0.00	0.50
9.78	75.80	0.31	120.00	0.00	0.50
9.91	79.20	0.31	120.00	0.00	0.50
10.04	79.50	0.34	120.00	0.00	0.50
10.17	78.50	0.38	120.00	0.00	0.50
10.29	74.30	0.39	120.00	0.00	0.50
10.36	73.60	0.38	120.00	0.00	0.50
10.43	75.20	0.37	120.00	0.00	0.50
10.56	76.00	0.42	120.00	0.00	0.50
10.69	76.90	0.45	120.00	0.00	0.50
10.75	75.30	0.45	120.00	0.00	0.50
10.82	73.50	0.45	120.00	0.00	0.50
10.89	70.60	0.45	120.00	0.00	0.50
10.95	69.10	0.46	120.00	0.00	0.50
11.08	71.00	0.38	120.00	0.00	0.50
11.22	72.30	0.37	120.00	0.00	0.50
11.35	68.80	0.41	120.00	0.00	0.50
11.48	66.60	0.40	120.00	0.00	0.50
11.56	62.80	0.43	120.00	0.00	0.50
11.65	65.50	0.43	120.00	0.00	0.50
11.73	66.30	0.44	120.00	0.00	0.50
11.81	66.00	0.46	120.00	0.00	0.50
11.92	63.80	0.46	120.00	0.00	0.50
12.03	61.70	0.40	120.00	0.00	0.50
12.15	58.80	0.37	120.00	0.00	0.50
12.28	59.30	0.29	120.00	0.00	0.50
12.41	59.90	0.25	120.00	0.00	0.50
12.54	61.90	0.25	120.00	0.00	0.50
12.66	66.30	0.23	120.00	0.00	0.50
12.73	68.40	0.24	120.00	0.00	0.50
12.80	69.50	0.25	120.00	0.00	0.50
12.93	71.60	0.30	120.00	0.00	0.50
13.06	78.30	0.33	120.00	0.00	0.50
13.19	90.20	0.40	120.00	0.00	0.50
13.32	107.20	0.41	120.00	0.00	0.50
13.45	123.00	0.41	120.00	0.00	0.50
13.58	138.40	0.40	120.00	0.00	0.50
13.71	157.40	0.38	120.00	0.00	0.50
13.84	170.60	0.36	120.00	0.00	0.50
13.97	173.60	0.39	120.00	0.00	0.50
14.04	177.70	0.40	120.00	0.00	0.50
14.10	181.50	0.37	120.00	0.00	0.50
14.23	187.60	0.40	120.00	0.00	0.50
14.36	184.50	0.41	120.00	0.00	0.50
14.48	173.60	0.42	120.00	0.00	0.50
14.60	178.20	0.41	120.00	0.00	0.50
14.72	189.60	0.37	120.00	0.00	0.50
14.85	201.90	0.37	120.00	0.00	0.50
14.98	201.70	0.33	120.00	0.00	0.50
15.10	212.40	0.37	120.00	0.00	0.50
15.23	222.70	0.39	120.00	0.00	0.50
15.33	226.10	0.41	120.00	0.00	0.50
15.45	233.60	0.43	120.00	0.00	0.50
15.55	235.20	0.44	120.00	0.00	0.50
15.65	234.30	0.45	120.00	0.00	0.50
15.75	231.50	0.45	120.00	0.00	0.50
15.85	224.40	0.47	120.00	0.00	0.50
15.95	218.00	0.46	120.00	0.00	0.50
16.06	223.20	0.43	120.00	0.00	0.50
16.19	226.80	0.42	120.00	0.00	0.50
16.31	226.80	0.43	120.00	0.00	0.50
16.43	221.60	0.43	120.00	0.00	0.50
16.55	212.30	0.42	120.00	0.00	0.50
16.62	205.10	0.42	120.00	0.00	0.50
16.75	199.90	0.40	120.00	0.00	0.50
16.88	205.50	0.37	120.00	0.00	0.50
17.00	207.40	0.38	120.00	0.00	0.50
17.13	213.50	0.39	120.00	0.00	0.50
17.26	219.90	0.38	120.00	0.00	0.50
17.39	206.30	0.41	120.00	0.00	0.50
17.52	189.30	0.41	120.00	0.00	0.50
17.59	183.20	0.40	120.00	0.00	0.50
17.65	182.20	0.38	120.00	0.00	0.50
17.78	187.30	0.34	120.00	0.00	0.50
17.92	187.30	0.51	120.00	0.00	0.50
18.05	189.40	0.43	120.00	0.00	0.50
18.18	182.60	0.43	120.00	0.00	0.50
18.27	165.30	0.48	120.00	0.00	0.50
18.37	165.30	0.44	120.00	0.00	0.50
18.45	160.00	0.37	120.00	0.00	0.50
18.52	154.60	0.36	120.00	0.00	0.50
18.60	152.60	0.33	120.00	0.00	0.50
18.68	150.60	0.34	120.00	0.00	0.50
18.77	154.50	0.40	120.00	0.00	0.50
18.86	158.60	0.43	120.00	0.00	0.50
18.96	168.10	0.43	120.00	0.00	0.50
19.04	184.00	0.48	120.00	0.00	0.50
19.14	198.40	0.53	120.00	0.00	0.50
19.24	223.60	0.42	120.00	0.00	0.50
19.36	252.30	0.37	120.00	0.00	0.50
19.45	271.60	0.34	120.00	0.00	0.50
19.55	272.40	0.33	120.00	0.00	0.50
19.64	270.40	0.35	120.00	0.00	0.50
19.75	254.50	0.49	120.00	0.00	0.50
19.84	233.80	0.62	120.00	0.00	0.50
19.94	214.50	0.64	120.00	0.00	0.50
20.04	192.70	0.64	120.00	0.00	0.50
20.14	159.30	0.64	120.00	0.00	0.50
20.24	130.70	0.56	120.00	0.00	0.50
20.34	110.90	0.37	120.00	0.00	0.50
20.45	97.70	0.35	120.00	0.00	0.50
20.56	90.60	0.36	120.00	0.00	0.50
20.66	86.50	0.43	120.00	0.00	0.50

20.77	86.70	0.51	120.00	0.00	0.50
20.88	90.40	0.55	120.00	0.00	0.50
20.99	97.70	0.59	120.00	0.00	0.50
21.09	107.20	0.68	120.00	0.00	0.50
21.20	118.30	0.70	120.00	0.00	0.50
21.30	122.70	0.71	120.00	0.00	0.50
21.38	124.80	0.69	120.00	0.00	0.50
21.45	121.80	0.70	120.00	0.00	0.50
21.56	107.20	0.73	120.00	0.00	0.50
21.68	88.30	0.82	120.00	0.00	0.50
21.80	74.40	0.91	120.00	0.00	0.50
21.92	68.50	0.99	120.00	0.00	0.50
22.04	73.10	0.99	120.00	0.00	0.50
22.16	81.30	0.95	120.00	0.00	0.50
22.28	89.30	0.88	120.00	0.00	0.50
22.40	97.50	0.85	120.00	0.00	0.50
22.53	105.80	0.88	120.00	0.00	0.50
22.66	114.20	0.91	120.00	0.00	0.50
22.73	118.30	0.93	120.00	0.00	0.50
22.81	121.50	0.94	120.00	0.00	0.50
22.89	126.10	0.94	120.00	0.00	0.50
22.98	128.50	0.96	120.00	0.00	0.50
23.06	132.10	0.89	120.00	0.00	0.50
23.15	137.00	0.88	120.00	0.00	0.50
23.24	141.50	0.89	120.00	0.00	0.50
23.33	146.80	0.91	120.00	0.00	0.50
23.42	144.10	1.00	120.00	0.00	0.50
23.51	149.00	1.00	120.00	0.00	0.50
23.60	152.50	1.02	120.00	0.00	0.50
23.68	158.50	1.00	120.00	0.00	0.50
23.77	162.50	0.99	120.00	0.00	0.50
23.85	162.10	0.97	120.00	0.00	0.50
23.94	161.00	1.00	120.00	0.00	0.50
24.02	158.50	1.01	120.00	0.00	0.50
24.10	152.00	1.03	120.00	0.00	0.50
24.19	142.80	1.06	120.00	0.00	0.50
24.28	140.50	1.04	120.00	0.00	0.50
24.37	140.20	1.01	120.00	0.00	0.50
24.48	140.20	0.99	120.00	0.00	0.50
24.59	141.20	0.96	120.00	0.00	0.50
24.70	141.50	0.93	120.00	0.00	0.50
24.82	140.60	0.88	120.00	0.00	0.50
24.93	132.90	0.84	120.00	0.00	0.50
25.04	116.80	0.82	120.00	0.00	0.50
25.16	94.90	0.79	120.00	0.00	0.50
25.27	74.30	0.81	120.00	0.00	0.50
25.39	58.40	0.92	120.00	0.00	0.50
25.50	46.60	1.33	120.00	0.00	0.50
25.61	37.60	2.32	120.00	0.00	0.50
25.73	29.70	3.10	120.00	0.00	0.50
25.84	28.00	3.23	120.00	0.00	0.50
25.96	24.00	3.28	120.00	0.00	0.50
26.08	27.40	3.25	120.00	0.00	0.50
26.19	24.00	3.63	120.00	0.00	0.50
26.30	24.50	4.15	120.00	0.00	0.50
26.42	26.50	3.88	120.00	0.00	0.50
26.49	23.40	3.95	120.00	0.00	0.50
26.57	20.50	3.75	120.00	0.00	0.50
26.65	17.90	3.75	120.00	0.00	0.50
26.73	16.90	3.56	120.00	0.00	0.50
26.82	20.90	2.39	120.00	0.00	0.50
26.91	36.70	0.97	120.00	0.00	0.50
27.00	55.20	0.79	120.00	0.00	0.50
27.15	74.70	0.75	120.00	0.00	0.50
27.23	70.40	0.92	120.00	0.00	0.50
27.30	83.90	0.88	120.00	0.00	0.50
27.38	92.60	0.91	120.00	0.00	0.50
27.45	100.00	0.95	120.00	0.00	0.50
27.52	107.40	0.97	120.00	0.00	0.50
27.62	116.90	0.98	120.00	0.00	0.50
27.72	124.20	0.99	120.00	0.00	0.50
27.83	130.10	1.02	120.00	0.00	0.50
27.94	135.10	1.03	120.00	0.00	0.50
28.05	135.90	1.07	120.00	0.00	0.50
28.16	137.10	1.10	120.00	0.00	0.50
28.27	139.90	1.15	120.00	0.00	0.50
28.34	140.30	1.19	120.00	0.00	0.50
28.41	142.40	1.19	120.00	0.00	0.50
28.49	146.80	1.17	120.00	0.00	0.50
28.57	151.30	1.16	120.00	0.00	0.50
28.65	165.00	1.12	120.00	0.00	0.50
28.73	171.80	1.11	120.00	0.00	0.50
28.81	179.20	1.10	120.00	0.00	0.50
28.89	185.50	1.11	120.00	0.00	0.50
28.97	193.50	1.11	120.00	0.00	0.50
29.04	199.00	1.10	120.00	0.00	0.50
29.12	203.30	1.10	120.00	0.00	0.50
29.20	206.20	1.09	120.00	0.00	0.50
29.28	206.50	1.06	120.00	0.00	0.50
29.36	205.50	1.04	120.00	0.00	0.50
29.43	203.70	1.01	120.00	0.00	0.50
29.50	202.20	0.98	120.00	0.00	0.50
29.58	203.20	0.93	120.00	0.00	0.50
29.66	202.80	0.89	120.00	0.00	0.50
29.74	201.00	0.87	120.00	0.00	0.50
29.81	198.40	0.85	120.00	0.00	0.50
29.89	199.10	0.82	120.00	0.00	0.50
29.97	203.80	0.76	120.00	0.00	0.50
30.04	208.40	0.72	120.00	0.00	0.50
30.12	215.10	0.72	120.00	0.00	0.50
30.20	219.90	0.74	120.00	0.00	0.50
30.27	227.80	0.73	120.00	0.00	0.50
30.35	215.50	0.78	120.00	0.00	0.50
30.41	231.30	0.71	120.00	0.00	0.50
30.48	237.20	0.69	120.00	0.00	0.50
30.55	243.10	0.70	120.00	0.00	0.50
30.61	244.40	0.70	120.00	0.00	0.50
30.71	241.70	0.70	120.00	0.00	0.50
30.81	241.10	0.68	120.00	0.00	0.50
30.91	232.30	0.69	120.00	0.00	0.50
30.97	231.00	0.69	120.00	0.00	0.50
31.05	226.00	0.69	120.00	0.00	0.50
31.14	216.80	0.70	120.00	0.00	0.50
31.22	204.80	0.71	120.00	0.00	0.50
31.31	192.90	0.73	120.00	0.00	0.50
31.40	182.60	0.77	120.00	0.00	0.50
31.49	175.30	0.82	120.00	0.00	0.50
31.58	171.90	0.87	120.00	0.00	0.50
31.66	169.40	0.94	120.00	0.00	0.50
31.75	165.80	1.01	120.00	0.00	0.50

31.84	162.60	1.06	120.00	0.00	0.50
31.93	159.40	1.06	120.00	0.00	0.50
32.02	163.70	1.00	120.00	0.00	0.50
32.11	170.90	0.94	120.00	0.00	0.50
32.19	177.30	0.90	120.00	0.00	0.50
32.28	181.40	0.85	120.00	0.00	0.50
32.37	185.60	0.77	120.00	0.00	0.50
32.46	182.70	0.73	120.00	0.00	0.50
32.55	174.10	0.70	120.00	0.00	0.50
32.65	166.50	0.62	120.00	0.00	0.50
32.76	161.60	0.65	120.00	0.00	0.50
32.88	158.60	0.69	120.00	0.00	0.50
32.99	143.30	0.76	120.00	0.00	0.50
33.12	144.40	0.68	120.00	0.00	0.50
33.19	147.90	0.69	120.00	0.00	0.50
33.27	143.80	0.73	120.00	0.00	0.50
33.34	142.50	0.74	120.00	0.00	0.50
33.41	139.20	0.77	120.00	0.00	0.50
33.48	139.40	0.75	120.00	0.00	0.50
33.54	140.30	0.75	120.00	0.00	0.50
33.62	142.80	0.74	120.00	0.00	0.50
33.75	151.60	0.73	120.00	0.00	0.50
33.84	157.80	0.73	120.00	0.00	0.50
33.92	164.40	0.72	120.00	0.00	0.50
34.01	168.30	0.73	120.00	0.00	0.50
34.10	169.80	0.73	120.00	0.00	0.50
34.20	169.70	0.74	120.00	0.00	0.50
34.28	172.90	0.72	120.00	0.00	0.50
34.37	179.20	0.70	120.00	0.00	0.50
34.46	183.40	0.69	120.00	0.00	0.50
34.55	188.60	0.68	120.00	0.00	0.50
34.64	190.00	0.68	120.00	0.00	0.50
34.73	191.40	0.68	120.00	0.00	0.50
34.80	189.90	0.68	120.00	0.00	0.50
34.88	188.10	0.69	120.00	0.00	0.50
34.97	187.50	0.70	120.00	0.00	0.50
35.05	186.70	0.72	120.00	0.00	0.50
35.13	192.70	0.71	120.00	0.00	0.50
35.21	200.80	0.68	120.00	0.00	0.50
35.29	205.40	0.66	120.00	0.00	0.50
35.37	204.80	0.65	120.00	0.00	0.50
35.48	200.40	0.63	120.00	0.00	0.50
35.58	196.50	0.59	120.00	0.00	0.50
35.69	198.20	0.54	120.00	0.00	0.50
35.81	193.50	0.51	120.00	0.00	0.50
35.94	183.00	0.54	120.00	0.00	0.50
36.01	177.90	0.56	120.00	0.00	0.50
36.09	173.20	0.57	120.00	0.00	0.50
36.18	167.40	0.54	120.00	0.00	0.50
36.26	164.70	0.61	120.00	0.00	0.50
36.34	161.50	0.70	120.00	0.00	0.50
36.43	159.70	0.75	120.00	0.00	0.50
36.52	150.40	0.82	120.00	0.00	0.50
36.59	151.10	0.84	120.00	0.00	0.50
36.66	148.10	0.87	120.00	0.00	0.50
36.74	146.10	0.87	120.00	0.00	0.50
36.83	143.70	0.87	120.00	0.00	0.50
36.93	143.40	0.84	120.00	0.00	0.50
37.03	145.00	0.79	120.00	0.00	0.50
37.14	147.40	0.75	120.00	0.00	0.50
37.25	151.90	0.71	120.00	0.00	0.50
37.38	159.60	0.66	120.00	0.00	0.50
37.45	163.60	0.66	120.00	0.00	0.50
37.53	172.00	0.63	120.00	0.00	0.50
37.60	179.90	0.61	120.00	0.00	0.50
37.68	191.10	0.58	120.00	0.00	0.50
37.75	203.50	0.54	120.00	0.00	0.50
37.82	215.90	0.49	120.00	0.00	0.50
37.89	224.80	0.46	120.00	0.00	0.50
37.97	231.60	0.43	120.00	0.00	0.50
38.05	236.70	0.41	120.00	0.00	0.50
38.12	238.90	0.40	120.00	0.00	0.50
38.20	242.80	0.39	120.00	0.00	0.50
38.27	242.10	0.39	120.00	0.00	0.50
38.35	241.30	0.39	120.00	0.00	0.50
38.42	238.40	0.39	120.00	0.00	0.50
38.50	236.10	0.37	120.00	0.00	0.50
38.57	236.40	0.34	120.00	0.00	0.50
38.65	239.50	0.30	120.00	0.00	0.50
38.73	243.30	0.29	120.00	0.00	0.50
38.81	244.50	0.30	120.00	0.00	0.50
38.90	246.00	0.32	120.00	0.00	0.50
38.98	236.50	0.33	120.00	0.00	0.50
39.06	235.40	0.33	120.00	0.00	0.50
39.15	237.60	0.32	120.00	0.00	0.50
39.24	237.20	0.34	120.00	0.00	0.50
39.33	236.70	0.34	120.00	0.00	0.50
39.42	235.50	0.38	120.00	0.00	0.50
39.51	236.30	0.41	120.00	0.00	0.50
39.58	232.60	0.43	120.00	0.00	0.50
39.68	238.00	0.45	120.00	0.00	0.50
39.78	239.60	0.47	120.00	0.00	0.50
39.89	240.40	0.50	120.00	0.00	0.50
40.00	245.00	0.54	120.00	0.00	0.50
40.11	250.10	0.57	120.00	0.00	0.50
40.24	251.80	0.61	120.00	0.00	0.50
40.31	250.10	0.59	120.00	0.00	0.50
40.39	245.70	0.52	120.00	0.00	0.50
40.46	238.50	0.45	120.00	0.00	0.50
40.53	233.30	0.42	120.00	0.00	0.50
40.60	229.00	0.38	120.00	0.00	0.50
40.68	220.60	0.40	120.00	0.00	0.50
40.75	216.30	0.42	120.00	0.00	0.50
40.82	206.60	0.44	120.00	0.00	0.50
40.90	202.20	0.44	120.00	0.00	0.50
40.97	190.30	0.46	120.00	0.00	0.50
41.04	183.00	0.45	120.00	0.00	0.50
41.12	182.00	0.42	120.00	0.00	0.50
41.19	185.30	0.38	120.00	0.00	0.50
41.26	190.40	0.36	120.00	0.00	0.50
41.34	191.60	0.38	120.00	0.00	0.50
41.41	179.30	0.46	120.00	0.00	0.50
41.48	158.80	0.65	120.00	0.00	0.50
41.56	132.90	0.97	120.00	0.00	0.50
41.63	103.40	1.54	120.00	0.00	0.50
41.71	78.20	2.36	120.00	0.00	0.50
41.79	60.30	3.03	120.00	0.00	0.50
41.86	55.00	2.89	120.00	0.00	0.50
41.93	52.40	2.76	120.00	0.00	0.50
42.01	44.50	3.33	120.00	0.00	0.50

42.09	43.00	3.60	120.00	0.00	0.50
42.16	59.60	2.52	120.00	0.00	0.50
42.23	68.60	1.90	120.00	0.00	0.50
42.31	71.90	1.46	120.00	0.00	0.50
42.39	86.70	1.08	120.00	0.00	0.50
42.46	90.90	1.01	120.00	0.00	0.50
42.54	91.50	1.19	120.00	0.00	0.50
42.61	97.90	1.24	120.00	0.00	0.50
42.69	106.90	1.21	120.00	0.00	0.50
42.80	122.00	1.28	120.00	0.00	0.50
42.92	130.00	1.22	120.00	0.00	0.50
43.04	132.40	0.98	120.00	0.00	0.50
43.15	127.60	0.84	120.00	0.00	0.50
43.28	116.90	0.83	120.00	0.00	0.50
43.41	101.50	1.22	120.00	0.00	0.50
43.48	92.80	1.64	120.00	0.00	0.50
43.55	83.30	2.23	120.00	0.00	0.50
43.63	72.20	2.68	120.00	0.00	0.50
43.73	63.10	2.75	120.00	0.00	0.50
43.82	64.70	2.41	120.00	0.00	0.50
43.90	83.90	1.61	120.00	0.00	0.50
43.98	119.80	1.01	120.00	0.00	0.50
44.05	148.80	0.75	120.00	0.00	0.50
44.13	167.90	0.59	120.00	0.00	0.50
44.20	180.80	0.53	120.00	0.00	0.50
44.28	189.30	0.54	120.00	0.00	0.50
44.35	198.20	0.56	120.00	0.00	0.50
44.43	203.60	0.56	120.00	0.00	0.50
44.50	209.10	0.55	120.00	0.00	0.50
44.58	215.30	0.54	120.00	0.00	0.50
44.65	223.20	0.53	120.00	0.00	0.50
44.72	225.10	0.54	120.00	0.00	0.50
44.84	231.40	0.58	120.00	0.00	0.50
44.96	248.20	0.55	120.00	0.00	0.50
45.08	273.30	0.49	120.00	0.00	0.50
45.19	290.60	0.47	120.00	0.00	0.50
45.31	299.80	0.48	120.00	0.00	0.50
45.38	304.10	0.49	120.00	0.00	0.50
45.46	309.00	0.46	120.00	0.00	0.50
45.53	313.10	0.43	120.00	0.00	0.50
45.61	315.50	0.46	120.00	0.00	0.50
45.69	314.40	0.49	120.00	0.00	0.50
45.76	308.70	0.52	120.00	0.00	0.50
45.85	304.60	0.49	120.00	0.00	0.50
45.93	303.50	0.44	120.00	0.00	0.50
46.02	297.80	0.41	120.00	0.00	0.50
46.11	286.30	0.40	120.00	0.00	0.50
46.19	271.20	0.37	120.00	0.00	0.50
46.28	249.90	0.35	120.00	0.00	0.50
46.37	224.20	0.35	120.00	0.00	0.50
46.46	193.70	0.40	120.00	0.00	0.50
46.56	158.90	0.61	120.00	0.00	0.50
46.63	138.20	0.77	120.00	0.00	0.50
46.71	116.40	0.97	120.00	0.00	0.50
46.80	103.90	1.08	120.00	0.00	0.50
46.89	97.30	1.23	120.00	0.00	0.50
46.98	90.80	1.52	120.00	0.00	0.50
47.07	86.30	1.86	120.00	0.00	0.50
47.16	81.10	2.17	120.00	0.00	0.50
47.25	75.50	2.48	120.00	0.00	0.50
47.34	64.90	3.05	120.00	0.00	0.50
47.42	61.10	3.17	120.00	0.00	0.50
47.51	66.90	2.48	120.00	0.00	0.50
47.60	74.40	2.10	120.00	0.00	0.50
47.69	81.10	2.06	120.00	0.00	0.50
47.78	78.40	2.47	120.00	0.00	0.50
47.87	70.70	2.79	120.00	0.00	0.50
47.95	63.40	3.06	120.00	0.00	0.50
48.05	57.70	3.42	120.00	0.00	0.50
48.13	54.90	3.66	120.00	0.00	0.50
48.22	62.60	3.31	120.00	0.00	0.50
48.31	82.20	2.52	120.00	0.00	0.50
48.40	105.00	1.91	120.00	0.00	0.50
48.49	117.40	1.70	120.00	0.00	0.50
48.58	127.30	0.85	120.00	0.00	0.50
48.67	134.80	0.93	120.00	0.00	0.50
48.76	141.40	1.00	120.00	0.00	0.50
48.84	150.00	1.06	120.00	0.00	0.50
48.93	162.30	1.14	120.00	0.00	0.50
49.02	184.20	1.16	120.00	0.00	0.50
49.12	209.50	1.14	120.00	0.00	0.50
49.21	230.50	1.08	120.00	0.00	0.50
49.30	247.30	0.94	120.00	0.00	0.50
49.41	262.80	0.75	120.00	0.00	0.50
49.52	265.30	0.58	120.00	0.00	0.50
49.63	247.50	0.48	120.00	0.00	0.50
49.74	212.10	0.47	120.00	0.00	0.50
49.85	173.00	0.68	120.00	0.00	0.50
49.97	127.40	1.39	120.00	0.00	0.50
50.10	77.00	2.64	120.00	0.00	0.50
50.17	58.20	3.31	120.00	0.00	0.50
50.23	48.50	3.46	120.00	0.00	0.50
50.30	47.30	3.11	120.00	0.00	0.50
50.37	42.30	3.15	120.00	0.00	0.50
50.50	39.40	3.45	120.00	0.00	0.50
50.57	43.30	3.26	120.00	0.00	0.50
50.64	50.40	2.90	120.00	0.00	0.50
50.71	57.40	2.80	120.00	0.00	0.50
50.79	63.50	2.80	120.00	0.00	0.50
50.88	66.70	2.78	120.00	0.00	0.50
50.97	70.50	2.56	120.00	0.00	0.50
51.06	70.50	2.69	120.00	0.00	0.50
51.15	67.80	2.85	120.00	0.00	0.50
51.24	68.10	2.92	120.00	0.00	0.50
51.33	78.10	2.58	120.00	0.00	0.50
51.41	115.20	1.73	120.00	0.00	0.50
51.50	151.50	1.35	120.00	0.00	0.50
51.59	183.50	1.09	120.00	0.00	0.50
51.68	204.20	0.63	120.00	0.00	0.50
51.77	219.50	0.60	120.00	0.00	0.50
51.86	235.50	0.60	120.00	0.00	0.50
51.93	237.60	0.64	120.00	0.00	0.50
52.03	238.20	0.68	120.00	0.00	0.50
52.10	240.80	0.68	120.00	0.00	0.50
52.18	243.40	0.69	120.00	0.00	0.50
52.26	244.20	0.68	120.00	0.00	0.50
52.34	252.70	0.63	120.00	0.00	0.50
52.44	266.20	0.59	120.00	0.00	0.50
52.56	275.60	0.59	120.00	0.00	0.50
52.68	287.00	0.57	120.00	0.00	0.50

52.80	292.20	0.58	120.00	0.00	0.50
52.91	288.20	0.59	120.00	0.00	0.50
53.02	278.90	0.60	120.00	0.00	0.50
53.14	269.20	0.62	120.00	0.00	0.50
53.25	258.70	0.69	120.00	0.00	0.50
53.37	249.60	0.74	120.00	0.00	0.50
53.48	241.30	0.79	120.00	0.00	0.50
53.60	237.50	0.78	120.00	0.00	0.50
53.71	241.70	0.77	120.00	0.00	0.50
53.81	249.60	0.76	120.00	0.00	0.50
53.92	260.40	0.76	120.00	0.00	0.50
54.03	270.50	0.74	120.00	0.00	0.50
54.15	274.10	0.70	120.00	0.00	0.50
54.23	276.70	0.67	120.00	0.00	0.50
54.31	274.20	0.61	120.00	0.00	0.50
54.39	268.10	0.55	120.00	0.00	0.50
54.47	256.20	0.49	120.00	0.00	0.50
54.55	240.30	0.46	120.00	0.00	0.50
54.63	221.40	0.47	120.00	0.00	0.50
54.71	199.90	0.49	120.00	0.00	0.50
54.79	179.80	0.57	120.00	0.00	0.50
54.86	160.30	0.72	120.00	0.00	0.50
54.94	146.10	0.88	120.00	0.00	0.50
55.01	136.90	0.97	120.00	0.00	0.50
55.10	128.30	0.95	120.00	0.00	0.50
55.17	125.90	0.82	120.00	0.00	0.50
55.24	121.90	0.78	120.00	0.00	0.50
55.33	112.90	0.95	120.00	0.00	0.50
55.43	97.40	1.44	120.00	0.00	0.50
55.53	80.50	2.10	120.00	0.00	0.50
55.63	71.30	2.66	120.00	0.00	0.50
55.73	69.30	2.93	120.00	0.00	0.50
55.84	56.60	3.75	120.00	0.00	0.50
55.96	38.50	4.88	120.00	0.00	0.50
56.08	26.30	5.49	120.00	0.00	0.50
56.16	23.60	5.26	120.00	0.00	0.50
56.23	22.20	4.76	120.00	0.00	0.50
56.30	21.30	3.97	120.00	0.00	0.50
56.37	20.30	3.75	120.00	0.00	0.50
56.44	19.80	3.72	120.00	0.00	0.50
56.51	18.80	3.90	120.00	0.00	0.50
56.59	18.40	4.05	120.00	0.00	0.50
56.66	18.80	4.25	120.00	0.00	0.50
56.74	21.20	3.59	120.00	0.00	0.50
56.83	23.60	3.41	120.00	0.00	0.50
56.92	28.50	4.02	120.00	0.00	0.50
57.01	30.70	4.30	120.00	0.00	0.50
57.10	26.90	5.19	120.00	0.00	0.50
57.19	25.60	5.73	120.00	0.00	0.50
57.28	22.90	6.69	120.00	0.00	0.50
57.37	22.60	6.77	120.00	0.00	0.50
57.46	22.10	6.76	120.00	0.00	0.50
57.55	22.10	6.93	120.00	0.00	0.50
57.64	22.80	6.61	120.00	0.00	0.50
57.73	23.40	5.58	120.00	0.00	0.50
57.82	25.20	4.60	120.00	0.00	0.50
57.91	27.00	4.80	120.00	0.00	0.50
58.00	29.20	5.25	120.00	0.00	0.50
58.08	32.50	5.53	120.00	0.00	0.50
58.15	32.40	6.08	120.00	0.00	0.50
58.23	34.30	6.40	120.00	0.00	0.50
58.32	36.30	6.64	120.00	0.00	0.50
58.41	38.10	6.66	120.00	0.00	0.50
58.51	41.80	6.23	120.00	0.00	0.50
58.61	44.30	5.84	120.00	0.00	0.50
58.72	47.10	5.51	120.00	0.00	0.50
58.82	46.70	5.39	120.00	0.00	0.50
58.92	43.50	5.43	120.00	0.00	0.50
59.03	38.00	6.04	120.00	0.00	0.50
59.13	31.70	7.20	120.00	0.00	0.50
59.24	28.80	7.47	120.00	0.00	0.50
59.34	29.30	6.67	120.00	0.00	0.50
59.44	34.20	5.29	120.00	0.00	0.50
59.56	36.80	4.78	120.00	0.00	0.50
59.68	36.30	4.80	120.00	0.00	0.50
59.81	34.20	5.12	120.00	0.00	0.50
59.94	31.00	5.52	120.00	0.00	0.50
60.07	27.60	6.01	120.00	0.00	0.50
60.19	26.00	6.04	120.00	0.00	0.50
60.32	23.20	6.61	120.00	0.00	0.50
60.46	20.90	6.98	120.00	0.00	0.50
60.54	18.80	7.40	120.00	0.00	0.50
60.62	17.90	7.39	120.00	0.00	0.50
60.70	17.80	7.17	120.00	0.00	0.50
60.78	16.50	7.28	120.00	0.00	0.50
60.87	15.20	6.38	120.00	0.00	0.50
60.95	14.40	6.44	120.00	0.00	0.50
61.04	13.00	6.51	120.00	0.00	0.50
61.13	11.70	6.52	120.00	0.00	0.50
61.19	8.60	8.07	120.00	0.00	0.50
61.29	8.60	6.40	120.00	0.00	0.50
61.42	8.60	5.51	120.00	0.00	0.50
61.48	8.20	5.68	120.00	0.00	0.50
61.55	8.30	5.70	120.00	0.00	0.50
61.62	8.20	5.87	120.00	0.00	0.50
61.70	9.00	5.66	120.00	0.00	0.50
61.77	9.90	5.92	120.00	0.00	0.50
61.84	10.10	6.60	120.00	0.00	0.50
61.91	10.60	7.15	120.00	0.00	0.50
61.97	12.00	7.11	120.00	0.00	0.50
62.06	14.20	6.46	120.00	0.00	0.50
62.14	16.50	5.63	120.00	0.00	0.50
62.23	16.70	5.29	120.00	0.00	0.50
62.32	16.10	5.04	120.00	0.00	0.50
62.41	16.60	4.40	120.00	0.00	0.50
62.50	16.80	4.09	120.00	0.00	0.50
62.58	17.40	3.85	120.00	0.00	0.50
62.67	16.80	3.92	120.00	0.00	0.50
62.76	16.00	4.14	120.00	0.00	0.50
62.85	15.70	4.13	120.00	0.00	0.50
62.93	15.40	4.14	120.00	0.00	0.50
63.02	14.80	4.22	120.00	0.00	0.50
63.11	15.70	3.82	120.00	0.00	0.50
63.20	16.60	3.78	120.00	0.00	0.50
63.29	16.20	4.42	120.00	0.00	0.50
63.38	17.00	4.64	120.00	0.00	0.50
63.47	17.70	4.59	120.00	0.00	0.50
63.56	19.40	4.39	120.00	0.00	0.50
63.65	18.60	4.81	120.00	0.00	0.50
63.74	18.50	4.90	120.00	0.00	0.50

63.83	18.40	4.76	120.00	0.00	0.50
63.92	17.90	5.12	120.00	0.00	0.50
64.01	17.50	5.48	120.00	0.00	0.50
64.10	16.90	5.88	120.00	0.00	0.50
64.18	17.50	5.48	120.00	0.00	0.50
64.26	17.40	5.17	120.00	0.00	0.50
64.34	17.30	5.03	120.00	0.00	0.50
64.42	17.90	4.60	120.00	0.00	0.50
64.50	17.70	4.22	120.00	0.00	0.50
64.58	17.40	3.96	120.00	0.00	0.50
64.66	17.20	4.13	120.00	0.00	0.50
64.74	16.80	0.00	120.00	0.00	0.50
64.82	16.30	0.00	120.00	0.00	0.50
64.89	16.80	0.00	120.00	0.00	0.50
64.97	16.80	0.00	120.00	0.00	0.50
65.04	16.90	0.00	120.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=1.05 in.
Settlement of Unsaturated Sands=0.31 in.
Total Settlement of Saturated and Unsaturated Sands=1.36 in.
Differential Settlement=0.678 to 0.894 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.34	5.00	1.05	0.31	1.36
5.00	0.92	0.34	5.00	1.05	0.30	1.35
10.00	0.26	0.34	5.00	1.05	0.27	1.31
15.00	1.35	0.33	5.00	1.05	0.19	1.24
20.00	1.08	0.33	5.00	1.05	0.15	1.20
25.00	0.81	0.32	5.00	1.05	0.07	1.11
30.00	0.56	0.32	5.00	1.05	0.00	1.05
35.00	0.37	0.33	1.13	0.86	0.00	0.86
40.00	0.55	0.33	1.64	0.63	0.00	0.63
45.00	0.54	0.34	1.61	0.30	0.00	0.30
50.00	0.22	0.33	0.66*	0.14	0.00	0.14
55.00	0.20	0.33	0.62*	0.08	0.00	0.08
60.00	2.00	0.32	5.00	0.00	0.00	0.00
65.00	2.00	0.31	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\CPT-09-104.liq
Title: SR-57 Northbound Widening/RW No 293
Subtitle: 602231-002
Surface Elev.=177.5
Hole No.=CPT-09-107
Depth of Hole= 69.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 44.00 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:

Surface Elev.=177.5
Hole No.=CPT-09-107
Depth of Hole=69.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 44.00 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60
1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	qc atm	fs atm	gamma pcf	Fines %	D50 mm
0.00	0.00	0.00	120.00	0.00	0.50
0.17	1.70	0.00	120.00	0.00	0.50
0.23	3.70	0.00	120.00	0.00	0.50
0.31	10.70	9.24	120.00	0.00	0.50
0.40	78.50	1.35	120.00	0.00	0.50
0.50	317.20	0.27	120.00	0.00	0.50
0.60	274.70	0.39	120.00	0.00	0.50
0.66	265.70	0.39	120.00	0.00	0.50
0.73	263.80	0.55	120.00	0.00	0.50
0.81	259.60	0.58	120.00	0.00	0.50
0.88	262.50	0.52	120.00	0.00	0.50
0.95	257.80	0.46	120.00	0.00	0.50
1.02	240.20	0.48	120.00	0.00	0.50
1.10	231.10	0.42	120.00	0.00	0.50
1.17	228.30	0.44	120.00	0.00	0.50
1.24	204.20	0.56	120.00	0.00	0.50
1.32	200.30	0.59	120.00	0.00	0.50
1.40	187.60	0.62	120.00	0.00	0.50
1.48	173.10	0.63	120.00	0.00	0.50
1.56	159.70	0.58	120.00	0.00	0.50

1.65	143.00	0.65	120.00	0.00	0.50
1.73	134.50	0.69	120.00	0.00	0.50
1.82	128.50	0.71	120.00	0.00	0.50
1.92	123.00	0.69	120.00	0.00	0.50
1.99	118.40	0.68	120.00	0.00	0.50
2.05	113.40	0.60	120.00	0.00	0.50
2.12	105.80	0.61	120.00	0.00	0.50
2.19	98.20	0.61	120.00	0.00	0.50
2.25	88.90	0.59	120.00	0.00	0.50
2.32	80.80	0.56	120.00	0.00	0.50
2.40	68.20	0.54	120.00	0.00	0.50
2.48	63.10	0.49	120.00	0.00	0.50
2.55	62.20	0.49	120.00	0.00	0.50
2.64	63.90	0.48	120.00	0.00	0.50
2.70	69.00	0.45	120.00	0.00	0.50
2.80	81.20	0.45	120.00	0.00	0.50
2.87	90.10	0.44	120.00	0.00	0.50
2.95	97.20	0.45	120.00	0.00	0.50
3.04	108.50	0.47	120.00	0.00	0.50
3.11	111.10	0.51	120.00	0.00	0.50
3.17	114.00	0.53	120.00	0.00	0.50
3.24	116.50	0.57	120.00	0.00	0.50
3.30	117.00	0.62	120.00	0.00	0.50
3.37	116.90	0.66	120.00	0.00	0.50
3.44	116.60	0.70	120.00	0.00	0.50
3.52	116.80	0.71	120.00	0.00	0.50
3.60	114.90	0.76	120.00	0.00	0.50
3.69	112.70	0.79	120.00	0.00	0.50
3.78	107.20	0.85	120.00	0.00	0.50
3.88	97.90	0.90	120.00	0.00	0.50
3.97	90.30	0.91	120.00	0.00	0.50
4.06	81.90	0.91	120.00	0.00	0.50
4.15	76.40	0.87	120.00	0.00	0.50
4.24	74.60	0.80	120.00	0.00	0.50
4.34	72.50	0.75	120.00	0.00	0.50
4.43	67.50	0.77	120.00	0.00	0.50
4.52	61.50	0.82	120.00	0.00	0.50
4.62	54.80	0.84	120.00	0.00	0.50
4.71	49.00	0.88	120.00	0.00	0.50
4.80	45.20	0.95	120.00	0.00	0.50
4.90	42.90	1.05	120.00	0.00	0.50
4.99	41.80	1.13	120.00	0.00	0.50
5.08	41.60	1.07	120.00	0.00	0.50
5.17	40.10	1.09	120.00	0.00	0.50
5.26	39.00	1.11	120.00	0.00	0.50
5.36	37.60	1.06	120.00	0.00	0.50
5.44	35.00	1.04	120.00	0.00	0.50
5.52	35.70	0.94	120.00	0.00	0.50
5.59	37.20	0.89	120.00	0.00	0.50
5.66	39.80	0.84	120.00	0.00	0.50
5.74	45.80	0.74	120.00	0.00	0.50
5.80	53.80	0.63	120.00	0.00	0.50
5.88	62.40	0.53	120.00	0.00	0.50
5.97	71.40	0.46	120.00	0.00	0.50
6.06	77.80	0.43	120.00	0.00	0.50
6.15	78.80	0.43	120.00	0.00	0.50
6.24	78.00	0.45	120.00	0.00	0.50
6.34	78.10	0.44	120.00	0.00	0.50
6.43	78.50	0.43	120.00	0.00	0.50
6.52	77.80	0.44	120.00	0.00	0.50
6.61	74.00	0.47	120.00	0.00	0.50
6.70	67.50	0.49	120.00	0.00	0.50
6.80	59.50	0.53	120.00	0.00	0.50
6.89	51.10	0.59	120.00	0.00	0.50
6.99	42.60	0.63	120.00	0.00	0.50
7.09	36.60	0.63	120.00	0.00	0.50
7.19	31.70	0.69	120.00	0.00	0.50
7.29	28.10	0.86	120.00	0.00	0.50
7.38	24.60	1.17	120.00	0.00	0.50
7.48	22.00	1.53	120.00	0.00	0.50
7.58	19.70	1.65	120.00	0.00	0.50
7.68	17.00	1.65	120.00	0.00	0.50
7.78	15.70	1.65	120.00	0.00	0.50
7.89	14.70	1.22	120.00	0.00	0.50
7.99	15.20	0.95	120.00	0.00	0.50
8.10	16.50	0.85	120.00	0.00	0.50
8.23	23.70	0.58	120.00	0.00	0.50
8.30	25.20	0.65	120.00	0.00	0.50
8.37	27.40	0.68	120.00	0.00	0.50
8.46	29.20	0.62	120.00	0.00	0.50
8.53	38.10	0.49	120.00	0.00	0.50
8.60	43.20	0.44	120.00	0.00	0.50
8.69	48.90	0.37	120.00	0.00	0.50
8.77	58.60	0.30	120.00	0.00	0.50
8.86	69.40	0.24	120.00	0.00	0.50
8.95	75.70	0.20	120.00	0.00	0.50
9.08	81.60	0.23	120.00	0.00	0.50
9.15	85.60	0.48	120.00	0.00	0.50
9.22	89.40	0.44	120.00	0.00	0.50
9.29	92.80	0.42	120.00	0.00	0.50
9.35	95.60	0.49	120.00	0.00	0.50
9.43	99.70	0.50	120.00	0.00	0.50
9.50	102.90	0.78	120.00	0.00	0.50
9.57	111.10	0.63	120.00	0.00	0.50
9.64	125.70	0.46	120.00	0.00	0.50
9.71	122.90	0.41	120.00	0.00	0.50
9.77	122.40	0.39	120.00	0.00	0.50
9.85	114.90	0.44	120.00	0.00	0.50
9.91	117.40	0.47	120.00	0.00	0.50
10.02	117.70	0.49	120.00	0.00	0.50
10.13	113.60	0.35	120.00	0.00	0.50
10.24	108.20	0.34	120.00	0.00	0.50
10.35	103.20	0.34	120.00	0.00	0.50
10.45	105.20	0.32	120.00	0.00	0.50
10.58	109.30	0.31	120.00	0.00	0.50
10.65	111.00	0.31	120.00	0.00	0.50
10.72	112.10	0.37	120.00	0.00	0.50
10.79	111.50	0.23	120.00	0.00	0.50
10.86	109.20	0.25	120.00	0.00	0.50
10.93	105.30	0.26	120.00	0.00	0.50
11.00	99.10	0.27	120.00	0.00	0.50
11.07	78.20	0.31	120.00	0.00	0.50
11.14	82.90	0.27	120.00	0.00	0.50
11.25	78.20	0.26	120.00	0.00	0.50
11.35	72.50	0.22	120.00	0.00	0.50
11.46	70.90	0.23	120.00	0.00	0.50
11.57	69.80	0.20	120.00	0.00	0.50
11.67	68.00	0.22	120.00	0.00	0.50
11.78	69.60	0.20	120.00	0.00	0.50
11.89	69.90	0.18	120.00	0.00	0.50

12.00	71.30	0.22	120.00	0.00	0.50
12.11	73.10	0.22	120.00	0.00	0.50
12.19	73.60	0.21	120.00	0.00	0.50
12.30	77.60	0.20	120.00	0.00	0.50
12.43	79.50	0.26	120.00	0.00	0.50
12.50	80.70	0.22	120.00	0.00	0.50
12.57	83.10	0.22	120.00	0.00	0.50
12.63	85.80	0.21	120.00	0.00	0.50
12.70	86.50	0.20	120.00	0.00	0.50
12.77	86.50	0.22	120.00	0.00	0.50
12.84	87.50	0.24	120.00	0.00	0.50
12.91	89.60	0.25	120.00	0.00	0.50
12.98	90.40	0.25	120.00	0.00	0.50
13.04	93.00	0.23	120.00	0.00	0.50
13.11	94.00	0.23	120.00	0.00	0.50
13.18	93.10	0.21	120.00	0.00	0.50
13.25	94.10	0.20	120.00	0.00	0.50
13.32	94.90	0.20	120.00	0.00	0.50
13.39	96.50	0.23	120.00	0.00	0.50
13.46	96.70	0.25	120.00	0.00	0.50
13.53	98.30	0.25	120.00	0.00	0.50
13.59	100.40	0.25	120.00	0.00	0.50
13.66	103.80	0.23	120.00	0.00	0.50
13.73	103.30	0.22	120.00	0.00	0.50
13.80	103.40	0.23	120.00	0.00	0.50
13.87	104.20	0.25	120.00	0.00	0.50
13.94	105.30	0.26	120.00	0.00	0.50
14.00	106.60	0.24	120.00	0.00	0.50
14.07	106.50	0.22	120.00	0.00	0.50
14.14	108.50	0.26	120.00	0.00	0.50
14.21	109.90	0.23	120.00	0.00	0.50
14.28	111.10	0.26	120.00	0.00	0.50
14.35	113.00	0.29	120.00	0.00	0.50
14.42	113.80	0.27	120.00	0.00	0.50
14.49	116.20	0.25	120.00	0.00	0.50
14.56	114.80	0.45	120.00	0.00	0.50
14.62	116.60	0.38	120.00	0.00	0.50
14.69	117.90	0.33	120.00	0.00	0.50
14.76	120.90	0.30	120.00	0.00	0.50
14.83	117.40	0.37	120.00	0.00	0.50
14.90	116.60	0.35	120.00	0.00	0.50
14.99	118.30	0.23	120.00	0.00	0.50
15.09	119.50	0.22	120.00	0.00	0.50
15.22	118.80	0.21	120.00	0.00	0.50
15.31	115.20	0.21	120.00	0.00	0.50
15.42	115.90	0.21	120.00	0.00	0.50
15.55	118.50	0.22	120.00	0.00	0.50
15.68	124.50	0.29	120.00	0.00	0.50
15.81	128.90	0.25	120.00	0.00	0.50
15.88	130.30	0.24	120.00	0.00	0.50
15.95	134.50	0.22	120.00	0.00	0.50
16.01	128.70	0.70	120.00	0.00	0.50
16.08	128.90	1.13	120.00	0.00	0.50
16.16	133.50	0.69	120.00	0.00	0.50
16.23	134.90	0.48	120.00	0.00	0.50
16.29	137.40	0.44	120.00	0.00	0.50
16.36	133.70	0.42	120.00	0.00	0.50
16.43	137.40	0.40	120.00	0.00	0.50
16.54	143.50	0.37	120.00	0.00	0.50
16.61	148.30	0.23	120.00	0.00	0.50
16.71	161.80	0.24	120.00	0.00	0.50
16.78	168.90	0.29	120.00	0.00	0.50
16.85	175.10	0.31	120.00	0.00	0.50
16.94	180.90	0.26	120.00	0.00	0.50
17.06	187.90	0.31	120.00	0.00	0.50
17.18	195.20	0.23	120.00	0.00	0.50
17.29	205.70	0.26	120.00	0.00	0.50
17.41	213.90	0.21	120.00	0.00	0.50
17.54	220.80	0.19	120.00	0.00	0.50
17.60	222.00	0.23	120.00	0.00	0.50
17.67	228.60	0.25	120.00	0.00	0.50
17.75	206.10	0.27	120.00	0.00	0.50
17.82	222.40	0.29	120.00	0.00	0.50
17.91	228.80	0.35	120.00	0.00	0.50
17.99	238.10	0.37	120.00	0.00	0.50
18.07	233.80	0.42	120.00	0.00	0.50
18.16	239.90	0.43	120.00	0.00	0.50
18.25	220.90	0.50	120.00	0.00	0.50
18.33	220.70	0.63	120.00	0.00	0.50
18.42	229.00	0.60	120.00	0.00	0.50
18.50	229.80	0.52	120.00	0.00	0.50
18.59	238.90	0.56	120.00	0.00	0.50
18.67	235.90	0.59	120.00	0.00	0.50
18.76	248.20	0.52	120.00	0.00	0.50
18.84	262.30	0.51	120.00	0.00	0.50
18.93	273.40	0.55	120.00	0.00	0.50
19.01	285.40	0.55	120.00	0.00	0.50
19.10	300.30	0.55	120.00	0.00	0.50
19.18	316.50	0.54	120.00	0.00	0.50
19.27	327.50	0.55	120.00	0.00	0.50
19.36	333.30	0.58	120.00	0.00	0.50
19.44	340.00	0.61	120.00	0.00	0.50
19.53	338.90	0.62	120.00	0.00	0.50
19.61	337.60	0.63	120.00	0.00	0.50
19.70	335.90	0.64	120.00	0.00	0.50
19.81	337.10	0.64	120.00	0.00	0.50
19.93	348.30	0.45	120.00	0.00	0.50
20.07	356.60	0.50	120.00	0.00	0.50
20.18	359.00	0.54	120.00	0.00	0.50
20.26	368.30	0.55	120.00	0.00	0.50
20.33	377.30	0.54	120.00	0.00	0.50
20.40	385.50	0.54	120.00	0.00	0.50
20.47	371.50	0.60	120.00	0.00	0.50
20.58	366.90	0.60	120.00	0.00	0.50
20.71	351.70	0.51	120.00	0.00	0.50
20.84	343.50	0.50	120.00	0.00	0.50
20.97	334.10	0.57	120.00	0.00	0.50
21.04	324.20	0.56	120.00	0.00	0.50
21.10	319.10	0.55	120.00	0.00	0.50
21.17	314.70	0.64	120.00	0.00	0.50
21.24	312.70	0.68	120.00	0.00	0.50
21.36	288.20	0.79	120.00	0.00	0.50
21.43	292.40	0.79	120.00	0.00	0.50
21.50	296.20	0.78	120.00	0.00	0.50
21.58	302.40	0.77	120.00	0.00	0.50
21.65	304.50	0.78	120.00	0.00	0.50
21.72	312.10	0.78	120.00	0.00	0.50
21.80	313.10	0.79	120.00	0.00	0.50
21.87	312.90	0.80	120.00	0.00	0.50
21.94	313.80	0.81	120.00	0.00	0.50

22.01	316.40	0.79	120.00	0.00	0.50
22.09	317.20	0.77	120.00	0.00	0.50
22.16	317.20	0.79	120.00	0.00	0.50
22.24	317.20	0.77	120.00	0.00	0.50
22.32	321.80	0.72	120.00	0.00	0.50
22.43	327.10	0.79	120.00	0.00	0.50
22.55	332.10	0.78	120.00	0.00	0.50
22.65	314.60	0.81	120.00	0.00	0.50
22.74	309.50	0.80	120.00	0.00	0.50
22.81	311.10	0.72	120.00	0.00	0.50
22.91	315.40	0.56	120.00	0.00	0.50
23.02	304.10	0.60	120.00	0.00	0.50
23.13	291.20	0.65	120.00	0.00	0.50
23.24	277.70	0.66	120.00	0.00	0.50
23.37	266.60	0.65	120.00	0.00	0.50
23.50	268.10	0.63	120.00	0.00	0.50
23.62	280.30	0.67	120.00	0.00	0.50
23.69	286.30	0.68	120.00	0.00	0.50
23.76	292.60	0.72	120.00	0.00	0.50
23.83	293.60	0.66	120.00	0.00	0.50
23.89	294.30	0.68	120.00	0.00	0.50
23.96	294.80	0.70	120.00	0.00	0.50
24.03	296.70	0.71	120.00	0.00	0.50
24.11	268.40	0.79	120.00	0.00	0.50
24.19	288.60	0.74	120.00	0.00	0.50
24.26	285.90	0.75	120.00	0.00	0.50
24.33	286.80	0.75	120.00	0.00	0.50
24.43	281.00	0.77	120.00	0.00	0.50
24.50	278.30	0.76	120.00	0.00	0.50
24.60	274.70	0.74	120.00	0.00	0.50
24.71	273.90	0.69	120.00	0.00	0.50
24.82	272.40	0.65	120.00	0.00	0.50
24.94	267.90	0.71	120.00	0.00	0.50
25.05	262.30	0.69	120.00	0.00	0.50
25.17	270.80	0.66	120.00	0.00	0.50
25.27	279.40	0.66	120.00	0.00	0.50
25.38	293.00	0.64	120.00	0.00	0.50
25.48	304.30	0.63	120.00	0.00	0.50
25.58	310.80	0.65	120.00	0.00	0.50
25.67	308.60	0.65	120.00	0.00	0.50
25.76	301.70	0.66	120.00	0.00	0.50
25.86	292.80	0.66	120.00	0.00	0.50
25.96	277.20	0.65	120.00	0.00	0.50
26.06	260.80	0.64	120.00	0.00	0.50
26.16	248.90	0.62	120.00	0.00	0.50
26.26	243.10	0.60	120.00	0.00	0.50
26.36	240.30	0.58	120.00	0.00	0.50
26.46	241.80	0.54	120.00	0.00	0.50
26.56	242.30	0.54	120.00	0.00	0.50
26.67	238.40	0.57	120.00	0.00	0.50
26.77	240.50	0.57	120.00	0.00	0.50
26.89	238.50	0.62	120.00	0.00	0.50
26.98	209.20	0.74	120.00	0.00	0.50
27.07	214.10	0.74	120.00	0.00	0.50
27.14	210.50	0.73	120.00	0.00	0.50
27.21	210.00	0.73	120.00	0.00	0.50
27.29	204.20	0.73	120.00	0.00	0.50
27.36	198.20	0.72	120.00	0.00	0.50
27.43	187.30	0.73	120.00	0.00	0.50
27.50	176.30	0.74	120.00	0.00	0.50
27.57	164.70	0.78	120.00	0.00	0.50
27.64	154.80	0.82	120.00	0.00	0.50
27.72	143.60	0.89	120.00	0.00	0.50
27.79	131.70	0.99	120.00	0.00	0.50
27.86	123.50	1.09	120.00	0.00	0.50
27.93	116.40	1.18	120.00	0.00	0.50
28.01	108.80	1.28	120.00	0.00	0.50
28.08	103.80	1.38	120.00	0.00	0.50
28.16	98.60	1.46	120.00	0.00	0.50
28.23	97.60	1.44	120.00	0.00	0.50
28.30	97.60	1.41	120.00	0.00	0.50
28.37	98.20	1.39	120.00	0.00	0.50
28.45	97.70	1.39	120.00	0.00	0.50
28.52	93.80	1.46	120.00	0.00	0.50
28.60	87.00	1.51	120.00	0.00	0.50
28.67	83.00	1.54	120.00	0.00	0.50
28.74	82.10	1.57	120.00	0.00	0.50
28.81	85.70	1.57	120.00	0.00	0.50
28.89	91.30	1.57	120.00	0.00	0.50
28.96	94.10	1.64	120.00	0.00	0.50
29.03	95.80	1.68	120.00	0.00	0.50
29.11	97.40	1.69	120.00	0.00	0.50
29.18	100.70	1.60	120.00	0.00	0.50
29.26	106.30	1.37	120.00	0.00	0.50
29.33	113.30	1.26	120.00	0.00	0.50
29.40	118.50	1.21	120.00	0.00	0.50
29.48	120.20	1.12	120.00	0.00	0.50
29.55	121.20	0.96	120.00	0.00	0.50
29.62	120.90	0.80	120.00	0.00	0.50
29.70	115.50	0.78	120.00	0.00	0.50
29.77	115.20	0.72	120.00	0.00	0.50
29.85	115.10	0.69	120.00	0.00	0.50
29.96	116.80	0.66	120.00	0.00	0.50
30.08	117.30	0.65	120.00	0.00	0.50
30.14	116.70	0.65	120.00	0.00	0.50
30.22	118.60	0.64	120.00	0.00	0.50
30.30	118.60	0.64	120.00	0.00	0.50
30.39	115.60	0.65	120.00	0.00	0.50
30.51	111.10	0.65	120.00	0.00	0.50
30.64	110.20	0.62	120.00	0.00	0.50
30.77	110.20	0.57	120.00	0.00	0.50
30.89	109.60	0.55	120.00	0.00	0.50
31.02	113.00	0.55	120.00	0.00	0.50
31.15	120.80	0.54	120.00	0.00	0.50
31.27	128.40	0.54	120.00	0.00	0.50
31.39	132.60	0.56	120.00	0.00	0.50
31.53	130.40	0.57	120.00	0.00	0.50
31.66	127.70	0.58	120.00	0.00	0.50
31.74	126.80	0.58	120.00	0.00	0.50
31.82	125.90	0.59	120.00	0.00	0.50
31.90	123.60	0.61	120.00	0.00	0.50
31.98	119.00	0.64	120.00	0.00	0.50
32.06	113.40	0.65	120.00	0.00	0.50
32.14	104.70	0.67	120.00	0.00	0.50
32.22	97.70	0.64	120.00	0.00	0.50
32.31	88.50	0.61	120.00	0.00	0.50
32.38	80.40	0.64	120.00	0.00	0.50
32.47	74.00	0.66	120.00	0.00	0.50
32.55	69.20	0.67	120.00	0.00	0.50
32.62	60.40	0.75	120.00	0.00	0.50

32.70	60.10	0.75	120.00	0.00	0.50
32.80	59.10	0.87	120.00	0.00	0.50
32.87	58.80	1.13	120.00	0.00	0.50
32.95	58.60	1.38	120.00	0.00	0.50
33.03	58.20	1.41	120.00	0.00	0.50
33.10	59.00	1.38	120.00	0.00	0.50
33.19	68.00	1.34	120.00	0.00	0.50
33.27	90.10	1.15	120.00	0.00	0.50
33.35	119.00	0.93	120.00	0.00	0.50
33.42	136.90	0.84	120.00	0.00	0.50
33.51	149.20	0.73	120.00	0.00	0.50
33.59	162.10	0.58	120.00	0.00	0.50
33.67	169.50	0.54	120.00	0.00	0.50
33.75	177.50	0.57	120.00	0.00	0.50
33.83	180.50	0.61	120.00	0.00	0.50
33.90	177.90	0.65	120.00	0.00	0.50
33.97	171.20	0.69	120.00	0.00	0.50
34.08	179.40	0.67	120.00	0.00	0.50
34.20	180.20	0.68	120.00	0.00	0.50
34.32	173.80	0.74	120.00	0.00	0.50
34.44	173.90	0.74	120.00	0.00	0.50
34.56	178.30	0.70	120.00	0.00	0.50
34.68	183.90	0.64	120.00	0.00	0.50
34.80	193.50	0.60	120.00	0.00	0.50
34.91	196.90	0.58	120.00	0.00	0.50
35.03	184.80	0.62	120.00	0.00	0.50
35.15	178.30	0.66	120.00	0.00	0.50
35.27	169.90	0.72	120.00	0.00	0.50
35.39	164.60	0.75	120.00	0.00	0.50
35.51	163.20	0.75	120.00	0.00	0.50
35.64	165.90	0.75	120.00	0.00	0.50
35.77	169.30	0.76	120.00	0.00	0.50
35.88	171.40	0.81	120.00	0.00	0.50
36.00	172.80	0.84	120.00	0.00	0.50
36.12	175.80	0.86	120.00	0.00	0.50
36.23	180.60	0.84	120.00	0.00	0.50
36.35	184.70	0.82	120.00	0.00	0.50
36.47	190.90	0.80	120.00	0.00	0.50
36.59	198.10	0.79	120.00	0.00	0.50
36.67	179.60	0.88	120.00	0.00	0.50
36.75	199.00	0.81	120.00	0.00	0.50
36.85	208.90	0.81	120.00	0.00	0.50
36.95	215.30	0.81	120.00	0.00	0.50
37.04	218.60	0.81	120.00	0.00	0.50
37.14	217.90	0.81	120.00	0.00	0.50
37.23	218.00	0.80	120.00	0.00	0.50
37.33	218.50	0.78	120.00	0.00	0.50
37.42	215.60	0.77	120.00	0.00	0.50
37.52	214.20	0.74	120.00	0.00	0.50
37.61	213.70	0.72	120.00	0.00	0.50
37.71	213.10	0.73	120.00	0.00	0.50
37.81	207.20	0.77	120.00	0.00	0.50
37.90	198.70	0.82	120.00	0.00	0.50
38.02	192.40	0.86	120.00	0.00	0.50
38.09	190.60	0.87	120.00	0.00	0.50
38.17	187.60	0.87	120.00	0.00	0.50
38.24	183.00	0.85	120.00	0.00	0.50
38.31	172.90	0.84	120.00	0.00	0.50
38.44	142.50	0.90	120.00	0.00	0.50
38.50	123.60	0.99	120.00	0.00	0.50
38.57	106.90	1.11	120.00	0.00	0.50
38.64	92.70	1.28	120.00	0.00	0.50
38.70	84.30	1.47	120.00	0.00	0.50
38.77	80.60	1.70	120.00	0.00	0.50
38.84	75.40	2.04	120.00	0.00	0.50
38.90	67.70	2.40	120.00	0.00	0.50
38.97	60.70	2.81	120.00	0.00	0.50
39.04	56.00	3.08	120.00	0.00	0.50
39.11	53.60	3.08	120.00	0.00	0.50
39.17	52.40	2.87	120.00	0.00	0.50
39.31	63.20	2.24	120.00	0.00	0.50
39.37	72.70	1.81	120.00	0.00	0.50
39.44	93.40	1.03	120.00	0.00	0.50
39.51	120.00	0.79	120.00	0.00	0.50
39.58	145.50	0.61	120.00	0.00	0.50
39.70	184.00	0.53	120.00	0.00	0.50
39.78	184.40	0.60	120.00	0.00	0.50
39.85	199.60	0.60	120.00	0.00	0.50
39.92	205.50	0.62	120.00	0.00	0.50
40.03	210.30	0.68	120.00	0.00	0.50
40.09	210.80	0.69	120.00	0.00	0.50
40.17	204.50	0.69	120.00	0.00	0.50
40.25	194.70	0.70	120.00	0.00	0.50
40.33	186.00	0.71	120.00	0.00	0.50
40.41	183.80	0.72	120.00	0.00	0.50
40.48	184.80	0.70	120.00	0.00	0.50
40.56	198.70	0.60	120.00	0.00	0.50
40.64	215.80	0.50	120.00	0.00	0.50
40.71	220.20	0.45	120.00	0.00	0.50
40.79	217.80	0.44	120.00	0.00	0.50
40.87	211.50	0.47	120.00	0.00	0.50
40.95	203.10	0.58	120.00	0.00	0.50
41.02	192.30	0.83	120.00	0.00	0.50
41.09	176.90	1.11	120.00	0.00	0.50
41.17	148.60	1.50	120.00	0.00	0.50
41.25	124.30	1.88	120.00	0.00	0.50
41.32	108.30	2.12	120.00	0.00	0.50
41.39	109.60	1.96	120.00	0.00	0.50
41.47	108.90	1.84	120.00	0.00	0.50
41.54	107.70	1.81	120.00	0.00	0.50
41.61	109.90	1.71	120.00	0.00	0.50
41.69	111.40	1.55	120.00	0.00	0.50
41.76	112.20	1.37	120.00	0.00	0.50
41.84	113.70	1.24	120.00	0.00	0.50
41.91	114.70	1.20	120.00	0.00	0.50
41.98	117.70	1.26	120.00	0.00	0.50
42.05	122.40	1.26	120.00	0.00	0.50
42.13	129.70	1.20	120.00	0.00	0.50
42.20	132.80	1.13	120.00	0.00	0.50
42.27	134.10	1.05	120.00	0.00	0.50
42.35	138.50	0.91	120.00	0.00	0.50
42.42	142.00	0.77	120.00	0.00	0.50
42.50	146.90	0.51	120.00	0.00	0.50
42.57	150.40	0.37	120.00	0.00	0.50
42.64	153.70	0.41	120.00	0.00	0.50
42.71	155.80	0.47	120.00	0.00	0.50
42.79	156.60	0.55	120.00	0.00	0.50
42.88	149.20	0.63	120.00	0.00	0.50
42.96	158.00	0.61	120.00	0.00	0.50
43.05	163.90	0.60	120.00	0.00	0.50

43.13	170.30	0.58	120.00	0.00	0.50
43.21	175.50	0.58	120.00	0.00	0.50
43.29	177.80	0.59	120.00	0.00	0.50
43.37	183.60	0.59	120.00	0.00	0.50
43.46	185.50	0.62	120.00	0.00	0.50
43.55	188.90	0.62	120.00	0.00	0.50
43.63	191.10	0.61	120.00	0.00	0.50
43.72	191.50	0.59	120.00	0.00	0.50
43.80	195.40	0.58	120.00	0.00	0.50
43.90	204.10	0.55	120.00	0.00	0.50
44.02	211.80	0.55	120.00	0.00	0.50
44.13	217.10	0.57	120.00	0.00	0.50
44.24	218.60	0.60	120.00	0.00	0.50
44.31	219.90	0.60	120.00	0.00	0.50
44.39	219.30	0.60	120.00	0.00	0.50
44.46	216.30	0.60	120.00	0.00	0.50
44.54	209.90	0.61	120.00	0.00	0.50
44.60	199.20	0.62	120.00	0.00	0.50
44.67	189.30	0.62	120.00	0.00	0.50
44.80	166.30	0.59	120.00	0.00	0.50
44.87	152.00	0.59	120.00	0.00	0.50
44.95	133.50	0.63	120.00	0.00	0.50
45.02	116.20	0.72	120.00	0.00	0.50
45.10	97.70	0.95	120.00	0.00	0.50
45.18	75.80	1.40	120.00	0.00	0.50
45.26	59.40	1.77	120.00	0.00	0.50
45.34	49.10	1.99	120.00	0.00	0.50
45.42	42.10	2.12	120.00	0.00	0.50
45.49	35.00	2.31	120.00	0.00	0.50
45.57	32.40	2.77	120.00	0.00	0.50
45.65	31.10	3.40	120.00	0.00	0.50
45.73	29.00	3.86	120.00	0.00	0.50
45.81	26.20	4.50	120.00	0.00	0.50
45.88	26.70	4.66	120.00	0.00	0.50
45.95	38.40	3.39	120.00	0.00	0.50
46.02	42.90	3.19	120.00	0.00	0.50
46.10	47.40	2.90	120.00	0.00	0.50
46.23	44.60	2.89	120.00	0.00	0.50
46.30	43.70	2.91	120.00	0.00	0.50
46.37	45.40	2.84	120.00	0.00	0.50
46.44	50.90	2.57	120.00	0.00	0.50
46.52	59.50	2.18	120.00	0.00	0.50
46.60	66.90	1.89	120.00	0.00	0.50
46.67	72.20	1.72	120.00	0.00	0.50
46.75	78.60	1.60	120.00	0.00	0.50
46.82	85.00	1.56	120.00	0.00	0.50
46.89	89.50	1.57	120.00	0.00	0.50
46.97	93.40	1.60	120.00	0.00	0.50
47.05	98.60	1.58	120.00	0.00	0.50
47.12	104.70	1.53	120.00	0.00	0.50
47.20	111.50	1.44	120.00	0.00	0.50
47.27	120.60	1.29	120.00	0.00	0.50
47.35	131.00	1.10	120.00	0.00	0.50
47.42	142.70	0.90	120.00	0.00	0.50
47.50	151.20	0.76	120.00	0.00	0.50
47.57	156.40	0.66	120.00	0.00	0.50
47.65	155.60	0.63	120.00	0.00	0.50
47.72	150.80	0.67	120.00	0.00	0.50
47.79	143.10	0.75	120.00	0.00	0.50
47.87	135.50	0.86	120.00	0.00	0.50
47.94	127.80	1.04	120.00	0.00	0.50
48.02	125.10	1.23	120.00	0.00	0.50
48.09	123.30	1.37	120.00	0.00	0.50
48.16	121.20	1.49	120.00	0.00	0.50
48.23	121.40	1.56	120.00	0.00	0.50
48.31	126.20	1.45	120.00	0.00	0.50
48.38	131.00	1.26	120.00	0.00	0.50
48.45	132.80	1.14	120.00	0.00	0.50
48.52	128.90	1.06	120.00	0.00	0.50
48.59	124.50	1.01	120.00	0.00	0.50
48.67	115.90	1.30	120.00	0.00	0.50
48.74	102.40	1.47	120.00	0.00	0.50
48.81	86.90	1.88	120.00	0.00	0.50
48.88	69.30	2.52	120.00	0.00	0.50
48.95	54.00	3.16	120.00	0.00	0.50
49.02	36.20	4.34	120.00	0.00	0.50
49.11	48.80	3.15	120.00	0.00	0.50
49.20	55.30	2.87	120.00	0.00	0.50
49.29	64.10	2.52	120.00	0.00	0.50
49.38	74.60	2.12	120.00	0.00	0.50
49.48	88.60	1.76	120.00	0.00	0.50
49.59	113.30	1.53	120.00	0.00	0.50
49.69	149.70	1.43	120.00	0.00	0.50
49.80	191.40	1.29	120.00	0.00	0.50
49.90	228.70	1.12	120.00	0.00	0.50
50.00	256.60	0.96	120.00	0.00	0.50
50.11	276.30	0.88	120.00	0.00	0.50
50.22	292.50	0.93	120.00	0.00	0.50
50.32	305.60	1.00	120.00	0.00	0.50
50.44	310.70	1.07	120.00	0.00	0.50
50.51	309.10	1.10	120.00	0.00	0.50
50.64	298.10	1.11	120.00	0.00	0.50
50.76	287.40	1.04	120.00	0.00	0.50
50.90	281.10	0.94	120.00	0.00	0.50
50.97	277.60	0.90	120.00	0.00	0.50
51.05	274.30	0.87	120.00	0.00	0.50
51.12	270.80	0.85	120.00	0.00	0.50
51.20	267.70	0.87	120.00	0.00	0.50
51.27	261.70	0.89	120.00	0.00	0.50
51.35	257.00	0.88	120.00	0.00	0.50
51.42	255.20	0.86	120.00	0.00	0.50
51.49	254.90	0.84	120.00	0.00	0.50
51.57	255.90	0.82	120.00	0.00	0.50
51.65	256.60	0.79	120.00	0.00	0.50
51.72	254.20	0.76	120.00	0.00	0.50
51.80	257.40	0.63	120.00	0.00	0.50
51.88	258.80	0.62	120.00	0.00	0.50
51.96	259.60	0.67	120.00	0.00	0.50
52.03	259.10	0.72	120.00	0.00	0.50
52.10	253.30	0.78	120.00	0.00	0.50
52.17	249.80	0.82	120.00	0.00	0.50
52.25	246.30	0.87	120.00	0.00	0.50
52.35	251.00	0.89	120.00	0.00	0.50
52.47	260.80	0.90	120.00	0.00	0.50
52.54	265.20	0.89	120.00	0.00	0.50
52.61	267.60	0.91	120.00	0.00	0.50
52.67	271.60	0.93	120.00	0.00	0.50
52.74	272.30	0.94	120.00	0.00	0.50
52.82	276.00	0.95	120.00	0.00	0.50
52.89	277.90	0.93	120.00	0.00	0.50

52.96	282.30	0.90	120.00	0.00	0.50
53.04	287.80	0.87	120.00	0.00	0.50
53.11	292.80	0.83	120.00	0.00	0.50
53.18	295.70	0.77	120.00	0.00	0.50
53.25	299.20	0.72	120.00	0.00	0.50
53.32	297.70	0.68	120.00	0.00	0.50
53.39	296.60	0.65	120.00	0.00	0.50
53.45	293.40	0.63	120.00	0.00	0.50
53.52	290.00	0.60	120.00	0.00	0.50
53.59	286.80	0.57	120.00	0.00	0.50
53.66	281.00	0.55	120.00	0.00	0.50
53.73	273.00	0.51	120.00	0.00	0.50
53.79	260.20	0.47	120.00	0.00	0.50
53.86	243.50	0.48	120.00	0.00	0.50
53.93	216.50	0.63	120.00	0.00	0.50
54.00	186.50	1.00	120.00	0.00	0.50
54.08	150.90	1.54	120.00	0.00	0.50
54.15	116.10	2.22	120.00	0.00	0.50
54.22	86.10	2.96	120.00	0.00	0.50
54.29	65.70	3.41	120.00	0.00	0.50
54.37	53.70	3.37	120.00	0.00	0.50
54.44	53.70	2.63	120.00	0.00	0.50
54.51	48.90	2.25	120.00	0.00	0.50
54.58	46.40	1.93	120.00	0.00	0.50
54.66	43.40	1.72	120.00	0.00	0.50
54.73	39.50	1.66	120.00	0.00	0.50
54.80	37.10	1.32	120.00	0.00	0.50
54.88	36.20	1.41	120.00	0.00	0.50
54.95	38.70	1.86	120.00	0.00	0.50
55.02	38.40	2.20	120.00	0.00	0.50
55.09	33.60	2.66	120.00	0.00	0.50
55.16	29.50	3.09	120.00	0.00	0.50
55.23	26.30	3.53	120.00	0.00	0.50
55.30	24.60	3.83	120.00	0.00	0.50
55.39	25.40	3.88	120.00	0.00	0.50
55.53	26.90	3.55	120.00	0.00	0.50
55.60	27.80	3.68	120.00	0.00	0.50
55.68	29.00	3.77	120.00	0.00	0.50
55.75	29.20	3.67	120.00	0.00	0.50
55.84	28.90	3.62	120.00	0.00	0.50
55.92	29.30	3.69	120.00	0.00	0.50
56.00	28.90	3.89	120.00	0.00	0.50
56.07	28.50	4.12	120.00	0.00	0.50
56.15	29.00	4.37	120.00	0.00	0.50
56.23	28.70	4.72	120.00	0.00	0.50
56.31	29.50	4.89	120.00	0.00	0.50
56.39	30.80	4.96	120.00	0.00	0.50
56.47	31.80	4.97	120.00	0.00	0.50
56.55	34.80	4.62	120.00	0.00	0.50
56.63	37.30	4.48	120.00	0.00	0.50
56.71	39.70	4.42	120.00	0.00	0.50
56.79	42.10	4.34	120.00	0.00	0.50
56.87	42.40	4.42	120.00	0.00	0.50
56.95	42.50	4.50	120.00	0.00	0.50
57.03	40.10	4.89	120.00	0.00	0.50
57.11	38.70	5.27	120.00	0.00	0.50
57.19	38.50	5.40	120.00	0.00	0.50
57.27	38.50	5.35	120.00	0.00	0.50
57.35	38.40	5.28	120.00	0.00	0.50
57.43	36.50	5.59	120.00	0.00	0.50
57.51	35.10	5.93	120.00	0.00	0.50
57.59	33.80	6.06	120.00	0.00	0.50
57.67	33.30	5.84	120.00	0.00	0.50
57.75	32.80	5.73	120.00	0.00	0.50
57.83	32.30	5.73	120.00	0.00	0.50
57.91	30.60	5.62	120.00	0.00	0.50
57.99	29.50	5.05	120.00	0.00	0.50
58.07	28.80	5.03	120.00	0.00	0.50
58.15	28.30	5.17	120.00	0.00	0.50
58.23	27.10	5.56	120.00	0.00	0.50
58.32	24.80	6.11	120.00	0.00	0.50
58.39	24.20	6.15	120.00	0.00	0.50
58.46	23.20	6.27	120.00	0.00	0.50
58.55	22.80	6.08	120.00	0.00	0.50
58.66	21.50	5.96	120.00	0.00	0.50
58.78	20.10	5.77	120.00	0.00	0.50
58.91	19.30	5.54	120.00	0.00	0.50
58.97	18.70	5.45	120.00	0.00	0.50
59.11	17.50	5.36	120.00	0.00	0.50
59.17	16.60	5.38	120.00	0.00	0.50
59.24	16.20	5.26	120.00	0.00	0.50
59.38	15.90	4.76	120.00	0.00	0.50
59.51	15.00	4.52	120.00	0.00	0.50
59.58	15.00	4.30	120.00	0.00	0.50
59.65	15.30	3.99	120.00	0.00	0.50
59.72	16.10	3.70	120.00	0.00	0.50
59.80	16.80	3.64	120.00	0.00	0.50
59.87	17.40	3.81	120.00	0.00	0.50
59.95	18.50	3.87	120.00	0.00	0.50
60.02	19.80	3.87	120.00	0.00	0.50
60.10	20.30	4.04	120.00	0.00	0.50
60.17	19.70	4.48	120.00	0.00	0.50
60.25	19.80	4.84	120.00	0.00	0.50
60.32	20.50	5.01	120.00	0.00	0.50
60.40	21.40	5.10	120.00	0.00	0.50
60.47	22.00	5.22	120.00	0.00	0.50
60.55	21.90	5.59	120.00	0.00	0.50
60.62	23.70	5.50	120.00	0.00	0.50
60.70	26.20	5.30	120.00	0.00	0.50
60.78	29.50	4.95	120.00	0.00	0.50
60.85	34.40	4.16	120.00	0.00	0.50
60.93	41.30	3.05	120.00	0.00	0.50
61.00	38.40	2.43	120.00	0.00	0.50
61.08	34.50	2.06	120.00	0.00	0.50
61.15	29.70	1.96	120.00	0.00	0.50
61.21	23.70	2.14	120.00	0.00	0.50
61.28	19.60	2.38	120.00	0.00	0.50
61.36	14.50	3.04	120.00	0.00	0.50
61.44	15.40	2.89	120.00	0.00	0.50
61.52	15.60	2.92	120.00	0.00	0.50
61.60	15.90	3.01	120.00	0.00	0.50
61.70	16.40	3.07	120.00	0.00	0.50
61.82	16.50	3.17	120.00	0.00	0.50
61.95	16.80	3.54	120.00	0.00	0.50
62.02	16.80	3.92	120.00	0.00	0.50
62.09	17.30	4.18	120.00	0.00	0.50
62.22	18.70	3.84	120.00	0.00	0.50
62.34	17.90	3.85	120.00	0.00	0.50
62.41	16.40	4.03	120.00	0.00	0.50
62.48	16.50	3.73	120.00	0.00	0.50

62.61	16.50	3.70	120.00	0.00	0.50
62.74	22.90	5.72	120.00	0.00	0.50
62.87	30.20	5.07	120.00	0.00	0.50
63.00	151.90	1.79	120.00	0.00	0.50
63.13	282.70	1.10	120.00	0.00	0.50
63.25	260.00	1.39	120.00	0.00	0.50
63.36	277.60	1.19	120.00	0.00	0.50
63.44	260.10	1.22	120.00	0.00	0.50
63.53	265.40	1.15	120.00	0.00	0.50
63.60	270.40	1.11	120.00	0.00	0.50
63.68	279.80	1.05	120.00	0.00	0.50
63.76	291.60	1.06	120.00	0.00	0.50
63.84	313.70	1.03	120.00	0.00	0.50
63.93	361.70	1.12	120.00	0.00	0.50
64.01	445.50	1.00	120.00	0.00	0.50
64.11	550.90	1.04	120.00	0.00	0.50
64.17	601.70	1.20	120.00	0.00	0.50
64.27	710.10	1.11	120.00	0.00	0.50
64.34	723.60	1.11	120.00	0.00	0.50
64.42	715.30	1.07	120.00	0.00	0.50
64.49	766.50	0.85	120.00	0.00	0.50
64.58	774.60	0.67	120.00	0.00	0.50
64.65	682.60	0.61	120.00	0.00	0.50
64.73	620.70	0.57	120.00	0.00	0.50
64.81	579.60	0.66	120.00	0.00	0.50
64.88	581.80	0.59	120.00	0.00	0.50
64.97	573.10	0.46	120.00	0.00	0.50
65.04	502.10	0.91	120.00	0.00	0.50
65.11	569.60	1.01	120.00	0.00	0.50
65.18	570.50	1.05	120.00	0.00	0.50
65.25	617.40	0.97	120.00	0.00	0.50
65.32	538.00	1.00	120.00	0.00	0.50
65.41	496.50	0.85	120.00	0.00	0.50
65.49	506.60	0.79	120.00	0.00	0.50
65.56	478.00	0.69	120.00	0.00	0.50
65.63	465.90	0.61	120.00	0.00	0.50
65.69	445.80	0.72	120.00	0.00	0.50
65.76	448.00	0.75	120.00	0.00	0.50
65.83	431.30	1.05	120.00	0.00	0.50
65.89	423.00	1.15	120.00	0.00	0.50
65.96	450.40	1.02	120.00	0.00	0.50
66.03	453.00	0.85	120.00	0.00	0.50
66.09	459.70	0.88	120.00	0.00	0.50
66.19	480.70	0.85	120.00	0.00	0.50
66.28	538.60	0.71	120.00	0.00	0.50
66.36	548.60	0.67	120.00	0.00	0.50
66.45	569.50	0.71	120.00	0.00	0.50
66.52	555.20	0.77	120.00	0.00	0.50
66.60	544.30	0.76	120.00	0.00	0.50
66.68	495.80	0.79	120.00	0.00	0.50
66.75	495.10	0.71	120.00	0.00	0.50
66.83	482.50	0.61	120.00	0.00	0.50
66.93	462.30	0.65	120.00	0.00	0.50
67.02	461.50	0.61	120.00	0.00	0.50
67.12	479.10	0.41	120.00	0.00	0.50
67.21	521.30	0.39	120.00	0.00	0.50
67.30	569.10	0.50	120.00	0.00	0.50
67.39	545.20	0.57	120.00	0.00	0.50
67.46	491.10	0.53	120.00	0.00	0.50
67.54	475.90	0.56	120.00	0.00	0.50
67.62	471.60	0.81	120.00	0.00	0.50
67.70	414.60	0.99	120.00	0.00	0.50
67.77	401.50	0.00	120.00	0.00	0.50
67.84	401.00	0.00	120.00	0.00	0.50
67.91	412.50	0.00	120.00	0.00	0.50
67.99	396.40	0.00	120.00	0.00	0.50
68.06	370.80	0.00	120.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=1.45 in.
Settlement of Unsaturated Sands=0.27 in.
Total Settlement of Saturated and Unsaturated Sands=1.71 in.
Differential Settlement=0.856 to 1.130 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.34	5.00	1.45	0.27	1.71
5.00	0.48	0.34	5.00	1.45	0.26	1.70
10.00	0.56	0.34	5.00	1.45	0.23	1.67
15.00	0.36	0.33	5.00	1.45	0.14	1.59
20.00	2.88	0.33	5.00	1.45	0.09	1.54
25.00	1.46	0.32	5.00	1.45	0.07	1.52
30.00	0.22	0.32	5.00	1.45	0.00	1.45
35.00	0.41	0.33	1.25	0.90	0.00	0.90
40.00	0.38	0.33	1.14	0.70	0.00	0.70
45.00	0.18	0.34	0.54*	0.28	0.00	0.28
50.00	0.39	0.33	1.17	0.01	0.00	0.01
55.00	2.00	0.33	5.00	0.00	0.00	0.00
60.00	2.00	0.32	5.00	0.00	0.00	0.00
65.00	2.48	0.31	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

****

LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\CPT-09-105.liq
Title: SR-57 Northbound Widening/RW No 275

Subtitle: 602231-002
Surface Elev.=175
Hole No.=CPT-09-108
Depth of Hole= 70.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:
Surface Elev.=175
Hole No.=CPT-09-108
Depth of Hole=70.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60
1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	qc atm	fs atm	gamma pcf	Fines %	D50 mm
0.00	58.40	0.00	120.00	0.00	0.50
0.13	116.80	0.00	120.00	0.00	0.50
0.20	175.30	0.00	120.00	0.00	0.50
0.26	289.80	0.00	120.00	0.00	0.50
0.33	390.80	7.61	120.00	0.00	0.50
0.39	424.30	7.80	120.00	0.00	0.50
0.46	405.50	7.60	120.00	0.00	0.50
0.52	367.80	7.06	120.00	0.00	0.50
0.59	334.80	6.16	120.00	0.00	0.50
0.66	308.40	5.13	120.00	0.00	0.50
0.72	289.50	4.23	120.00	0.00	0.50
0.79	278.40	3.66	120.00	0.00	0.50
0.85	273.70	3.42	120.00	0.00	0.50
0.92	269.30	3.36	120.00	0.00	0.50
0.98	260.20	3.42	120.00	0.00	0.50
1.05	250.00	3.52	120.00	0.00	0.50
1.12	237.20	3.47	120.00	0.00	0.50
1.18	225.70	3.34	120.00	0.00	0.50
1.25	208.50	3.17	120.00	0.00	0.50
1.31	187.40	2.65	120.00	0.00	0.50
1.38	169.20	2.48	120.00	0.00	0.50
1.44	151.80	2.31	120.00	0.00	0.50
1.51	133.40	2.18	120.00	0.00	0.50
1.57	121.40	2.08	120.00	0.00	0.50
1.64	103.70	1.99	120.00	0.00	0.50
1.71	93.20	1.89	120.00	0.00	0.50
1.77	86.30	1.84	120.00	0.00	0.50
1.84	78.90	1.82	120.00	0.00	0.50
1.90	72.30	1.82	120.00	0.00	0.50
1.97	66.70	1.73	120.00	0.00	0.50
2.03	60.90	1.67	120.00	0.00	0.50
2.10	55.90	1.54	120.00	0.00	0.50
2.16	51.70	1.44	120.00	0.00	0.50
2.23	48.90	1.38	120.00	0.00	0.50
2.30	45.40	1.26	120.00	0.00	0.50
2.36	43.00	1.20	120.00	0.00	0.50
2.43	40.10	1.10	120.00	0.00	0.50
2.49	37.70	1.03	120.00	0.00	0.50
2.56	37.20	0.89	120.00	0.00	0.50
2.62	36.70	0.81	120.00	0.00	0.50
2.69	36.60	0.83	120.00	0.00	0.50
2.76	35.80	0.84	120.00	0.00	0.50
2.82	34.20	0.85	120.00	0.00	0.50
2.89	33.60	0.88	120.00	0.00	0.50
2.95	32.70	0.88	120.00	0.00	0.50
3.02	32.60	0.90	120.00	0.00	0.50
3.08	31.40	0.89	120.00	0.00	0.50
3.15	29.80	0.89	120.00	0.00	0.50
3.21	28.40	0.89	120.00	0.00	0.50
3.28	26.90	0.86	120.00	0.00	0.50
3.35	25.50	0.81	120.00	0.00	0.50
3.41	24.00	0.78	120.00	0.00	0.50
3.48	22.80	0.72	120.00	0.00	0.50
3.54	23.10	0.69	120.00	0.00	0.50
3.61	24.40	0.64	120.00	0.00	0.50
3.67	24.50	0.60	120.00	0.00	0.50
3.74	26.80	0.54	120.00	0.00	0.50
3.81	26.60	0.49	120.00	0.00	0.50
3.87	27.60	0.47	120.00	0.00	0.50
3.94	27.60	0.42	120.00	0.00	0.50
4.00	28.50	0.35	120.00	0.00	0.50
4.07	28.70	0.30	120.00	0.00	0.50
4.13	28.50	0.28	120.00	0.00	0.50
4.20	30.00	0.26	120.00	0.00	0.50
4.26	30.00	0.25	120.00	0.00	0.50
4.33	29.60	0.24	120.00	0.00	0.50
4.40	29.20	0.23	120.00	0.00	0.50
4.46	29.30	0.23	120.00	0.00	0.50
4.53	29.40	0.23	120.00	0.00	0.50
4.59	29.40	0.22	120.00	0.00	0.50
4.66	29.90	0.22	120.00	0.00	0.50
4.72	30.00	0.21	120.00	0.00	0.50
4.79	30.90	0.22	120.00	0.00	0.50
4.86	31.10	0.22	120.00	0.00	0.50
4.92	29.80	0.24	120.00	0.00	0.50
4.99	28.50	0.24	120.00	0.00	0.50
5.05	26.80	0.25	120.00	0.00	0.50
5.12	27.20	0.27	120.00	0.00	0.50
5.18	26.30	0.29	120.00	0.00	0.50
5.25	26.60	0.30	120.00	0.00	0.50
5.31	26.40	0.33	120.00	0.00	0.50
5.38	26.90	0.35	120.00	0.00	0.50
5.45	29.10	0.39	120.00	0.00	0.50
5.51	31.60	0.42	120.00	0.00	0.50
5.58	33.70	0.44	120.00	0.00	0.50
5.64	35.30	0.45	120.00	0.00	0.50
5.71	36.50	0.44	120.00	0.00	0.50
5.77	38.60	0.43	120.00	0.00	0.50

5.84	41.30	0.42	120.00	0.00	0.50
5.91	43.10	0.39	120.00	0.00	0.50
5.97	43.40	0.33	120.00	0.00	0.50
6.04	41.80	0.31	120.00	0.00	0.50
6.10	39.20	0.29	120.00	0.00	0.50
6.17	35.90	0.27	120.00	0.00	0.50
6.23	31.50	0.26	120.00	0.00	0.50
6.30	26.70	0.24	120.00	0.00	0.50
6.36	23.40	0.23	120.00	0.00	0.50
6.43	20.60	0.23	120.00	0.00	0.50
6.50	18.40	0.24	120.00	0.00	0.50
6.56	17.50	0.26	120.00	0.00	0.50
6.63	17.10	0.30	120.00	0.00	0.50
6.69	16.80	0.35	120.00	0.00	0.50
6.76	17.10	0.39	120.00	0.00	0.50
6.82	17.80	0.41	120.00	0.00	0.50
6.89	18.00	0.44	120.00	0.00	0.50
6.95	18.00	0.45	120.00	0.00	0.50
7.02	18.30	0.44	120.00	0.00	0.50
7.09	18.80	0.43	120.00	0.00	0.50
7.15	19.00	0.43	120.00	0.00	0.50
7.22	19.90	0.40	120.00	0.00	0.50
7.28	20.90	0.39	120.00	0.00	0.50
7.35	22.10	0.41	120.00	0.00	0.50
7.41	23.50	0.43	120.00	0.00	0.50
7.48	25.70	0.46	120.00	0.00	0.50
7.55	27.50	0.49	120.00	0.00	0.50
7.61	29.60	0.50	120.00	0.00	0.50
7.68	32.50	0.51	120.00	0.00	0.50
7.74	35.50	0.52	120.00	0.00	0.50
7.81	38.80	0.51	120.00	0.00	0.50
7.87	42.70	0.51	120.00	0.00	0.50
7.94	46.30	0.52	120.00	0.00	0.50
8.01	49.80	0.53	120.00	0.00	0.50
8.07	53.80	0.52	120.00	0.00	0.50
8.14	56.50	0.54	120.00	0.00	0.50
8.20	60.30	0.56	120.00	0.00	0.50
8.27	64.30	0.58	120.00	0.00	0.50
8.33	68.50	0.60	120.00	0.00	0.50
8.40	73.50	0.62	120.00	0.00	0.50
8.46	78.50	0.65	120.00	0.00	0.50
8.53	82.80	0.66	120.00	0.00	0.50
8.60	86.20	0.69	120.00	0.00	0.50
8.66	87.70	0.69	120.00	0.00	0.50
8.73	89.20	0.69	120.00	0.00	0.50
8.79	90.50	0.71	120.00	0.00	0.50
8.86	91.00	0.71	120.00	0.00	0.50
8.92	92.30	0.72	120.00	0.00	0.50
8.99	93.40	0.73	120.00	0.00	0.50
9.06	92.80	0.76	120.00	0.00	0.50
9.12	92.20	0.69	120.00	0.00	0.50
9.19	90.90	0.71	120.00	0.00	0.50
9.25	89.10	0.73	120.00	0.00	0.50
9.32	87.30	0.73	120.00	0.00	0.50
9.38	83.00	0.73	120.00	0.00	0.50
9.45	84.70	0.72	120.00	0.00	0.50
9.51	86.20	0.71	120.00	0.00	0.50
9.58	86.80	0.69	120.00	0.00	0.50
9.65	87.30	0.67	120.00	0.00	0.50
9.71	87.60	0.66	120.00	0.00	0.50
9.78	89.60	0.66	120.00	0.00	0.50
9.84	90.30	0.67	120.00	0.00	0.50
9.91	91.90	0.68	120.00	0.00	0.50
9.97	93.70	0.70	120.00	0.00	0.50
10.03	95.00	0.72	120.00	0.00	0.50
10.10	96.40	0.74	120.00	0.00	0.50
10.17	97.80	0.75	120.00	0.00	0.50
10.23	99.10	0.76	120.00	0.00	0.50
10.30	100.20	0.75	120.00	0.00	0.50
10.36	100.50	0.75	120.00	0.00	0.50
10.43	99.00	0.76	120.00	0.00	0.50
10.49	95.60	0.74	120.00	0.00	0.50
10.56	92.20	0.72	120.00	0.00	0.50
10.62	90.10	0.70	120.00	0.00	0.50
10.69	88.60	0.68	120.00	0.00	0.50
10.76	88.30	0.67	120.00	0.00	0.50
10.82	89.00	0.66	120.00	0.00	0.50
10.89	90.70	0.65	120.00	0.00	0.50
10.95	93.90	0.63	120.00	0.00	0.50
11.02	95.20	0.61	120.00	0.00	0.50
11.08	98.00	0.60	120.00	0.00	0.50
11.15	100.30	0.63	120.00	0.00	0.50
11.22	102.40	0.63	120.00	0.00	0.50
11.28	104.40	0.61	120.00	0.00	0.50
11.35	104.60	0.70	120.00	0.00	0.50
11.41	102.50	0.93	120.00	0.00	0.50
11.48	101.30	1.10	120.00	0.00	0.50
11.54	100.90	1.10	120.00	0.00	0.50
11.61	104.20	1.09	120.00	0.00	0.50
11.67	101.30	1.07	120.00	0.00	0.50
11.74	88.40	0.99	120.00	0.00	0.50
11.81	88.70	0.93	120.00	0.00	0.50
11.87	92.30	0.90	120.00	0.00	0.50
11.94	94.50	0.83	120.00	0.00	0.50
12.00	94.60	0.63	120.00	0.00	0.50
12.07	98.00	0.64	120.00	0.00	0.50
12.13	101.30	0.67	120.00	0.00	0.50
12.20	103.60	0.66	120.00	0.00	0.50
12.27	106.00	0.64	120.00	0.00	0.50
12.33	106.50	0.69	120.00	0.00	0.50
12.40	108.60	0.71	120.00	0.00	0.50
12.46	111.70	0.74	120.00	0.00	0.50
12.53	115.00	0.78	120.00	0.00	0.50
12.59	117.60	0.82	120.00	0.00	0.50
12.66	126.70	0.87	120.00	0.00	0.50
12.72	133.20	0.93	120.00	0.00	0.50
12.79	140.30	1.01	120.00	0.00	0.50
12.86	146.70	1.07	120.00	0.00	0.50
12.92	151.00	1.13	120.00	0.00	0.50
12.99	154.30	1.20	120.00	0.00	0.50
13.05	158.20	1.25	120.00	0.00	0.50
13.12	160.40	1.30	120.00	0.00	0.50
13.18	162.20	1.33	120.00	0.00	0.50
13.25	163.20	1.34	120.00	0.00	0.50
13.32	164.00	1.34	120.00	0.00	0.50
13.38	165.30	1.32	120.00	0.00	0.50
13.45	166.90	1.31	120.00	0.00	0.50
13.51	168.50	1.31	120.00	0.00	0.50
13.58	172.20	1.32	120.00	0.00	0.50
13.64	173.00	1.32	120.00	0.00	0.50

13.71	172.30	1.32	120.00	0.00	0.50
13.77	169.70	1.33	120.00	0.00	0.50
13.84	164.90	1.31	120.00	0.00	0.50
13.91	158.40	1.31	120.00	0.00	0.50
13.97	151.10	1.24	120.00	0.00	0.50
14.04	143.30	1.20	120.00	0.00	0.50
14.10	137.90	1.16	120.00	0.00	0.50
14.17	130.80	1.11	120.00	0.00	0.50
14.23	127.40	1.06	120.00	0.00	0.50
14.30	123.60	1.01	120.00	0.00	0.50
14.37	120.10	0.97	120.00	0.00	0.50
14.43	118.00	0.95	120.00	0.00	0.50
14.50	117.10	0.92	120.00	0.00	0.50
14.56	116.10	0.89	120.00	0.00	0.50
14.63	116.50	0.87	120.00	0.00	0.50
14.69	116.00	0.86	120.00	0.00	0.50
14.76	116.70	0.84	120.00	0.00	0.50
14.82	117.70	0.84	120.00	0.00	0.50
14.89	119.10	0.83	120.00	0.00	0.50
14.96	121.60	0.84	120.00	0.00	0.50
15.02	125.70	0.85	120.00	0.00	0.50
15.09	128.50	0.86	120.00	0.00	0.50
15.15	132.60	0.87	120.00	0.00	0.50
15.22	137.80	0.90	120.00	0.00	0.50
15.28	144.80	0.92	120.00	0.00	0.50
15.35	154.40	0.75	120.00	0.00	0.50
15.41	166.00	0.84	120.00	0.00	0.50
15.48	176.40	0.96	120.00	0.00	0.50
15.55	185.00	1.07	120.00	0.00	0.50
15.61	185.10	1.12	120.00	0.00	0.50
15.68	176.30	1.12	120.00	0.00	0.50
15.74	169.50	1.09	120.00	0.00	0.50
15.81	166.10	1.07	120.00	0.00	0.50
15.87	164.60	1.03	120.00	0.00	0.50
15.94	170.40	1.04	120.00	0.00	0.50
16.01	182.20	1.15	120.00	0.00	0.50
16.07	196.10	1.14	120.00	0.00	0.50
16.14	212.50	1.28	120.00	0.00	0.50
16.20	224.20	1.35	120.00	0.00	0.50
16.27	231.60	1.40	120.00	0.00	0.50
16.33	237.00	1.43	120.00	0.00	0.50
16.40	235.90	1.44	120.00	0.00	0.50
16.46	232.10	1.48	120.00	0.00	0.50
16.53	227.30	1.53	120.00	0.00	0.50
16.60	220.30	1.54	120.00	0.00	0.50
16.66	211.00	1.54	120.00	0.00	0.50
16.73	201.40	1.54	120.00	0.00	0.50
16.79	190.40	1.55	120.00	0.00	0.50
16.86	181.20	1.58	120.00	0.00	0.50
16.92	174.00	1.56	120.00	0.00	0.50
16.99	167.80	1.50	120.00	0.00	0.50
17.06	161.60	1.44	120.00	0.00	0.50
17.12	156.60	1.39	120.00	0.00	0.50
17.19	151.20	1.31	120.00	0.00	0.50
17.25	144.80	1.26	120.00	0.00	0.50
17.32	137.60	1.24	120.00	0.00	0.50
17.38	130.50	1.20	120.00	0.00	0.50
17.45	127.20	1.20	120.00	0.00	0.50
17.51	123.30	1.18	120.00	0.00	0.50
17.58	123.00	1.16	120.00	0.00	0.50
17.65	125.50	1.17	120.00	0.00	0.50
17.71	128.90	1.18	120.00	0.00	0.50
17.78	134.70	1.19	120.00	0.00	0.50
17.84	142.20	1.24	120.00	0.00	0.50
17.91	147.80	1.24	120.00	0.00	0.50
17.97	156.60	1.27	120.00	0.00	0.50
18.04	168.90	1.29	120.00	0.00	0.50
18.11	183.90	1.36	120.00	0.00	0.50
18.17	195.90	1.43	120.00	0.00	0.50
18.24	205.20	1.51	120.00	0.00	0.50
18.30	214.00	1.61	120.00	0.00	0.50
18.37	220.80	1.70	120.00	0.00	0.50
18.43	224.90	1.76	120.00	0.00	0.50
18.50	226.10	1.84	120.00	0.00	0.50
18.56	225.00	1.87	120.00	0.00	0.50
18.63	225.10	1.69	120.00	0.00	0.50
18.70	220.80	1.70	120.00	0.00	0.50
18.76	214.60	1.73	120.00	0.00	0.50
18.83	206.60	1.70	120.00	0.00	0.50
18.89	200.10	1.85	120.00	0.00	0.50
18.96	180.50	2.27	120.00	0.00	0.50
19.02	176.20	2.28	120.00	0.00	0.50
19.09	185.90	2.40	120.00	0.00	0.50
19.16	183.40	2.52	120.00	0.00	0.50
19.22	174.10	2.66	120.00	0.00	0.50
19.29	164.10	2.69	120.00	0.00	0.50
19.35	160.40	2.66	120.00	0.00	0.50
19.42	158.90	2.55	120.00	0.00	0.50
19.48	157.50	2.33	120.00	0.00	0.50
19.55	155.30	2.09	120.00	0.00	0.50
19.61	152.60	1.87	120.00	0.00	0.50
19.68	150.50	1.69	120.00	0.00	0.50
19.75	148.80	1.56	120.00	0.00	0.50
19.81	146.50	1.43	120.00	0.00	0.50
19.88	143.90	1.29	120.00	0.00	0.50
19.94	140.20	1.24	120.00	0.00	0.50
20.01	137.20	1.19	120.00	0.00	0.50
20.07	134.30	1.16	120.00	0.00	0.50
20.14	131.10	1.14	120.00	0.00	0.50
20.20	128.50	1.09	120.00	0.00	0.50
20.27	129.70	1.07	120.00	0.00	0.50
20.34	130.10	1.09	120.00	0.00	0.50
20.40	131.90	1.11	120.00	0.00	0.50
20.47	134.30	1.11	120.00	0.00	0.50
20.53	137.50	1.13	120.00	0.00	0.50
20.60	139.00	1.14	120.00	0.00	0.50
20.66	140.10	1.14	120.00	0.00	0.50
20.73	143.20	1.15	120.00	0.00	0.50
20.80	145.10	1.13	120.00	0.00	0.50
20.86	146.50	1.12	120.00	0.00	0.50
20.93	149.70	1.12	120.00	0.00	0.50
20.99	152.40	1.13	120.00	0.00	0.50
21.06	155.70	1.16	120.00	0.00	0.50
21.12	158.90	1.19	120.00	0.00	0.50
21.19	161.20	1.22	120.00	0.00	0.50
21.25	164.50	1.26	120.00	0.00	0.50
21.32	169.10	1.29	120.00	0.00	0.50
21.39	172.50	1.30	120.00	0.00	0.50
21.45	177.70	1.32	120.00	0.00	0.50
21.52	183.70	1.36	120.00	0.00	0.50

21.58	188.60	1.27	120.00	0.00	0.50
21.65	194.10	1.26	120.00	0.00	0.50
21.71	203.50	1.39	120.00	0.00	0.50
21.78	213.50	1.52	120.00	0.00	0.50
21.85	226.90	1.61	120.00	0.00	0.50
21.91	239.60	1.72	120.00	0.00	0.50
21.98	250.50	1.82	120.00	0.00	0.50
22.04	269.70	1.91	120.00	0.00	0.50
22.11	286.90	1.97	120.00	0.00	0.50
22.17	303.20	2.01	120.00	0.00	0.50
22.24	316.70	2.06	120.00	0.00	0.50
22.30	329.20	2.09	120.00	0.00	0.50
22.37	341.30	2.16	120.00	0.00	0.50
22.44	351.20	2.22	120.00	0.00	0.50
22.50	359.20	2.23	120.00	0.00	0.50
22.57	362.10	2.26	120.00	0.00	0.50
22.63	363.60	2.45	120.00	0.00	0.50
22.70	364.70	3.06	120.00	0.00	0.50
22.76	366.30	3.09	120.00	0.00	0.50
22.83	368.90	2.95	120.00	0.00	0.50
22.90	373.10	2.78	120.00	0.00	0.50
22.96	378.20	2.59	120.00	0.00	0.50
23.03	375.30	2.31	120.00	0.00	0.50
23.09	372.60	2.44	120.00	0.00	0.50
23.16	374.50	2.40	120.00	0.00	0.50
23.22	382.00	2.29	120.00	0.00	0.50
23.29	395.30	2.23	120.00	0.00	0.50
23.35	396.80	2.29	120.00	0.00	0.50
23.42	379.00	2.50	120.00	0.00	0.50
23.49	360.90	2.72	120.00	0.00	0.50
23.55	350.90	2.73	120.00	0.00	0.50
23.62	342.80	2.67	120.00	0.00	0.50
23.68	333.90	2.62	120.00	0.00	0.50
23.75	331.40	2.57	120.00	0.00	0.50
23.81	331.20	2.63	120.00	0.00	0.50
23.88	333.20	2.67	120.00	0.00	0.50
23.95	335.60	2.77	120.00	0.00	0.50
24.01	331.90	2.91	120.00	0.00	0.50
24.08	328.10	3.05	120.00	0.00	0.50
24.14	323.50	3.20	120.00	0.00	0.50
24.21	317.10	3.30	120.00	0.00	0.50
24.27	311.90	3.32	120.00	0.00	0.50
24.34	312.30	3.32	120.00	0.00	0.50
24.40	314.90	3.31	120.00	0.00	0.50
24.47	316.50	3.23	120.00	0.00	0.50
24.54	316.40	3.07	120.00	0.00	0.50
24.60	312.20	3.04	120.00	0.00	0.50
24.67	304.80	2.95	120.00	0.00	0.50
24.73	302.90	2.90	120.00	0.00	0.50
24.80	297.50	2.70	120.00	0.00	0.50
24.86	288.50	2.66	120.00	0.00	0.50
24.93	291.70	2.69	120.00	0.00	0.50
25.00	293.00	2.60	120.00	0.00	0.50
25.06	301.20	2.50	120.00	0.00	0.50
25.13	313.90	2.62	120.00	0.00	0.50
25.19	327.30	3.48	120.00	0.00	0.50
25.26	339.00	3.65	120.00	0.00	0.50
25.32	341.60	3.73	120.00	0.00	0.50
25.39	341.80	3.77	120.00	0.00	0.50
25.45	345.40	3.72	120.00	0.00	0.50
25.52	350.40	3.51	120.00	0.00	0.50
25.59	354.40	3.19	120.00	0.00	0.50
25.65	357.00	3.01	120.00	0.00	0.50
25.72	356.60	2.72	120.00	0.00	0.50
25.78	354.00	2.66	120.00	0.00	0.50
25.85	353.00	2.60	120.00	0.00	0.50
25.91	342.90	2.64	120.00	0.00	0.50
25.98	331.40	2.70	120.00	0.00	0.50
26.04	323.30	2.74	120.00	0.00	0.50
26.11	315.30	2.73	120.00	0.00	0.50
26.18	313.70	2.71	120.00	0.00	0.50
26.24	313.80	2.77	120.00	0.00	0.50
26.31	312.00	2.83	120.00	0.00	0.50
26.37	318.30	2.90	120.00	0.00	0.50
26.44	327.80	2.91	120.00	0.00	0.50
26.50	335.50	2.86	120.00	0.00	0.50
26.57	339.20	2.89	120.00	0.00	0.50
26.64	338.10	2.85	120.00	0.00	0.50
26.70	335.90	2.78	120.00	0.00	0.50
26.77	335.40	2.72	120.00	0.00	0.50
26.83	330.50	2.69	120.00	0.00	0.50
26.90	322.80	2.72	120.00	0.00	0.50
26.96	315.70	2.71	120.00	0.00	0.50
27.03	309.50	2.61	120.00	0.00	0.50
27.09	303.40	2.60	120.00	0.00	0.50
27.16	295.40	2.65	120.00	0.00	0.50
27.23	284.40	2.59	120.00	0.00	0.50
27.29	277.10	2.54	120.00	0.00	0.50
27.36	266.30	2.53	120.00	0.00	0.50
27.42	252.90	2.57	120.00	0.00	0.50
27.49	248.40	2.60	120.00	0.00	0.50
27.55	246.60	2.59	120.00	0.00	0.50
27.62	246.50	2.56	120.00	0.00	0.50
27.69	246.80	2.51	120.00	0.00	0.50
27.75	246.80	2.47	120.00	0.00	0.50
27.82	245.90	2.44	120.00	0.00	0.50
27.88	244.40	2.42	120.00	0.00	0.50
27.95	243.40	2.39	120.00	0.00	0.50
28.01	240.70	2.35	120.00	0.00	0.50
28.08	236.80	2.21	120.00	0.00	0.50
28.14	235.40	2.10	120.00	0.00	0.50
28.21	232.80	2.16	120.00	0.00	0.50
28.28	232.40	2.16	120.00	0.00	0.50
28.34	233.20	2.14	120.00	0.00	0.50
28.41	232.80	2.11	120.00	0.00	0.50
28.47	227.20	2.10	120.00	0.00	0.50
28.54	229.10	2.11	120.00	0.00	0.50
28.60	229.70	2.14	120.00	0.00	0.50
28.67	229.80	2.18	120.00	0.00	0.50
28.74	228.60	2.17	120.00	0.00	0.50
28.80	227.90	2.17	120.00	0.00	0.50
28.87	228.40	2.17	120.00	0.00	0.50
28.93	228.40	2.17	120.00	0.00	0.50
29.00	232.60	2.16	120.00	0.00	0.50
29.06	233.80	2.16	120.00	0.00	0.50
29.13	233.20	2.17	120.00	0.00	0.50
29.19	232.30	2.17	120.00	0.00	0.50
29.26	232.30	2.14	120.00	0.00	0.50
29.33	227.80	2.09	120.00	0.00	0.50
29.39	224.10	2.11	120.00	0.00	0.50

29.46	220.70	2.07	120.00	0.00	0.50
29.52	217.80	2.04	120.00	0.00	0.50
29.59	215.70	2.03	120.00	0.00	0.50
29.65	213.50	2.04	120.00	0.00	0.50
29.72	211.60	2.10	120.00	0.00	0.50
29.79	210.30	2.10	120.00	0.00	0.50
29.85	209.30	2.11	120.00	0.00	0.50
29.92	208.00	2.11	120.00	0.00	0.50
29.98	207.90	2.13	120.00	0.00	0.50
30.05	206.80	2.18	120.00	0.00	0.50
30.11	206.70	2.21	120.00	0.00	0.50
30.18	207.30	2.22	120.00	0.00	0.50
30.24	207.80	2.23	120.00	0.00	0.50
30.31	206.60	2.23	120.00	0.00	0.50
30.38	207.50	2.23	120.00	0.00	0.50
30.44	207.90	2.23	120.00	0.00	0.50
30.51	208.40	2.23	120.00	0.00	0.50
30.57	210.20	2.24	120.00	0.00	0.50
30.64	214.40	2.28	120.00	0.00	0.50
30.70	218.30	2.31	120.00	0.00	0.50
30.77	221.10	2.35	120.00	0.00	0.50
30.83	221.80	2.38	120.00	0.00	0.50
30.90	221.30	2.40	120.00	0.00	0.50
30.97	224.70	2.42	120.00	0.00	0.50
31.03	227.00	2.45	120.00	0.00	0.50
31.10	230.90	2.46	120.00	0.00	0.50
31.16	234.40	2.49	120.00	0.00	0.50
31.23	235.80	2.53	120.00	0.00	0.50
31.29	236.60	2.59	120.00	0.00	0.50
31.36	238.30	2.63	120.00	0.00	0.50
31.43	238.70	2.36	120.00	0.00	0.50
31.49	238.70	2.46	120.00	0.00	0.50
31.56	239.60	2.53	120.00	0.00	0.50
31.62	241.20	2.56	120.00	0.00	0.50
31.69	230.90	2.60	120.00	0.00	0.50
31.75	235.60	2.66	120.00	0.00	0.50
31.82	238.10	2.71	120.00	0.00	0.50
31.88	240.40	2.77	120.00	0.00	0.50
31.95	243.90	2.87	120.00	0.00	0.50
32.02	247.90	3.01	120.00	0.00	0.50
32.08	253.80	3.18	120.00	0.00	0.50
32.15	261.70	3.45	120.00	0.00	0.50
32.21	267.00	3.74	120.00	0.00	0.50
32.28	270.00	4.03	120.00	0.00	0.50
32.34	271.80	4.31	120.00	0.00	0.50
32.41	268.60	4.56	120.00	0.00	0.50
32.48	263.70	4.72	120.00	0.00	0.50
32.54	261.50	4.75	120.00	0.00	0.50
32.61	258.90	4.61	120.00	0.00	0.50
32.67	255.40	4.45	120.00	0.00	0.50
32.74	254.50	4.33	120.00	0.00	0.50
32.80	252.30	4.26	120.00	0.00	0.50
32.87	249.90	4.16	120.00	0.00	0.50
32.93	246.80	4.09	120.00	0.00	0.50
33.00	241.10	4.06	120.00	0.00	0.50
33.07	231.40	4.03	120.00	0.00	0.50
33.13	220.40	4.00	120.00	0.00	0.50
33.20	210.90	3.93	120.00	0.00	0.50
33.26	203.90	3.87	120.00	0.00	0.50
33.33	199.70	3.83	120.00	0.00	0.50
33.39	197.90	3.80	120.00	0.00	0.50
33.46	197.30	3.80	120.00	0.00	0.50
33.53	193.90	3.83	120.00	0.00	0.50
33.59	193.60	3.84	120.00	0.00	0.50
33.66	196.30	3.85	120.00	0.00	0.50
33.72	202.20	3.87	120.00	0.00	0.50
33.79	211.40	3.92	120.00	0.00	0.50
33.85	222.20	4.02	120.00	0.00	0.50
33.92	230.00	4.16	120.00	0.00	0.50
33.98	236.50	4.27	120.00	0.00	0.50
34.05	241.30	4.35	120.00	0.00	0.50
34.12	243.50	4.32	120.00	0.00	0.50
34.18	242.80	4.17	120.00	0.00	0.50
34.25	240.80	3.91	120.00	0.00	0.50
34.31	234.00	3.66	120.00	0.00	0.50
34.38	224.60	2.95	120.00	0.00	0.50
34.44	215.20	2.70	120.00	0.00	0.50
34.51	208.40	2.66	120.00	0.00	0.50
34.58	208.20	2.62	120.00	0.00	0.50
34.64	210.90	2.62	120.00	0.00	0.50
34.71	209.30	2.69	120.00	0.00	0.50
34.77	207.50	2.67	120.00	0.00	0.50
34.84	208.60	2.65	120.00	0.00	0.50
34.90	207.80	2.63	120.00	0.00	0.50
34.97	206.20	2.63	120.00	0.00	0.50
35.03	209.20	2.67	120.00	0.00	0.50
35.10	211.00	2.74	120.00	0.00	0.50
35.17	212.30	2.86	120.00	0.00	0.50
35.23	216.40	3.07	120.00	0.00	0.50
35.30	222.00	3.29	120.00	0.00	0.50
35.36	225.10	3.45	120.00	0.00	0.50
35.43	228.40	3.53	120.00	0.00	0.50
35.49	229.70	3.60	120.00	0.00	0.50
35.56	231.30	3.69	120.00	0.00	0.50
35.62	235.80	3.68	120.00	0.00	0.50
35.69	238.60	3.60	120.00	0.00	0.50
35.76	237.70	3.54	120.00	0.00	0.50
35.82	236.20	3.47	120.00	0.00	0.50
35.89	236.00	3.42	120.00	0.00	0.50
35.95	235.90	3.36	120.00	0.00	0.50
36.02	233.80	3.27	120.00	0.00	0.50
36.08	236.30	3.15	120.00	0.00	0.50
36.15	237.90	3.07	120.00	0.00	0.50
36.22	238.80	3.07	120.00	0.00	0.50
36.28	241.30	3.09	120.00	0.00	0.50
36.35	244.10	3.10	120.00	0.00	0.50
36.41	244.10	3.10	120.00	0.00	0.50
36.48	244.80	3.08	120.00	0.00	0.50
36.54	247.10	3.07	120.00	0.00	0.50
36.61	248.50	3.05	120.00	0.00	0.50
36.67	249.10	3.09	120.00	0.00	0.50
36.74	247.90	3.10	120.00	0.00	0.50
36.81	242.20	3.08	120.00	0.00	0.50
36.87	238.00	3.07	120.00	0.00	0.50
36.94	235.00	3.13	120.00	0.00	0.50
37.00	233.80	3.16	120.00	0.00	0.50
37.07	233.90	3.23	120.00	0.00	0.50
37.13	234.10	3.34	120.00	0.00	0.50
37.20	233.30	3.49	120.00	0.00	0.50
37.27	236.30	3.65	120.00	0.00	0.50

37.33	236.30	3.85	120.00	0.00	0.50
37.40	234.10	3.95	120.00	0.00	0.50
37.46	231.60	3.99	120.00	0.00	0.50
37.53	230.10	3.98	120.00	0.00	0.50
37.59	224.40	3.78	120.00	0.00	0.50
37.66	222.00	3.33	120.00	0.00	0.50
37.72	221.30	3.42	120.00	0.00	0.50
37.79	220.40	3.47	120.00	0.00	0.50
37.86	219.00	3.51	120.00	0.00	0.50
37.92	219.70	3.58	120.00	0.00	0.50
37.99	215.00	3.67	120.00	0.00	0.50
38.05	216.40	3.73	120.00	0.00	0.50
38.12	217.10	3.74	120.00	0.00	0.50
38.18	217.40	3.77	120.00	0.00	0.50
38.25	217.50	3.75	120.00	0.00	0.50
38.32	217.80	3.73	120.00	0.00	0.50
38.38	220.10	3.72	120.00	0.00	0.50
38.45	224.70	3.71	120.00	0.00	0.50
38.51	229.10	3.71	120.00	0.00	0.50
38.58	233.60	3.67	120.00	0.00	0.50
38.64	237.90	3.57	120.00	0.00	0.50
38.71	241.50	3.40	120.00	0.00	0.50
38.77	244.30	3.20	120.00	0.00	0.50
38.84	246.50	2.99	120.00	0.00	0.50
38.91	244.90	2.80	120.00	0.00	0.50
38.97	244.00	2.66	120.00	0.00	0.50
39.04	243.50	2.61	120.00	0.00	0.50
39.10	241.30	2.56	120.00	0.00	0.50
39.17	236.30	2.47	120.00	0.00	0.50
39.23	232.80	2.32	120.00	0.00	0.50
39.30	229.40	2.11	120.00	0.00	0.50
39.37	226.00	1.87	120.00	0.00	0.50
39.43	223.60	1.68	120.00	0.00	0.50
39.50	222.90	1.57	120.00	0.00	0.50
39.56	223.80	1.54	120.00	0.00	0.50
39.63	224.70	1.57	120.00	0.00	0.50
39.69	225.60	1.62	120.00	0.00	0.50
39.76	223.10	1.68	120.00	0.00	0.50
39.82	217.40	1.75	120.00	0.00	0.50
39.89	210.10	1.83	120.00	0.00	0.50
39.96	201.60	1.91	120.00	0.00	0.50
40.02	195.10	2.01	120.00	0.00	0.50
40.09	192.70	2.06	120.00	0.00	0.50
40.15	191.70	2.04	120.00	0.00	0.50
40.22	189.60	2.05	120.00	0.00	0.50
40.28	186.70	2.06	120.00	0.00	0.50
40.35	186.30	2.06	120.00	0.00	0.50
40.41	186.50	2.06	120.00	0.00	0.50
40.48	188.90	2.02	120.00	0.00	0.50
40.55	193.10	2.00	120.00	0.00	0.50
40.61	196.70	2.03	120.00	0.00	0.50
40.68	194.50	1.98	120.00	0.00	0.50
40.74	190.70	1.85	120.00	0.00	0.50
40.81	184.40	1.93	120.00	0.00	0.50
40.87	176.90	1.94	120.00	0.00	0.50
40.94	168.40	1.93	120.00	0.00	0.50
41.01	158.10	1.88	120.00	0.00	0.50
41.07	144.30	1.81	120.00	0.00	0.50
41.14	132.10	1.80	120.00	0.00	0.50
41.20	113.60	1.92	120.00	0.00	0.50
41.27	94.40	2.09	120.00	0.00	0.50
41.33	77.10	2.15	120.00	0.00	0.50
41.40	62.10	2.05	120.00	0.00	0.50
41.46	51.70	1.90	120.00	0.00	0.50
41.53	49.30	1.79	120.00	0.00	0.50
41.60	48.50	1.76	120.00	0.00	0.50
41.66	51.30	1.82	120.00	0.00	0.50
41.73	58.20	1.75	120.00	0.00	0.50
41.79	67.80	1.60	120.00	0.00	0.50
41.86	75.30	1.39	120.00	0.00	0.50
41.92	74.50	1.18	120.00	0.00	0.50
41.99	69.20	1.00	120.00	0.00	0.50
42.06	62.40	0.97	120.00	0.00	0.50
42.12	53.20	1.01	120.00	0.00	0.50
42.19	44.00	1.06	120.00	0.00	0.50
42.25	38.30	1.09	120.00	0.00	0.50
42.32	31.60	1.07	120.00	0.00	0.50
42.38	24.60	1.03	120.00	0.00	0.50
42.45	19.60	1.01	120.00	0.00	0.50
42.51	17.70	1.00	120.00	0.00	0.50
42.58	19.10	0.97	120.00	0.00	0.50
42.65	21.30	0.86	120.00	0.00	0.50
42.71	23.50	0.82	120.00	0.00	0.50
42.78	24.50	0.81	120.00	0.00	0.50
42.84	24.10	0.85	120.00	0.00	0.50
42.91	25.00	0.92	120.00	0.00	0.50
42.97	36.80	0.96	120.00	0.00	0.50
43.04	53.10	0.93	120.00	0.00	0.50
43.11	66.90	0.91	120.00	0.00	0.50
43.17	71.30	0.95	120.00	0.00	0.50
43.24	66.50	1.13	120.00	0.00	0.50
43.30	61.20	1.27	120.00	0.00	0.50
43.37	56.40	1.31	120.00	0.00	0.50
43.43	52.60	1.34	120.00	0.00	0.50
43.50	49.20	1.42	120.00	0.00	0.50
43.56	51.40	1.33	120.00	0.00	0.50
43.63	70.80	1.29	120.00	0.00	0.50
43.70	105.70	1.29	120.00	0.00	0.50
43.76	148.70	1.31	120.00	0.00	0.50
43.83	180.80	1.34	120.00	0.00	0.50
43.89	204.90	1.45	120.00	0.00	0.50
43.96	223.50	1.37	120.00	0.00	0.50
44.02	238.20	1.45	120.00	0.00	0.50
44.09	250.80	1.68	120.00	0.00	0.50
44.16	259.50	1.88	120.00	0.00	0.50
44.22	266.80	2.05	120.00	0.00	0.50
44.29	268.50	2.17	120.00	0.00	0.50
44.35	266.30	2.22	120.00	0.00	0.50
44.42	270.20	2.23	120.00	0.00	0.50
44.48	271.20	2.27	120.00	0.00	0.50
44.55	268.50	2.31	120.00	0.00	0.50
44.61	270.20	2.34	120.00	0.00	0.50
44.68	271.00	2.35	120.00	0.00	0.50
44.75	271.20	2.35	120.00	0.00	0.50
44.81	272.10	2.32	120.00	0.00	0.50
44.88	273.40	2.32	120.00	0.00	0.50
44.94	274.80	2.31	120.00	0.00	0.50
45.01	277.30	2.29	120.00	0.00	0.50
45.07	279.70	2.26	120.00	0.00	0.50
45.14	279.90	2.28	120.00	0.00	0.50

45.20	279.30	2.31	120.00	0.00	0.50
45.27	279.30	2.37	120.00	0.00	0.50
45.34	280.60	2.44	120.00	0.00	0.50
45.40	278.70	2.48	120.00	0.00	0.50
45.47	277.40	2.51	120.00	0.00	0.50
45.53	276.50	2.52	120.00	0.00	0.50
45.60	275.60	2.51	120.00	0.00	0.50
45.66	274.40	2.47	120.00	0.00	0.50
45.73	274.20	2.38	120.00	0.00	0.50
45.80	271.70	2.32	120.00	0.00	0.50
45.86	267.90	2.22	120.00	0.00	0.50
45.93	264.20	2.11	120.00	0.00	0.50
45.99	262.70	2.00	120.00	0.00	0.50
46.06	260.50	1.91	120.00	0.00	0.50
46.12	256.90	1.85	120.00	0.00	0.50
46.19	251.40	1.78	120.00	0.00	0.50
46.25	244.10	1.71	120.00	0.00	0.50
46.32	235.50	1.65	120.00	0.00	0.50
46.39	220.70	1.64	120.00	0.00	0.50
46.45	203.70	1.60	120.00	0.00	0.50
46.52	183.60	1.58	120.00	0.00	0.50
46.58	162.40	1.60	120.00	0.00	0.50
46.65	143.50	1.65	120.00	0.00	0.50
46.71	128.50	1.72	120.00	0.00	0.50
46.78	114.90	1.69	120.00	0.00	0.50
46.85	104.20	1.79	120.00	0.00	0.50
46.91	96.30	1.93	120.00	0.00	0.50
46.98	89.60	2.04	120.00	0.00	0.50
47.04	86.60	2.02	120.00	0.00	0.50
47.11	91.10	1.98	120.00	0.00	0.50
47.17	97.90	1.97	120.00	0.00	0.50
47.24	103.90	2.04	120.00	0.00	0.50
47.30	108.30	2.07	120.00	0.00	0.50
47.37	108.00	1.92	120.00	0.00	0.50
47.44	106.90	1.77	120.00	0.00	0.50
47.50	107.80	1.66	120.00	0.00	0.50
47.57	109.20	1.63	120.00	0.00	0.50
47.63	110.50	1.67	120.00	0.00	0.50
47.70	111.10	1.73	120.00	0.00	0.50
47.76	111.60	1.84	120.00	0.00	0.50
47.83	111.00	1.97	120.00	0.00	0.50
47.90	107.40	2.12	120.00	0.00	0.50
47.96	101.80	2.27	120.00	0.00	0.50
48.03	90.90	2.41	120.00	0.00	0.50
48.09	76.40	2.53	120.00	0.00	0.50
48.16	60.90	2.57	120.00	0.00	0.50
48.22	47.60	2.40	120.00	0.00	0.50
48.29	40.10	2.16	120.00	0.00	0.50
48.35	34.00	1.90	120.00	0.00	0.50
48.42	28.90	1.65	120.00	0.00	0.50
48.49	25.00	1.48	120.00	0.00	0.50
48.55	22.00	1.29	120.00	0.00	0.50
48.62	20.00	1.15	120.00	0.00	0.50
48.68	20.60	1.05	120.00	0.00	0.50
48.75	19.40	0.99	120.00	0.00	0.50
48.81	18.80	1.01	120.00	0.00	0.50
48.88	20.60	1.15	120.00	0.00	0.50
48.95	26.50	1.32	120.00	0.00	0.50
49.01	31.10	1.47	120.00	0.00	0.50
49.08	33.90	1.63	120.00	0.00	0.50
49.14	35.80	1.84	120.00	0.00	0.50
49.21	38.90	2.05	120.00	0.00	0.50
49.27	46.00	2.21	120.00	0.00	0.50
49.34	53.70	2.30	120.00	0.00	0.50
49.40	57.50	2.35	120.00	0.00	0.50
49.47	61.00	2.21	120.00	0.00	0.50
49.54	65.40	1.77	120.00	0.00	0.50
49.60	70.20	1.29	120.00	0.00	0.50
49.67	66.20	0.98	120.00	0.00	0.50
49.73	61.70	0.89	120.00	0.00	0.50
49.80	56.20	0.93	120.00	0.00	0.50
49.86	49.30	1.04	120.00	0.00	0.50
49.93	42.10	1.16	120.00	0.00	0.50
50.00	35.10	1.23	120.00	0.00	0.50
50.06	28.50	1.26	120.00	0.00	0.50
50.13	23.40	1.25	120.00	0.00	0.50
50.19	20.20	1.19	120.00	0.00	0.50
50.26	17.40	1.05	120.00	0.00	0.50
50.32	15.80	0.88	120.00	0.00	0.50
50.39	15.60	0.71	120.00	0.00	0.50
50.45	14.40	0.64	120.00	0.00	0.50
50.52	13.70	0.62	120.00	0.00	0.50
50.59	13.40	0.60	120.00	0.00	0.50
50.65	12.50	0.55	120.00	0.00	0.50
50.72	12.30	0.53	120.00	0.00	0.50
50.78	12.40	0.50	120.00	0.00	0.50
50.85	12.20	0.49	120.00	0.00	0.50
50.91	12.20	0.50	120.00	0.00	0.50
50.98	12.10	0.52	120.00	0.00	0.50
51.04	12.10	0.51	120.00	0.00	0.50
51.11	13.00	0.51	120.00	0.00	0.50
51.18	15.00	0.54	120.00	0.00	0.50
51.24	16.60	0.56	120.00	0.00	0.50
51.31	17.00	0.58	120.00	0.00	0.50
51.37	17.10	0.60	120.00	0.00	0.50
51.44	17.30	0.67	120.00	0.00	0.50
51.50	16.60	0.76	120.00	0.00	0.50
51.57	18.00	0.90	120.00	0.00	0.50
51.64	22.60	1.04	120.00	0.00	0.50
51.70	32.00	1.16	120.00	0.00	0.50
51.77	46.30	1.19	120.00	0.00	0.50
51.83	59.70	1.15	120.00	0.00	0.50
51.90	68.60	1.09	120.00	0.00	0.50
51.96	74.10	1.04	120.00	0.00	0.50
52.03	76.20	1.02	120.00	0.00	0.50
52.09	75.20	1.06	120.00	0.00	0.50
52.16	73.20	1.15	120.00	0.00	0.50
52.23	71.00	1.27	120.00	0.00	0.50
52.29	68.30	1.56	120.00	0.00	0.50
52.36	66.80	1.93	120.00	0.00	0.50
52.42	69.20	2.17	120.00	0.00	0.50
52.49	73.00	2.32	120.00	0.00	0.50
52.55	82.70	2.46	120.00	0.00	0.50
52.62	82.30	2.57	120.00	0.00	0.50
52.69	85.10	2.65	120.00	0.00	0.50
52.75	92.60	2.63	120.00	0.00	0.50
52.82	98.50	2.42	120.00	0.00	0.50
52.88	102.90	2.16	120.00	0.00	0.50
52.95	107.00	2.20	120.00	0.00	0.50
53.01	110.80	2.21	120.00	0.00	0.50

53.08	114.70	2.20	120.00	0.00	0.50
53.14	121.00	2.09	120.00	0.00	0.50
53.21	125.40	1.94	120.00	0.00	0.50
53.28	127.10	1.87	120.00	0.00	0.50
53.34	125.20	1.88	120.00	0.00	0.50
53.41	123.40	1.91	120.00	0.00	0.50
53.47	121.60	1.80	120.00	0.00	0.50
53.54	117.60	1.47	120.00	0.00	0.50
53.60	111.10	1.47	120.00	0.00	0.50
53.67	104.20	1.43	120.00	0.00	0.50
53.74	98.60	1.40	120.00	0.00	0.50
53.80	92.80	1.40	120.00	0.00	0.50
53.87	86.10	1.37	120.00	0.00	0.50
53.93	81.60	1.35	120.00	0.00	0.50
54.00	77.20	1.33	120.00	0.00	0.50
54.06	71.30	1.36	120.00	0.00	0.50
54.13	63.70	1.40	120.00	0.00	0.50
54.19	54.80	1.38	120.00	0.00	0.50
54.26	45.30	1.31	120.00	0.00	0.50
54.33	35.90	1.19	120.00	0.00	0.50
54.39	28.20	1.07	120.00	0.00	0.50
54.46	22.10	0.93	120.00	0.00	0.50
54.52	17.70	0.77	120.00	0.00	0.50
54.59	15.20	0.64	120.00	0.00	0.50
54.65	13.90	0.52	120.00	0.00	0.50
54.72	13.20	0.41	120.00	0.00	0.50
54.79	13.00	0.32	120.00	0.00	0.50
54.85	12.30	0.27	120.00	0.00	0.50
54.92	12.10	0.24	120.00	0.00	0.50
54.98	12.20	0.23	120.00	0.00	0.50
55.05	12.70	0.22	120.00	0.00	0.50
55.11	12.10	0.23	120.00	0.00	0.50
55.18	11.90	0.24	120.00	0.00	0.50
55.24	12.30	0.27	120.00	0.00	0.50
55.31	12.20	0.28	120.00	0.00	0.50
55.38	12.20	0.33	120.00	0.00	0.50
55.44	12.20	0.41	120.00	0.00	0.50
55.51	12.70	0.50	120.00	0.00	0.50
55.57	13.60	0.54	120.00	0.00	0.50
55.64	14.80	0.54	120.00	0.00	0.50
55.70	15.50	0.54	120.00	0.00	0.50
55.77	15.50	0.55	120.00	0.00	0.50
55.83	15.60	0.56	120.00	0.00	0.50
55.90	14.90	0.58	120.00	0.00	0.50
55.97	15.80	0.59	120.00	0.00	0.50
56.03	16.10	0.63	120.00	0.00	0.50
56.10	17.10	0.62	120.00	0.00	0.50
56.16	17.80	0.61	120.00	0.00	0.50
56.23	18.90	0.58	120.00	0.00	0.50
56.29	19.30	0.57	120.00	0.00	0.50
56.36	20.40	0.57	120.00	0.00	0.50
56.43	21.20	0.54	120.00	0.00	0.50
56.49	21.30	0.52	120.00	0.00	0.50
56.56	21.00	0.52	120.00	0.00	0.50
56.62	20.00	0.55	120.00	0.00	0.50
56.69	18.90	0.58	120.00	0.00	0.50
56.75	18.40	0.75	120.00	0.00	0.50
56.82	18.10	0.96	120.00	0.00	0.50
56.88	18.60	0.98	120.00	0.00	0.50
56.95	19.40	1.00	120.00	0.00	0.50

57.02	19.90	1.04	120.00	0.00	0.50
57.08	22.10	1.03	120.00	0.00	0.50
57.15	28.30	0.99	120.00	0.00	0.50
57.21	27.90	0.89	120.00	0.00	0.50
57.28	26.70	0.81	120.00	0.00	0.50
57.34	24.50	0.79	120.00	0.00	0.50
57.41	22.40	0.75	120.00	0.00	0.50
57.48	20.50	0.70	120.00	0.00	0.50
57.54	19.00	0.64	120.00	0.00	0.50
57.61	17.40	0.62	120.00	0.00	0.50
57.67	15.70	0.61	120.00	0.00	0.50
57.74	16.00	0.60	120.00	0.00	0.50
57.80	16.30	0.57	120.00	0.00	0.50
57.87	16.90	0.51	120.00	0.00	0.50
57.93	16.50	0.45	120.00	0.00	0.50
58.00	16.10	0.42	120.00	0.00	0.50
58.07	15.40	0.43	120.00	0.00	0.50
58.13	14.00	0.43	120.00	0.00	0.50
58.20	13.00	0.44	120.00	0.00	0.50
58.26	12.70	0.43	120.00	0.00	0.50
58.33	12.10	0.42	120.00	0.00	0.50
58.39	11.80	0.41	120.00	0.00	0.50
58.46	11.60	0.39	120.00	0.00	0.50
58.53	11.50	0.35	120.00	0.00	0.50
58.59	11.60	0.31	120.00	0.00	0.50
58.66	11.40	0.29	120.00	0.00	0.50
58.72	10.90	0.30	120.00	0.00	0.50
58.79	11.10	0.34	120.00	0.00	0.50
58.85	11.40	0.34	120.00	0.00	0.50
58.92	11.60	0.35	120.00	0.00	0.50
58.98	12.00	0.34	120.00	0.00	0.50
59.05	11.70	0.33	120.00	0.00	0.50
59.12	10.80	0.32	120.00	0.00	0.50
59.18	10.50	0.31	120.00	0.00	0.50
59.25	10.70	0.32	120.00	0.00	0.50
59.31	10.70	0.32	120.00	0.00	0.50
59.38	10.50	0.32	120.00	0.00	0.50
59.44	11.00	0.35	120.00	0.00	0.50
59.51	11.10	0.36	120.00	0.00	0.50
59.58	11.80	0.37	120.00	0.00	0.50
59.64	12.40	0.37	120.00	0.00	0.50
59.71	12.50	0.35	120.00	0.00	0.50
59.77	13.10	0.38	120.00	0.00	0.50
59.84	13.90	0.44	120.00	0.00	0.50
59.90	14.90	0.53	120.00	0.00	0.50
59.97	16.20	0.58	120.00	0.00	0.50
60.03	17.10	0.63	120.00	0.00	0.50
60.10	17.80	0.70	120.00	0.00	0.50
60.17	18.30	0.78	120.00	0.00	0.50
60.23	18.40	0.86	120.00	0.00	0.50
60.30	18.10	0.91	120.00	0.00	0.50
60.36	18.20	0.92	120.00	0.00	0.50
60.43	18.20	0.90	120.00	0.00	0.50
60.49	17.80	0.93	120.00	0.00	0.50
60.56	17.20	0.94	120.00	0.00	0.50
60.62	16.50	0.93	120.00	0.00	0.50
60.69	16.10	0.92	120.00	0.00	0.50
60.76	16.40	0.92	120.00	0.00	0.50
60.82	15.90	0.92	120.00	0.00	0.50
60.89	15.50	0.90	120.00	0.00	0.50

60.95	15.20	0.91	120.00	0.00	0.50
61.02	14.40	0.92	120.00	0.00	0.50
61.08	13.80	0.91	120.00	0.00	0.50
61.15	13.70	0.90	120.00	0.00	0.50
61.22	14.40	0.90	120.00	0.00	0.50
61.28	15.30	0.88	120.00	0.00	0.50
61.35	16.00	0.85	120.00	0.00	0.50
61.41	17.80	0.85	120.00	0.00	0.50
61.48	18.80	0.87	120.00	0.00	0.50
61.54	20.60	0.89	120.00	0.00	0.50
61.61	22.40	0.94	120.00	0.00	0.50
61.67	23.50	1.02	120.00	0.00	0.50
61.74	23.80	1.09	120.00	0.00	0.50
61.81	24.40	1.17	120.00	0.00	0.50
61.87	24.50	1.23	120.00	0.00	0.50
61.94	23.80	1.27	120.00	0.00	0.50
62.00	22.70	1.30	120.00	0.00	0.50
62.07	21.40	1.33	120.00	0.00	0.50
62.13	20.40	1.29	120.00	0.00	0.50
62.20	19.30	1.26	120.00	0.00	0.50
62.27	17.90	1.23	120.00	0.00	0.50
62.33	16.50	1.19	120.00	0.00	0.50
62.40	16.20	1.12	120.00	0.00	0.50
62.46	16.90	1.04	120.00	0.00	0.50
62.53	17.40	0.96	120.00	0.00	0.50
62.59	17.50	0.89	120.00	0.00	0.50
62.66	17.70	0.84	120.00	0.00	0.50
62.72	17.90	0.81	120.00	0.00	0.50
62.79	18.20	0.78	120.00	0.00	0.50
62.86	18.10	0.75	120.00	0.00	0.50
62.92	17.20	0.74	120.00	0.00	0.50
62.99	17.40	0.77	120.00	0.00	0.50
63.05	17.30	0.65	120.00	0.00	0.50
63.12	17.00	0.62	120.00	0.00	0.50
63.18	16.80	0.62	120.00	0.00	0.50
63.25	17.10	0.62	120.00	0.00	0.50
63.32	16.90	0.63	120.00	0.00	0.50
63.38	16.60	0.61	120.00	0.00	0.50
63.45	16.60	0.60	120.00	0.00	0.50
63.51	16.60	0.62	120.00	0.00	0.50
63.58	16.10	0.67	120.00	0.00	0.50
63.64	16.10	0.71	120.00	0.00	0.50
63.71	15.40	0.71	120.00	0.00	0.50
63.77	15.00	0.68	120.00	0.00	0.50
63.84	14.90	0.62	120.00	0.00	0.50
63.91	14.60	0.58	120.00	0.00	0.50
63.97	14.40	0.52	120.00	0.00	0.50
64.04	14.40	0.51	120.00	0.00	0.50
64.10	14.90	0.44	120.00	0.00	0.50
64.17	13.30	0.41	120.00	0.00	0.50
64.23	13.90	0.40	120.00	0.00	0.50
64.30	13.50	0.45	120.00	0.00	0.50
64.37	15.30	0.41	120.00	0.00	0.50
64.43	14.90	0.43	120.00	0.00	0.50
64.50	15.10	0.47	120.00	0.00	0.50
64.56	14.90	0.49	120.00	0.00	0.50
64.63	16.40	0.51	120.00	0.00	0.50
64.69	15.90	0.50	120.00	0.00	0.50
64.76	15.40	0.49	120.00	0.00	0.50
64.82	16.20	0.48	120.00	0.00	0.50
64.89	16.30	0.44	120.00	0.00	0.50
64.96	15.90	0.40	120.00	0.00	0.50
65.02	15.20	0.38	120.00	0.00	0.50
65.09	14.50	0.38	120.00	0.00	0.50
65.15	15.60	0.40	120.00	0.00	0.50
65.22	16.00	0.37	120.00	0.00	0.50
65.28	14.70	0.37	120.00	0.00	0.50
65.35	14.60	0.40	120.00	0.00	0.50
65.41	14.80	0.41	120.00	0.00	0.50
65.48	16.90	0.43	120.00	0.00	0.50
65.55	16.30	0.50	120.00	0.00	0.50
65.61	17.40	0.55	120.00	0.00	0.50
65.68	18.70	0.65	120.00	0.00	0.50
65.74	19.40	0.83	120.00	0.00	0.50
65.81	18.60	1.13	120.00	0.00	0.50
65.87	26.20	1.50	120.00	0.00	0.50
65.94	43.30	1.85	120.00	0.00	0.50
66.01	66.50	2.11	120.00	0.00	0.50
66.07	91.10	2.46	120.00	0.00	0.50
66.14	102.20	3.08	120.00	0.00	0.50
66.20	107.40	3.78	120.00	0.00	0.50
66.27	114.30	4.19	120.00	0.00	0.50
66.33	117.70	4.19	120.00	0.00	0.50
66.40	108.10	3.99	120.00	0.00	0.50
66.46	101.30	3.66	120.00	0.00	0.50
66.53	104.50	3.24	120.00	0.00	0.50
66.60	106.90	2.87	120.00	0.00	0.50
66.66	105.30	2.41	120.00	0.00	0.50
66.73	98.20	1.99	120.00	0.00	0.50
66.79	86.30	1.75	120.00	0.00	0.50
66.86	71.10	1.57	120.00	0.00	0.50
66.92	52.00	1.41	120.00	0.00	0.50
66.99	41.00	1.18	120.00	0.00	0.50
67.06	32.90	0.87	120.00	0.00	0.50
67.12	25.60	0.58	120.00	0.00	0.50
67.19	20.60	0.51	120.00	0.00	0.50
67.25	17.30	0.51	120.00	0.00	0.50
67.32	15.70	0.47	120.00	0.00	0.50
67.38	15.20	0.41	120.00	0.00	0.50
67.45	15.10	0.40	120.00	0.00	0.50
67.51	15.40	0.40	120.00	0.00	0.50
67.58	16.10	0.41	120.00	0.00	0.50
67.65	16.20	0.44	120.00	0.00	0.50
67.71	16.10	0.46	120.00	0.00	0.50
67.78	16.50	0.45	120.00	0.00	0.50
67.84	16.80	0.45	120.00	0.00	0.50
67.91	16.70	0.42	120.00	0.00	0.50
67.97	16.20	0.41	120.00	0.00	0.50
68.04	16.20	0.39	120.00	0.00	0.50
68.11	15.50	0.36	120.00	0.00	0.50
68.17	15.70	0.35	120.00	0.00	0.50
68.24	15.20	0.33	120.00	0.00	0.50
68.30	15.00	0.31	120.00	0.00	0.50
68.37	14.80	0.31	120.00	0.00	0.50
68.43	14.40	0.34	120.00	0.00	0.50
68.50	14.40	0.36	120.00	0.00	0.50
68.56	14.90	0.38	120.00	0.00	0.50
68.63	15.30	0.41	120.00	0.00	0.50
68.70	15.50	0.44	120.00	0.00	0.50
68.76	16.10	0.46	120.00	0.00	0.50

68.83	16.00	0.47	120.00	0.00	0.50
68.89	15.90	0.50	120.00	0.00	0.50
68.96	15.60	0.50	120.00	0.00	0.50
69.02	15.60	0.47	120.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.20 in.
Settlement of Unsaturated Sands=0.19 in.
Total Settlement of Saturated and Unsaturated Sands=0.39 in.
Differential Settlement=0.194 to 0.256 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.34	5.00	0.20	0.19	0.39
5.00	0.16	0.34	5.00	0.20	0.18	0.37
10.00	0.39	0.34	5.00	0.20	0.14	0.33
15.00	0.42	0.33	5.00	0.20	0.10	0.29
20.00	0.46	0.33	5.00	0.20	0.06	0.25
25.00	1.85	0.32	5.00	0.20	0.03	0.22
30.00	0.70	0.32	5.00	0.20	0.00	0.20
35.00	0.64	0.33	1.93	0.20	0.00	0.20
40.00	0.45	0.33	1.35	0.20	0.00	0.20
45.00	0.73	0.34	2.17	0.13	0.00	0.13
50.00	2.00	0.33	5.00	0.09	0.00	0.09
55.00	2.00	0.33	5.00	0.00	0.00	0.00
60.00	2.00	0.32	5.00	0.00	0.00	0.00
65.00	2.00	0.31	5.00	0.00	0.00	0.00
70.00	2.00	0.29	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

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LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\CPT-09-106.liq .
Title: SR-57 Northbound Widening/RW No 275
Subtitle: 602231-002
Surface Elev.=169.5
Hole No.=CPT-09-109
Depth of Hole= 60.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:

Surface Elev.=169.5
Hole No.=CPT-09-109
Depth of Hole=60.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60
1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: No
* Recommended Options

In-Situ Test Data:

Depth ft	qc atm	fs atm	gamma pcf	Fines %	D50 mm
0.00	125.00	0.00	120.00	0.00	0.50
0.13	249.90	0.00	120.00	0.00	0.50
0.20	466.60	0.00	120.00	0.00	0.50
0.26	534.60	0.00	120.00	0.00	0.50
0.33	511.50	1.81	120.00	0.00	0.50
0.39	478.90	1.91	120.00	0.00	0.50
0.46	440.40	2.01	120.00	0.00	0.50
0.52	406.30	1.88	120.00	0.00	0.50
0.59	363.60	1.77	120.00	0.00	0.50
0.66	330.50	1.60	120.00	0.00	0.50
0.72	311.20	1.55	120.00	0.00	0.50
0.79	294.00	1.51	120.00	0.00	0.50
0.85	276.90	1.47	120.00	0.00	0.50
0.92	261.90	1.40	120.00	0.00	0.50
0.98	245.90	1.33	120.00	0.00	0.50
1.05	232.40	1.28	120.00	0.00	0.50
1.12	218.50	1.23	120.00	0.00	0.50
1.18	203.60	1.19	120.00	0.00	0.50
1.25	188.50	1.16	120.00	0.00	0.50
1.31	173.60	1.09	120.00	0.00	0.50
1.38	162.30	1.01	120.00	0.00	0.50
1.44	153.60	0.97	120.00	0.00	0.50
1.51	147.50	0.92	120.00	0.00	0.50
1.57	144.40	0.83	120.00	0.00	0.50
1.64	141.20	0.75	120.00	0.00	0.50
1.71	136.20	0.75	120.00	0.00	0.50
1.77	131.90	0.77	120.00	0.00	0.50
1.84	125.30	0.78	120.00	0.00	0.50
1.90	116.80	0.78	120.00	0.00	0.50
1.97	111.60	0.75	120.00	0.00	0.50
2.03	104.80	0.70	120.00	0.00	0.50

2.10	97.90	0.66	120.00	0.00	0.50
2.16	90.90	0.62	120.00	0.00	0.50
2.23	83.80	0.58	120.00	0.00	0.50
2.30	75.90	0.52	120.00	0.00	0.50
2.36	69.00	0.50	120.00	0.00	0.50
2.43	63.00	0.46	120.00	0.00	0.50
2.49	58.50	0.42	120.00	0.00	0.50
2.56	56.50	0.38	120.00	0.00	0.50
2.62	54.90	0.35	120.00	0.00	0.50
2.69	54.70	0.35	120.00	0.00	0.50
2.76	54.70	0.34	120.00	0.00	0.50
2.82	54.50	0.33	120.00	0.00	0.50
2.89	54.80	0.33	120.00	0.00	0.50
2.95	53.00	0.33	120.00	0.00	0.50
3.02	51.40	0.32	120.00	0.00	0.50
3.08	49.90	0.32	120.00	0.00	0.50
3.15	47.60	0.30	120.00	0.00	0.50
3.21	46.40	0.29	120.00	0.00	0.50
3.28	45.40	0.29	120.00	0.00	0.50
3.35	44.40	0.29	120.00	0.00	0.50
3.41	43.60	0.29	120.00	0.00	0.50
3.48	42.90	0.29	120.00	0.00	0.50
3.54	41.90	0.29	120.00	0.00	0.50
3.61	41.50	0.29	120.00	0.00	0.50
3.67	41.00	0.28	120.00	0.00	0.50
3.74	40.20	0.28	120.00	0.00	0.50
3.81	38.90	0.28	120.00	0.00	0.50
3.87	37.60	0.27	120.00	0.00	0.50
3.94	35.50	0.26	120.00	0.00	0.50
4.00	33.90	0.26	120.00	0.00	0.50
4.07	33.10	0.25	120.00	0.00	0.50
4.13	32.60	0.25	120.00	0.00	0.50
4.20	33.00	0.25	120.00	0.00	0.50
4.26	34.00	0.26	120.00	0.00	0.50
4.33	35.50	0.27	120.00	0.00	0.50
4.40	37.30	0.28	120.00	0.00	0.50
4.46	39.90	0.30	120.00	0.00	0.50
4.53	43.40	0.33	120.00	0.00	0.50
4.59	47.90	0.35	120.00	0.00	0.50
4.66	53.20	0.38	120.00	0.00	0.50
4.72	57.30	0.40	120.00	0.00	0.50
4.79	61.00	0.43	120.00	0.00	0.50
4.86	63.90	0.45	120.00	0.00	0.50
4.92	65.30	0.46	120.00	0.00	0.50
4.99	64.70	0.47	120.00	0.00	0.50
5.05	62.10	0.47	120.00	0.00	0.50
5.12	58.30	0.45	120.00	0.00	0.50
5.18	53.40	0.42	120.00	0.00	0.50
5.25	47.90	0.39	120.00	0.00	0.50
5.31	42.80	0.36	120.00	0.00	0.50
5.38	39.50	0.34	120.00	0.00	0.50
5.45	37.60	0.33	120.00	0.00	0.50
5.51	36.80	0.35	120.00	0.00	0.50
5.58	38.40	0.37	120.00	0.00	0.50
5.64	40.50	0.39	120.00	0.00	0.50
5.71	42.60	0.41	120.00	0.00	0.50
5.77	44.90	0.38	120.00	0.00	0.50
5.84	46.70	0.36	120.00	0.00	0.50
5.91	47.50	0.36	120.00	0.00	0.50
5.97	46.60	0.35	120.00	0.00	0.50
6.04	44.60	0.33	120.00	0.00	0.50
6.10	41.30	0.31	120.00	0.00	0.50
6.17	38.20	0.29	120.00	0.00	0.50
6.23	37.30	0.28	120.00	0.00	0.50
6.30	36.10	0.27	120.00	0.00	0.50
6.36	35.50	0.28	120.00	0.00	0.50
6.43	34.80	0.29	120.00	0.00	0.50
6.50	34.60	0.31	120.00	0.00	0.50
6.56	35.10	0.33	120.00	0.00	0.50
6.63	35.80	0.35	120.00	0.00	0.50
6.69	36.20	0.38	120.00	0.00	0.50
6.76	37.00	0.40	120.00	0.00	0.50
6.82	38.40	0.41	120.00	0.00	0.50
6.89	39.20	0.43	120.00	0.00	0.50
6.95	40.40	0.44	120.00	0.00	0.50
7.02	41.70	0.44	120.00	0.00	0.50
7.09	42.70	0.44	120.00	0.00	0.50
7.15	43.90	0.44	120.00	0.00	0.50
7.22	44.70	0.43	120.00	0.00	0.50
7.28	45.10	0.42	120.00	0.00	0.50
7.35	46.10	0.41	120.00	0.00	0.50
7.41	47.20	0.41	120.00	0.00	0.50
7.48	48.30	0.41	120.00	0.00	0.50
7.55	49.30	0.40	120.00	0.00	0.50
7.61	50.10	0.40	120.00	0.00	0.50
7.68	51.00	0.39	120.00	0.00	0.50
7.74	51.90	0.41	120.00	0.00	0.50
7.81	53.20	0.42	120.00	0.00	0.50
7.87	53.90	0.42	120.00	0.00	0.50
7.94	54.60	0.44	120.00	0.00	0.50
8.01	56.20	0.45	120.00	0.00	0.50
8.07	58.50	0.45	120.00	0.00	0.50
8.14	61.00	0.45	120.00	0.00	0.50
8.20	63.80	0.46	120.00	0.00	0.50
8.27	66.30	0.47	120.00	0.00	0.50
8.33	68.50	0.49	120.00	0.00	0.50
8.40	70.20	0.50	120.00	0.00	0.50
8.46	71.70	0.52	120.00	0.00	0.50
8.53	73.10	0.53	120.00	0.00	0.50
8.60	74.60	0.54	120.00	0.00	0.50
8.66	76.00	0.57	120.00	0.00	0.50
8.73	77.40	0.60	120.00	0.00	0.50
8.79	78.40	0.62	120.00	0.00	0.50
8.86	78.90	0.63	120.00	0.00	0.50
8.92	79.40	0.65	120.00	0.00	0.50
8.99	79.70	0.61	120.00	0.00	0.50
9.06	79.50	0.57	120.00	0.00	0.50
9.12	78.40	0.60	120.00	0.00	0.50
9.19	77.40	0.60	120.00	0.00	0.50
9.25	76.00	0.61	120.00	0.00	0.50
9.32	74.30	0.62	120.00	0.00	0.50
9.38	72.80	0.62	120.00	0.00	0.50
9.45	72.70	0.61	120.00	0.00	0.50
9.51	71.90	0.60	120.00	0.00	0.50
9.58	70.80	0.60	120.00	0.00	0.50
9.65	69.70	0.59	120.00	0.00	0.50
9.71	69.00	0.59	120.00	0.00	0.50
9.78	67.50	0.58	120.00	0.00	0.50
9.84	65.90	0.57	120.00	0.00	0.50
9.91	65.30	0.56	120.00	0.00	0.50

9.97	65.50	0.55	120.00	0.00	0.50
10.03	67.10	0.55	120.00	0.00	0.50
10.10	69.70	0.56	120.00	0.00	0.50
10.17	72.10	0.56	120.00	0.00	0.50
10.23	74.50	0.56	120.00	0.00	0.50
10.30	76.20	0.57	120.00	0.00	0.50
10.36	77.20	0.57	120.00	0.00	0.50
10.43	77.40	0.55	120.00	0.00	0.50
10.49	76.90	0.54	120.00	0.00	0.50
10.56	75.70	0.53	120.00	0.00	0.50
10.62	73.30	0.51	120.00	0.00	0.50
10.69	72.30	0.48	120.00	0.00	0.50
10.76	71.50	0.46	120.00	0.00	0.50
10.82	70.70	0.45	120.00	0.00	0.50
10.89	70.70	0.44	120.00	0.00	0.50
10.95	70.20	0.44	120.00	0.00	0.50
11.02	69.90	0.43	120.00	0.00	0.50
11.08	70.30	0.43	120.00	0.00	0.50
11.15	70.60	0.43	120.00	0.00	0.50
11.22	71.40	0.44	120.00	0.00	0.50
11.28	72.30	0.45	120.00	0.00	0.50
11.35	72.70	0.44	120.00	0.00	0.50
11.41	72.50	0.45	120.00	0.00	0.50
11.48	72.60	0.46	120.00	0.00	0.50
11.54	73.30	0.43	120.00	0.00	0.50
11.61	73.20	0.44	120.00	0.00	0.50
11.67	73.40	0.44	120.00	0.00	0.50
11.74	74.20	0.44	120.00	0.00	0.50
11.81	75.90	0.44	120.00	0.00	0.50
11.87	77.00	0.43	120.00	0.00	0.50
11.94	78.70	0.43	120.00	0.00	0.50
12.00	80.70	0.43	120.00	0.00	0.50
12.07	80.60	0.44	120.00	0.00	0.50
12.13	80.60	0.38	120.00	0.00	0.50
12.20	80.50	0.34	120.00	0.00	0.50
12.27	79.90	0.38	120.00	0.00	0.50
12.33	80.30	0.40	120.00	0.00	0.50
12.40	81.30	0.43	120.00	0.00	0.50
12.46	80.80	0.46	120.00	0.00	0.50
12.53	78.10	0.48	120.00	0.00	0.50
12.59	84.00	0.48	120.00	0.00	0.50
12.66	86.40	0.50	120.00	0.00	0.50
12.72	88.10	0.53	120.00	0.00	0.50
12.79	89.40	0.54	120.00	0.00	0.50
12.86	90.50	0.54	120.00	0.00	0.50
12.92	89.20	0.54	120.00	0.00	0.50
12.99	87.70	0.53	120.00	0.00	0.50
13.05	86.60	0.51	120.00	0.00	0.50
13.12	87.10	0.50	120.00	0.00	0.50
13.18	86.30	0.49	120.00	0.00	0.50
13.25	85.50	0.47	120.00	0.00	0.50
13.32	85.30	0.47	120.00	0.00	0.50
13.38	84.20	0.45	120.00	0.00	0.50
13.45	83.80	0.44	120.00	0.00	0.50
13.51	83.70	0.44	120.00	0.00	0.50
13.58	83.10	0.46	120.00	0.00	0.50
13.64	82.70	0.49	120.00	0.00	0.50
13.71	82.40	0.52	120.00	0.00	0.50
13.77	82.60	0.54	120.00	0.00	0.50
13.84	84.60	0.53	120.00	0.00	0.50
13.91	87.80	0.50	120.00	0.00	0.50
13.97	91.20	0.48	120.00	0.00	0.50
14.04	93.90	0.46	120.00	0.00	0.50
14.10	91.30	0.47	120.00	0.00	0.50
14.17	87.10	0.49	120.00	0.00	0.50
14.23	82.60	0.49	120.00	0.00	0.50
14.30	78.50	0.45	120.00	0.00	0.50
14.37	75.40	0.42	120.00	0.00	0.50
14.43	73.20	0.40	120.00	0.00	0.50
14.50	71.90	0.38	120.00	0.00	0.50
14.56	71.60	0.38	120.00	0.00	0.50
14.63	74.90	0.39	120.00	0.00	0.50
14.69	80.90	0.40	120.00	0.00	0.50
14.76	89.00	0.42	120.00	0.00	0.50
14.82	98.80	0.45	120.00	0.00	0.50
14.89	107.50	0.48	120.00	0.00	0.50
14.96	115.20	0.51	120.00	0.00	0.50
15.02	122.10	0.54	120.00	0.00	0.50
15.09	128.30	0.57	120.00	0.00	0.50
15.15	133.30	0.58	120.00	0.00	0.50
15.22	137.70	0.60	120.00	0.00	0.50
15.28	141.40	0.62	120.00	0.00	0.50
15.35	142.30	0.67	120.00	0.00	0.50
15.41	141.00	0.58	120.00	0.00	0.50
15.48	139.00	0.57	120.00	0.00	0.50
15.55	137.30	0.61	120.00	0.00	0.50
15.61	137.50	0.65	120.00	0.00	0.50
15.68	136.50	0.69	120.00	0.00	0.50
15.74	139.30	0.71	120.00	0.00	0.50
15.81	144.20	0.73	120.00	0.00	0.50
15.87	147.60	0.76	120.00	0.00	0.50
15.94	149.70	0.78	120.00	0.00	0.50
16.01	152.80	0.81	120.00	0.00	0.50
16.07	155.80	0.83	120.00	0.00	0.50
16.14	157.30	0.84	120.00	0.00	0.50
16.20	158.90	0.88	120.00	0.00	0.50
16.27	159.70	0.91	120.00	0.00	0.50
16.33	159.60	0.92	120.00	0.00	0.50
16.40	158.90	0.94	120.00	0.00	0.50
16.46	155.90	0.95	120.00	0.00	0.50
16.53	152.30	0.95	120.00	0.00	0.50
16.60	147.40	0.94	120.00	0.00	0.50
16.66	139.90	0.90	120.00	0.00	0.50
16.73	137.80	0.86	120.00	0.00	0.50
16.79	137.40	0.82	120.00	0.00	0.50
16.86	139.50	0.79	120.00	0.00	0.50
16.92	145.50	0.79	120.00	0.00	0.50
16.99	153.80	0.81	120.00	0.00	0.50
17.06	163.00	0.82	120.00	0.00	0.50
17.12	172.30	0.85	120.00	0.00	0.50
17.19	180.20	0.90	120.00	0.00	0.50
17.25	184.60	0.96	120.00	0.00	0.50
17.32	189.70	1.01	120.00	0.00	0.50
17.38	192.90	1.05	120.00	0.00	0.50
17.45	194.50	1.09	120.00	0.00	0.50
17.51	196.50	1.14	120.00	0.00	0.50
17.58	199.40	1.18	120.00	0.00	0.50
17.65	201.90	1.23	120.00	0.00	0.50
17.71	202.30	1.27	120.00	0.00	0.50
17.78	201.70	1.32	120.00	0.00	0.50

17.84	203.80	1.38	120.00	0.00	0.50
17.91	208.90	1.44	120.00	0.00	0.50
17.97	215.00	1.48	120.00	0.00	0.50
18.04	219.30	1.53	120.00	0.00	0.50
18.11	222.00	1.59	120.00	0.00	0.50
18.17	225.30	1.64	120.00	0.00	0.50
18.24	228.40	1.65	120.00	0.00	0.50
18.30	229.50	1.68	120.00	0.00	0.50
18.37	232.50	1.68	120.00	0.00	0.50
18.43	236.00	1.69	120.00	0.00	0.50
18.50	236.30	1.69	120.00	0.00	0.50
18.56	237.50	1.69	120.00	0.00	0.50
18.63	237.70	1.68	120.00	0.00	0.50
18.70	237.40	1.57	120.00	0.00	0.50
18.76	238.20	1.57	120.00	0.00	0.50
18.83	240.00	1.61	120.00	0.00	0.50
18.89	241.00	1.64	120.00	0.00	0.50
18.96	239.10	1.64	120.00	0.00	0.50
19.02	235.50	1.65	120.00	0.00	0.50
19.09	233.50	1.65	120.00	0.00	0.50
19.16	234.40	1.63	120.00	0.00	0.50
19.22	236.70	1.64	120.00	0.00	0.50
19.29	239.60	1.67	120.00	0.00	0.50
19.35	243.50	1.70	120.00	0.00	0.50
19.42	249.10	1.72	120.00	0.00	0.50
19.48	249.80	1.72	120.00	0.00	0.50
19.55	250.20	1.71	120.00	0.00	0.50
19.61	251.50	1.71	120.00	0.00	0.50
19.68	252.60	1.70	120.00	0.00	0.50
19.75	253.50	1.66	120.00	0.00	0.50
19.81	254.20	1.61	120.00	0.00	0.50
19.88	255.10	1.58	120.00	0.00	0.50
19.94	258.10	1.55	120.00	0.00	0.50
20.01	261.60	1.52	120.00	0.00	0.50
20.07	265.00	1.47	120.00	0.00	0.50
20.14	264.80	1.45	120.00	0.00	0.50
20.20	264.40	1.45	120.00	0.00	0.50
20.27	263.30	1.45	120.00	0.00	0.50
20.34	261.40	1.46	120.00	0.00	0.50
20.40	258.60	1.44	120.00	0.00	0.50
20.47	260.90	1.47	120.00	0.00	0.50
20.53	266.30	1.57	120.00	0.00	0.50
20.60	272.60	1.66	120.00	0.00	0.50
20.66	275.90	1.91	120.00	0.00	0.50
20.73	275.20	1.98	120.00	0.00	0.50
20.80	270.30	1.93	120.00	0.00	0.50
20.86	262.20	1.88	120.00	0.00	0.50
20.93	259.00	1.80	120.00	0.00	0.50
20.99	250.80	1.65	120.00	0.00	0.50
21.06	240.50	1.50	120.00	0.00	0.50
21.12	233.70	1.47	120.00	0.00	0.50
21.19	227.20	1.45	120.00	0.00	0.50
21.25	224.20	1.42	120.00	0.00	0.50
21.32	218.30	1.41	120.00	0.00	0.50
21.39	212.90	1.39	120.00	0.00	0.50
21.45	206.60	1.40	120.00	0.00	0.50
21.52	199.30	1.38	120.00	0.00	0.50
21.58	191.90	1.38	120.00	0.00	0.50
21.65	184.20	1.35	120.00	0.00	0.50
21.71	179.90	1.27	120.00	0.00	0.50
21.78	179.60	1.13	120.00	0.00	0.50
21.85	182.90	1.21	120.00	0.00	0.50
21.91	191.00	1.27	120.00	0.00	0.50
21.98	200.70	1.32	120.00	0.00	0.50
22.04	209.10	1.35	120.00	0.00	0.50
22.11	213.70	1.35	120.00	0.00	0.50
22.17	220.30	1.32	120.00	0.00	0.50
22.24	225.20	1.37	120.00	0.00	0.50
22.30	229.50	1.39	120.00	0.00	0.50
22.37	236.20	1.39	120.00	0.00	0.50
22.44	246.60	1.38	120.00	0.00	0.50
22.50	252.20	1.38	120.00	0.00	0.50
22.57	256.50	1.44	120.00	0.00	0.50
22.63	260.90	1.44	120.00	0.00	0.50
22.70	265.30	1.44	120.00	0.00	0.50
22.76	267.70	1.44	120.00	0.00	0.50
22.83	266.00	1.44	120.00	0.00	0.50
22.90	266.20	1.48	120.00	0.00	0.50
22.96	267.70	1.54	120.00	0.00	0.50
23.03	269.40	1.55	120.00	0.00	0.50
23.09	270.60	1.56	120.00	0.00	0.50
23.16	273.40	1.60	120.00	0.00	0.50
23.22	274.40	1.67	120.00	0.00	0.50
23.29	277.90	1.69	120.00	0.00	0.50
23.35	283.80	1.67	120.00	0.00	0.50
23.42	290.00	1.65	120.00	0.00	0.50
23.49	293.40	1.66	120.00	0.00	0.50
23.55	297.50	1.69	120.00	0.00	0.50
23.62	304.20	1.73	120.00	0.00	0.50
23.68	309.90	1.79	120.00	0.00	0.50
23.75	314.60	1.76	120.00	0.00	0.50
23.81	319.60	1.88	120.00	0.00	0.50
23.88	324.90	2.45	120.00	0.00	0.50
23.95	327.70	3.25	120.00	0.00	0.50
24.01	333.60	2.88	120.00	0.00	0.50
24.08	341.60	2.91	120.00	0.00	0.50
24.14	354.70	2.56	120.00	0.00	0.50
24.21	378.60	2.62	120.00	0.00	0.50
24.27	434.20	2.73	120.00	0.00	0.50
24.34	359.40	2.77	120.00	0.00	0.50
24.40	347.20	2.78	120.00	0.00	0.50
24.47	329.60	2.85	120.00	0.00	0.50
24.54	319.90	2.75	120.00	0.00	0.50
24.60	324.60	2.61	120.00	0.00	0.50
24.67	320.00	2.44	120.00	0.00	0.50
24.73	321.00	2.27	120.00	0.00	0.50
24.80	319.10	2.16	120.00	0.00	0.50
24.86	314.00	2.14	120.00	0.00	0.50
24.93	310.90	2.20	120.00	0.00	0.50
25.00	311.90	2.13	120.00	0.00	0.50
25.06	299.60	2.26	120.00	0.00	0.50
25.13	294.30	2.05	120.00	0.00	0.50
25.19	292.70	2.01	120.00	0.00	0.50
25.26	280.00	1.88	120.00	0.00	0.50
25.32	282.70	1.85	120.00	0.00	0.50
25.39	286.20	1.84	120.00	0.00	0.50
25.45	290.50	1.82	120.00	0.00	0.50
25.52	291.30	1.94	120.00	0.00	0.50
25.59	286.40	2.10	120.00	0.00	0.50
25.65	284.30	2.21	120.00	0.00	0.50

25.72	288.20	2.26	120.00	0.00	0.50
25.78	295.20	2.15	120.00	0.00	0.50
25.85	302.10	2.44	120.00	0.00	0.50
25.91	305.80	2.55	120.00	0.00	0.50
25.98	316.50	2.80	120.00	0.00	0.50
26.04	302.90	2.86	120.00	0.00	0.50
26.11	315.00	2.77	120.00	0.00	0.50
26.18	310.20	2.55	120.00	0.00	0.50
26.24	300.30	2.46	120.00	0.00	0.50
26.31	300.00	2.44	120.00	0.00	0.50
26.37	298.40	2.41	120.00	0.00	0.50
26.44	297.40	2.31	120.00	0.00	0.50
26.50	294.60	2.17	120.00	0.00	0.50
26.57	289.20	2.07	120.00	0.00	0.50
26.64	285.50	1.96	120.00	0.00	0.50
26.70	286.50	1.80	120.00	0.00	0.50
26.77	289.00	1.93	120.00	0.00	0.50
26.83	270.40	1.97	120.00	0.00	0.50
26.90	271.40	1.95	120.00	0.00	0.50
26.96	268.30	1.91	120.00	0.00	0.50
27.03	257.70	1.79	120.00	0.00	0.50
27.09	249.20	1.68	120.00	0.00	0.50
27.16	246.20	1.64	120.00	0.00	0.50
27.23	246.30	1.61	120.00	0.00	0.50
27.29	246.90	1.56	120.00	0.00	0.50
27.36	245.60	1.61	120.00	0.00	0.50
27.42	240.90	1.65	120.00	0.00	0.50
27.49	238.60	1.70	120.00	0.00	0.50
27.55	238.50	1.70	120.00	0.00	0.50
27.62	240.50	1.69	120.00	0.00	0.50
27.69	240.20	1.73	120.00	0.00	0.50
27.75	238.60	2.00	120.00	0.00	0.50
27.82	238.60	2.49	120.00	0.00	0.50
27.88	241.60	2.77	120.00	0.00	0.50
27.95	247.90	2.60	120.00	0.00	0.50
28.01	256.10	2.10	120.00	0.00	0.50
28.08	266.00	2.03	120.00	0.00	0.50
28.14	279.10	3.36	120.00	0.00	0.50
28.21	290.40	3.65	120.00	0.00	0.50
28.28	292.00	3.72	120.00	0.00	0.50
28.34	282.10	3.97	120.00	0.00	0.50
28.41	264.20	4.20	120.00	0.00	0.50
28.47	253.40	4.21	120.00	0.00	0.50
28.54	248.50	3.50	120.00	0.00	0.50
28.60	249.30	2.83	120.00	0.00	0.50
28.67	250.50	2.39	120.00	0.00	0.50
28.74	247.20	1.77	120.00	0.00	0.50
28.80	240.80	1.61	120.00	0.00	0.50
28.87	234.80	1.53	120.00	0.00	0.50
28.93	230.20	1.47	120.00	0.00	0.50
29.00	226.70	1.42	120.00	0.00	0.50
29.06	220.90	1.39	120.00	0.00	0.50
29.13	217.20	1.40	120.00	0.00	0.50
29.19	211.70	1.40	120.00	0.00	0.50
29.26	206.50	1.39	120.00	0.00	0.50
29.33	204.60	1.41	120.00	0.00	0.50
29.39	205.10	1.43	120.00	0.00	0.50
29.46	206.90	1.42	120.00	0.00	0.50
29.52	208.70	1.44	120.00	0.00	0.50
29.59	209.30	1.45	120.00	0.00	0.50
29.65	210.50	1.49	120.00	0.00	0.50
29.72	213.80	1.52	120.00	0.00	0.50
29.79	215.60	1.57	120.00	0.00	0.50
29.85	216.90	1.63	120.00	0.00	0.50
29.92	218.70	1.69	120.00	0.00	0.50
29.98	219.80	1.74	120.00	0.00	0.50
30.05	221.50	1.77	120.00	0.00	0.50
30.11	222.40	1.80	120.00	0.00	0.50
30.18	221.90	1.81	120.00	0.00	0.50
30.24	220.40	1.80	120.00	0.00	0.50
30.31	220.30	1.78	120.00	0.00	0.50
30.38	220.90	1.78	120.00	0.00	0.50
30.44	220.80	1.74	120.00	0.00	0.50
30.51	222.70	1.74	120.00	0.00	0.50
30.57	222.10	1.73	120.00	0.00	0.50
30.64	220.20	1.75	120.00	0.00	0.50
30.70	220.40	1.80	120.00	0.00	0.50
30.77	220.30	1.83	120.00	0.00	0.50
30.83	221.80	1.87	120.00	0.00	0.50
30.90	226.90	1.90	120.00	0.00	0.50
30.97	231.90	1.94	120.00	0.00	0.50
31.03	237.00	1.99	120.00	0.00	0.50
31.10	243.80	2.08	120.00	0.00	0.50
31.16	249.10	2.19	120.00	0.00	0.50
31.23	253.80	2.04	120.00	0.00	0.50
31.29	258.50	1.83	120.00	0.00	0.50
31.36	260.50	1.98	120.00	0.00	0.50
31.43	263.10	2.12	120.00	0.00	0.50
31.49	265.60	2.24	120.00	0.00	0.50
31.56	265.80	2.26	120.00	0.00	0.50
31.62	260.70	2.22	120.00	0.00	0.50
31.69	262.70	2.16	120.00	0.00	0.50
31.75	257.20	2.10	120.00	0.00	0.50
31.82	255.60	2.09	120.00	0.00	0.50
31.88	253.50	2.05	120.00	0.00	0.50
31.95	248.40	2.02	120.00	0.00	0.50
32.02	242.50	2.03	120.00	0.00	0.50
32.08	235.20	2.03	120.00	0.00	0.50
32.15	231.10	2.04	120.00	0.00	0.50
32.21	228.00	2.06	120.00	0.00	0.50
32.28	224.00	2.05	120.00	0.00	0.50
32.34	221.20	2.05	120.00	0.00	0.50
32.41	217.50	2.05	120.00	0.00	0.50
32.48	213.40	2.04	120.00	0.00	0.50
32.54	212.00	2.03	120.00	0.00	0.50
32.61	210.10	2.02	120.00	0.00	0.50
32.67	207.00	2.02	120.00	0.00	0.50
32.74	205.30	2.03	120.00	0.00	0.50
32.80	201.50	2.02	120.00	0.00	0.50
32.87	198.30	2.04	120.00	0.00	0.50
32.93	195.70	2.05	120.00	0.00	0.50
33.00	192.20	2.01	120.00	0.00	0.50
33.07	190.70	1.98	120.00	0.00	0.50
33.13	188.80	1.93	120.00	0.00	0.50
33.20	186.70	1.91	120.00	0.00	0.50
33.26	187.10	1.89	120.00	0.00	0.50
33.33	186.60	1.92	120.00	0.00	0.50
33.39	185.50	1.87	120.00	0.00	0.50
33.46	183.90	1.89	120.00	0.00	0.50
33.53	185.50	1.88	120.00	0.00	0.50

33.59	186.30	1.86	120.00	0.00	0.50
33.66	190.60	1.89	120.00	0.00	0.50
33.72	190.20	1.92	120.00	0.00	0.50
33.79	193.00	1.97	120.00	0.00	0.50
33.85	192.90	1.98	120.00	0.00	0.50
33.92	188.80	2.00	120.00	0.00	0.50
33.98	185.00	2.00	120.00	0.00	0.50
34.05	180.30	1.91	120.00	0.00	0.50
34.12	176.20	1.83	120.00	0.00	0.50
34.18	170.00	1.73	120.00	0.00	0.50
34.25	162.60	1.62	120.00	0.00	0.50
34.31	160.30	1.29	120.00	0.00	0.50
34.38	150.90	1.06	120.00	0.00	0.50
34.44	143.10	1.01	120.00	0.00	0.50
34.51	133.00	0.97	120.00	0.00	0.50
34.58	122.50	0.90	120.00	0.00	0.50
34.64	108.50	0.83	120.00	0.00	0.50
34.71	92.60	0.75	120.00	0.00	0.50
34.77	84.80	0.68	120.00	0.00	0.50
34.84	73.90	0.63	120.00	0.00	0.50
34.90	65.50	0.60	120.00	0.00	0.50
34.97	57.70	0.59	120.00	0.00	0.50
35.03	50.70	0.59	120.00	0.00	0.50
35.10	46.00	0.58	120.00	0.00	0.50
35.17	41.60	0.59	120.00	0.00	0.50
35.23	37.90	0.61	120.00	0.00	0.50
35.30	35.50	0.63	120.00	0.00	0.50
35.36	33.00	0.67	120.00	0.00	0.50
35.43	29.90	0.73	120.00	0.00	0.50
35.49	27.00	0.75	120.00	0.00	0.50
35.56	24.30	0.76	120.00	0.00	0.50
35.62	22.20	0.74	120.00	0.00	0.50
35.69	21.20	0.72	120.00	0.00	0.50
35.76	20.30	0.67	120.00	0.00	0.50
35.82	20.10	0.60	120.00	0.00	0.50
35.89	20.30	0.53	120.00	0.00	0.50
35.95	19.90	0.51	120.00	0.00	0.50
36.02	19.70	0.52	120.00	0.00	0.50
36.08	20.90	0.54	120.00	0.00	0.50
36.15	20.30	0.55	120.00	0.00	0.50
36.22	20.30	0.57	120.00	0.00	0.50
36.28	21.10	0.61	120.00	0.00	0.50
36.35	25.40	0.66	120.00	0.00	0.50
36.41	34.70	0.73	120.00	0.00	0.50
36.48	62.50	0.82	120.00	0.00	0.50
36.54	95.90	0.93	120.00	0.00	0.50
36.61	134.10	1.08	120.00	0.00	0.50
36.67	164.60	1.27	120.00	0.00	0.50
36.74	192.90	1.47	120.00	0.00	0.50
36.81	214.00	1.70	120.00	0.00	0.50
36.87	228.40	1.95	120.00	0.00	0.50
36.94	234.60	2.21	120.00	0.00	0.50
37.00	238.90	2.47	120.00	0.00	0.50
37.07	241.30	2.65	120.00	0.00	0.50
37.13	238.30	2.78	120.00	0.00	0.50
37.20	235.40	2.88	120.00	0.00	0.50
37.27	233.60	2.96	120.00	0.00	0.50
37.33	235.20	3.00	120.00	0.00	0.50
37.40	241.00	3.02	120.00	0.00	0.50
37.46	249.60	2.99	120.00	0.00	0.50
37.53	261.70	2.94	120.00	0.00	0.50
37.59	273.60	2.93	120.00	0.00	0.50
37.66	283.70	2.96	120.00	0.00	0.50
37.72	291.60	2.40	120.00	0.00	0.50
37.79	293.80	2.41	120.00	0.00	0.50
37.86	295.30	2.39	120.00	0.00	0.50
37.92	295.80	2.36	120.00	0.00	0.50
37.99	291.70	2.33	120.00	0.00	0.50
38.05	281.60	2.29	120.00	0.00	0.50
38.12	280.80	2.24	120.00	0.00	0.50
38.18	280.70	2.16	120.00	0.00	0.50
38.25	279.50	2.09	120.00	0.00	0.50
38.32	278.20	2.06	120.00	0.00	0.50
38.38	273.40	2.06	120.00	0.00	0.50
38.45	272.30	2.12	120.00	0.00	0.50
38.51	270.50	2.24	120.00	0.00	0.50
38.58	267.00	2.40	120.00	0.00	0.50
38.64	262.10	2.56	120.00	0.00	0.50
38.71	260.70	2.73	120.00	0.00	0.50
38.77	257.90	2.84	120.00	0.00	0.50
38.84	256.40	2.88	120.00	0.00	0.50
38.91	256.20	2.87	120.00	0.00	0.50
38.97	257.10	2.82	120.00	0.00	0.50
39.04	256.20	2.77	120.00	0.00	0.50
39.10	256.40	2.73	120.00	0.00	0.50
39.17	257.60	2.70	120.00	0.00	0.50
39.23	259.30	2.69	120.00	0.00	0.50
39.30	261.20	2.69	120.00	0.00	0.50
39.37	261.80	2.68	120.00	0.00	0.50
39.43	261.50	2.67	120.00	0.00	0.50
39.50	263.40	2.66	120.00	0.00	0.50
39.56	266.10	2.67	120.00	0.00	0.50
39.63	269.50	2.68	120.00	0.00	0.50
39.69	273.50	2.65	120.00	0.00	0.50
39.76	278.00	2.56	120.00	0.00	0.50
39.82	282.70	2.43	120.00	0.00	0.50
39.89	288.10	2.29	120.00	0.00	0.50
39.96	295.80	2.17	120.00	0.00	0.50
40.02	303.60	2.05	120.00	0.00	0.50
40.09	309.90	1.93	120.00	0.00	0.50
40.15	313.80	1.86	120.00	0.00	0.50
40.22	317.40	1.82	120.00	0.00	0.50
40.28	320.70	1.82	120.00	0.00	0.50
40.35	323.00	1.86	120.00	0.00	0.50
40.41	322.80	1.84	120.00	0.00	0.50
40.48	322.40	1.77	120.00	0.00	0.50
40.55	320.30	1.66	120.00	0.00	0.50
40.61	315.50	1.39	120.00	0.00	0.50
40.68	311.70	1.13	120.00	0.00	0.50
40.74	306.80	1.13	120.00	0.00	0.50
40.81	300.70	1.16	120.00	0.00	0.50
40.87	295.10	1.20	120.00	0.00	0.50
40.94	280.50	1.25	120.00	0.00	0.50
41.01	274.70	1.36	120.00	0.00	0.50
41.07	274.50	1.40	120.00	0.00	0.50
41.14	272.80	1.41	120.00	0.00	0.50
41.20	267.30	1.39	120.00	0.00	0.50
41.27	258.30	1.42	120.00	0.00	0.50
41.33	248.10	1.43	120.00	0.00	0.50
41.40	237.10	1.43	120.00	0.00	0.50

41.46	225.20	1.48	120.00	0.00	0.50
41.53	211.50	1.58	120.00	0.00	0.50
41.60	197.50	1.71	120.00	0.00	0.50
41.66	183.80	1.84	120.00	0.00	0.50
41.73	172.50	1.96	120.00	0.00	0.50
41.79	161.00	2.05	120.00	0.00	0.50
41.86	149.90	2.14	120.00	0.00	0.50
41.92	140.00	2.23	120.00	0.00	0.50
41.99	132.20	2.33	120.00	0.00	0.50
42.06	125.70	2.45	120.00	0.00	0.50
42.12	120.40	2.58	120.00	0.00	0.50
42.19	113.40	2.69	120.00	0.00	0.50
42.25	112.90	2.78	120.00	0.00	0.50
42.32	118.60	2.70	120.00	0.00	0.50
42.38	137.80	2.59	120.00	0.00	0.50
42.45	158.60	2.46	120.00	0.00	0.50
42.51	176.30	2.30	120.00	0.00	0.50
42.58	182.00	1.96	120.00	0.00	0.50
42.65	175.70	1.57	120.00	0.00	0.50
42.71	164.80	1.19	120.00	0.00	0.50
42.78	150.10	1.07	120.00	0.00	0.50
42.84	133.90	1.05	120.00	0.00	0.50
42.91	115.70	1.13	120.00	0.00	0.50
42.97	95.30	1.27	120.00	0.00	0.50
43.04	76.10	1.49	120.00	0.00	0.50
43.11	58.90	1.66	120.00	0.00	0.50
43.17	43.90	1.70	120.00	0.00	0.50
43.24	33.90	1.54	120.00	0.00	0.50
43.30	32.60	1.41	120.00	0.00	0.50
43.37	29.80	1.26	120.00	0.00	0.50
43.43	24.50	1.13	120.00	0.00	0.50
43.50	20.90	1.12	120.00	0.00	0.50
43.56	22.50	1.13	120.00	0.00	0.50
43.63	25.20	1.11	120.00	0.00	0.50
43.70	28.50	1.09	120.00	0.00	0.50
43.76	32.10	1.08	120.00	0.00	0.50
43.83	35.90	1.15	120.00	0.00	0.50
43.89	38.40	1.20	120.00	0.00	0.50
43.96	39.80	1.19	120.00	0.00	0.50
44.02	40.80	1.00	120.00	0.00	0.50
44.09	44.40	1.01	120.00	0.00	0.50
44.16	48.80	1.05	120.00	0.00	0.50
44.22	52.10	1.13	120.00	0.00	0.50
44.29	51.50	1.24	120.00	0.00	0.50
44.35	46.90	1.34	120.00	0.00	0.50
44.42	41.90	1.42	120.00	0.00	0.50
44.48	36.70	1.48	120.00	0.00	0.50
44.55	31.30	1.31	120.00	0.00	0.50
44.61	28.20	1.20	120.00	0.00	0.50
44.68	25.60	1.11	120.00	0.00	0.50
44.75	23.60	1.02	120.00	0.00	0.50
44.81	23.00	0.99	120.00	0.00	0.50
44.88	25.10	0.96	120.00	0.00	0.50
44.94	26.90	0.94	120.00	0.00	0.50
45.01	27.10	1.00	120.00	0.00	0.50
45.07	27.30	1.09	120.00	0.00	0.50
45.14	29.80	1.18	120.00	0.00	0.50
45.20	33.70	1.24	120.00	0.00	0.50
45.27	36.80	1.33	120.00	0.00	0.50
45.34	38.10	1.39	120.00	0.00	0.50
45.40	37.60	1.42	120.00	0.00	0.50
45.47	34.80	1.34	120.00	0.00	0.50
45.53	30.80	1.18	120.00	0.00	0.50
45.60	27.10	1.03	120.00	0.00	0.50
45.66	23.60	0.91	120.00	0.00	0.50
45.73	20.10	0.87	120.00	0.00	0.50
45.80	19.80	0.89	120.00	0.00	0.50
45.86	22.20	0.94	120.00	0.00	0.50
45.93	26.80	1.02	120.00	0.00	0.50
45.99	30.90	1.13	120.00	0.00	0.50
46.06	34.30	1.26	120.00	0.00	0.50
46.12	37.90	1.41	120.00	0.00	0.50
46.19	42.50	1.55	120.00	0.00	0.50
46.25	48.40	1.67	120.00	0.00	0.50
46.32	54.40	1.78	120.00	0.00	0.50
46.39	60.10	1.89	120.00	0.00	0.50
46.45	65.20	1.95	120.00	0.00	0.50
46.52	69.40	2.01	120.00	0.00	0.50
46.58	73.10	2.06	120.00	0.00	0.50
46.65	76.20	2.11	120.00	0.00	0.50
46.71	81.80	2.10	120.00	0.00	0.50
46.78	87.70	2.05	120.00	0.00	0.50
46.85	93.40	1.97	120.00	0.00	0.50
46.91	97.70	1.82	120.00	0.00	0.50
46.98	98.40	1.70	120.00	0.00	0.50
47.04	96.60	1.52	120.00	0.00	0.50
47.11	92.80	1.12	120.00	0.00	0.50
47.17	90.20	1.31	120.00	0.00	0.50
47.24	87.60	1.49	120.00	0.00	0.50
47.30	84.70	1.69	120.00	0.00	0.50
47.37	80.80	1.88	120.00	0.00	0.50
47.44	82.10	1.98	120.00	0.00	0.50
47.50	83.20	1.97	120.00	0.00	0.50
47.57	84.10	1.89	120.00	0.00	0.50
47.63	83.30	1.81	120.00	0.00	0.50
47.70	80.40	1.72	120.00	0.00	0.50
47.76	77.20	1.61	120.00	0.00	0.50
47.83	74.00	1.55	120.00	0.00	0.50
47.90	69.50	1.57	120.00	0.00	0.50
47.96	66.10	1.61	120.00	0.00	0.50
48.03	63.60	1.70	120.00	0.00	0.50
48.09	62.00	1.78	120.00	0.00	0.50
48.16	60.70	1.85	120.00	0.00	0.50
48.22	57.70	1.89	120.00	0.00	0.50
48.29	53.70	1.96	120.00	0.00	0.50
48.35	51.20	1.98	120.00	0.00	0.50
48.42	50.90	1.95	120.00	0.00	0.50
48.49	52.00	1.87	120.00	0.00	0.50
48.55	53.10	1.80	120.00	0.00	0.50
48.62	53.90	1.72	120.00	0.00	0.50
48.68	53.90	1.61	120.00	0.00	0.50
48.75	51.90	1.53	120.00	0.00	0.50
48.81	47.70	1.45	120.00	0.00	0.50
48.88	42.50	1.39	120.00	0.00	0.50
48.95	36.60	1.33	120.00	0.00	0.50
49.01	30.40	1.22	120.00	0.00	0.50
49.08	25.60	1.12	120.00	0.00	0.50
49.14	22.60	1.00	120.00	0.00	0.50
49.21	21.00	0.87	120.00	0.00	0.50
49.27	19.00	0.75	120.00	0.00	0.50

49.34	18.40	0.70	120.00	0.00	0.50
49.40	17.90	0.67	120.00	0.00	0.50
49.47	17.60	0.65	120.00	0.00	0.50
49.54	17.40	0.65	120.00	0.00	0.50
49.60	16.80	0.62	120.00	0.00	0.50
49.67	17.20	0.59	120.00	0.00	0.50
49.73	18.50	0.56	120.00	0.00	0.50
49.80	18.50	0.54	120.00	0.00	0.50
49.86	18.20	0.54	120.00	0.00	0.50
49.93	17.80	0.59	120.00	0.00	0.50
50.00	17.60	0.70	120.00	0.00	0.50
50.06	19.40	0.77	120.00	0.00	0.50
50.13	26.30	0.83	120.00	0.00	0.50
50.19	35.40	0.92	120.00	0.00	0.50
50.26	44.90	1.07	120.00	0.00	0.50
50.32	52.70	1.26	120.00	0.00	0.50
50.39	60.10	1.44	120.00	0.00	0.50
50.45	66.80	1.25	120.00	0.00	0.50
50.52	72.50	1.12	120.00	0.00	0.50
50.59	78.40	1.26	120.00	0.00	0.50
50.65	85.60	1.41	120.00	0.00	0.50
50.72	91.00	1.51	120.00	0.00	0.50
50.78	95.20	1.52	120.00	0.00	0.50
50.85	100.80	1.48	120.00	0.00	0.50
50.91	101.60	1.42	120.00	0.00	0.50
50.98	101.20	1.43	120.00	0.00	0.50
51.04	100.20	1.45	120.00	0.00	0.50
51.11	97.10	1.45	120.00	0.00	0.50
51.18	88.50	1.42	120.00	0.00	0.50
51.24	73.50	1.59	120.00	0.00	0.50
51.31	57.90	1.59	120.00	0.00	0.50
51.37	44.10	1.50	120.00	0.00	0.50
51.44	33.90	1.35	120.00	0.00	0.50
51.50	28.10	1.21	120.00	0.00	0.50
51.57	24.30	1.10	120.00	0.00	0.50
51.64	22.60	1.02	120.00	0.00	0.50
51.70	22.50	0.96	120.00	0.00	0.50
51.77	22.70	0.91	120.00	0.00	0.50
51.83	25.20	0.97	120.00	0.00	0.50
51.90	29.60	1.05	120.00	0.00	0.50
51.96	37.80	1.15	120.00	0.00	0.50
52.03	54.10	1.27	120.00	0.00	0.50
52.09	75.50	1.39	120.00	0.00	0.50
52.16	96.40	1.44	120.00	0.00	0.50
52.23	115.70	1.47	120.00	0.00	0.50
52.29	131.90	1.51	120.00	0.00	0.50
52.36	141.30	1.54	120.00	0.00	0.50
52.42	147.60	1.50	120.00	0.00	0.50
52.49	150.70	1.51	120.00	0.00	0.50
52.55	151.50	1.54	120.00	0.00	0.50
52.62	151.40	1.56	120.00	0.00	0.50
52.69	151.80	1.56	120.00	0.00	0.50
52.75	151.80	1.58	120.00	0.00	0.50
52.82	151.60	1.57	120.00	0.00	0.50
52.88	152.00	1.55	120.00	0.00	0.50
52.95	153.50	1.54	120.00	0.00	0.50
53.01	154.70	1.57	120.00	0.00	0.50
53.08	157.20	1.58	120.00	0.00	0.50
53.14	159.40	1.61	120.00	0.00	0.50
53.21	161.00	1.63	120.00	0.00	0.50
53.28	164.20	1.63	120.00	0.00	0.50
53.34	171.20	1.59	120.00	0.00	0.50
53.41	175.70	1.58	120.00	0.00	0.50
53.47	178.20	1.64	120.00	0.00	0.50
53.54	179.80	1.57	120.00	0.00	0.50
53.60	182.50	1.59	120.00	0.00	0.50
53.67	180.00	1.68	120.00	0.00	0.50
53.74	180.20	1.76	120.00	0.00	0.50
53.80	180.90	1.84	120.00	0.00	0.50
53.87	181.40	1.85	120.00	0.00	0.50
53.93	184.50	1.84	120.00	0.00	0.50
54.00	190.90	1.83	120.00	0.00	0.50
54.06	195.80	1.84	120.00	0.00	0.50
54.13	203.10	1.85	120.00	0.00	0.50
54.19	211.30	1.82	120.00	0.00	0.50
54.26	219.30	1.80	120.00	0.00	0.50
54.33	226.70	1.78	120.00	0.00	0.50
54.39	235.90	1.75	120.00	0.00	0.50
54.46	244.40	1.72	120.00	0.00	0.50
54.52	249.70	1.69	120.00	0.00	0.50
54.59	253.60	1.64	120.00	0.00	0.50
54.65	255.90	1.59	120.00	0.00	0.50
54.72	253.80	1.53	120.00	0.00	0.50
54.79	244.90	1.47	120.00	0.00	0.50
54.85	235.70	1.42	120.00	0.00	0.50
54.92	224.30	1.37	120.00	0.00	0.50
54.98	211.60	1.32	120.00	0.00	0.50
55.05	198.80	1.31	120.00	0.00	0.50
55.11	182.00	1.36	120.00	0.00	0.50
55.18	160.30	1.47	120.00	0.00	0.50
55.24	134.80	1.65	120.00	0.00	0.50
55.31	107.30	1.74	120.00	0.00	0.50
55.38	79.80	1.76	120.00	0.00	0.50
55.44	56.20	1.72	120.00	0.00	0.50
55.51	42.40	1.58	120.00	0.00	0.50
55.57	34.00	1.36	120.00	0.00	0.50
55.64	29.10	1.13	120.00	0.00	0.50
55.70	25.60	0.92	120.00	0.00	0.50
55.77	22.50	0.73	120.00	0.00	0.50
55.83	20.20	0.54	120.00	0.00	0.50
55.90	17.80	0.40	120.00	0.00	0.50
55.97	15.80	0.35	120.00	0.00	0.50
56.03	14.80	0.33	120.00	0.00	0.50
56.10	14.90	0.31	120.00	0.00	0.50
56.16	14.50	0.31	120.00	0.00	0.50
56.23	14.10	0.34	120.00	0.00	0.50
56.29	14.20	0.30	120.00	0.00	0.50
56.36	14.60	0.27	120.00	0.00	0.50
56.43	14.80	0.26	120.00	0.00	0.50
56.49	16.40	0.26	120.00	0.00	0.50
56.56	17.90	0.34	120.00	0.00	0.50
56.62	19.40	0.49	120.00	0.00	0.50
56.69	22.10	0.64	120.00	0.00	0.50
56.75	27.80	0.79	120.00	0.00	0.50
56.82	30.60	1.00	120.00	0.00	0.50
56.88	31.10	1.27	120.00	0.00	0.50
56.95	30.90	1.42	120.00	0.00	0.50
57.02	33.40	1.50	120.00	0.00	0.50
57.08	43.30	1.55	120.00	0.00	0.50
57.15	48.80	1.57	120.00	0.00	0.50

57.21	59.40	1.58	120.00	0.00	0.50
57.28	69.20	1.64	120.00	0.00	0.50
57.34	73.70	1.74	120.00	0.00	0.50
57.41	70.10	1.82	120.00	0.00	0.50
57.48	64.90	1.86	120.00	0.00	0.50
57.54	59.70	1.84	120.00	0.00	0.50
57.61	54.40	1.74	120.00	0.00	0.50
57.67	48.90	1.64	120.00	0.00	0.50
57.74	43.30	1.61	120.00	0.00	0.50
57.80	37.50	1.55	120.00	0.00	0.50
57.87	32.40	1.44	120.00	0.00	0.50
57.93	28.00	1.26	120.00	0.00	0.50
58.00	24.40	1.06	120.00	0.00	0.50
58.07	22.00	0.90	120.00	0.00	0.50
58.13	20.40	0.73	120.00	0.00	0.50
58.20	19.60	0.62	120.00	0.00	0.50
58.26	19.90	0.52	120.00	0.00	0.50
58.33	19.00	0.41	120.00	0.00	0.50
58.39	17.60	0.36	120.00	0.00	0.50
58.46	16.50	0.33	120.00	0.00	0.50
58.53	15.60	0.39	120.00	0.00	0.50
58.59	15.10	0.45	120.00	0.00	0.50
58.66	15.90	0.51	120.00	0.00	0.50
58.72	17.60	0.59	120.00	0.00	0.50
58.79	20.80	0.72	120.00	0.00	0.50
58.85	24.60	0.92	120.00	0.00	0.50
58.92	27.10	0.85	120.00	0.00	0.50
58.98	27.30	0.81	120.00	0.00	0.50
59.05	27.20	0.93	120.00	0.00	0.50
59.12	29.30	1.21	120.00	0.00	0.50
59.18	30.80	1.50	120.00	0.00	0.50
59.25	29.70	1.49	120.00	0.00	0.50
59.31	26.30	1.36	120.00	0.00	0.50
59.38	22.80	1.24	120.00	0.00	0.50
59.44	21.60	1.14	120.00	0.00	0.50
59.51	20.00	1.05	120.00	0.00	0.50
59.58	19.10	0.85	120.00	0.00	0.50
59.64	18.80	0.75	120.00	0.00	0.50
59.71	18.80	0.72	120.00	0.00	0.50
59.77	19.10	0.00	120.00	0.00	0.50
59.84	19.60	0.00	120.00	0.00	0.50
59.90	20.90	0.00	120.00	0.00	0.50
59.97	21.80	0.00	120.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.31 in.
Settlement of Unsaturated Sands=0.25 in.
Total Settlement of Saturated and Unsaturated Sands=0.56 in.
Differential Settlement=0.280 to 0.370 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.34	5.00	0.31	0.25	0.56
5.00	0.37	0.34	5.00	0.31	0.23	0.54
10.00	0.24	0.34	5.00	0.31	0.18	0.49
15.00	0.34	0.33	5.00	0.31	0.09	0.41
20.00	1.80	0.33	5.00	0.31	0.05	0.37
25.00	2.22	0.32	5.00	0.31	0.03	0.34
30.00	0.70	0.32	5.00	0.31	0.00	0.31
35.00	0.14	0.33	0.44*	0.23	0.00	0.23
40.00	0.93	0.33	2.79	0.16	0.00	0.16
45.00	2.00	0.34	5.00	0.12	0.00	0.12
50.00	2.00	0.33	5.00	0.10	0.00	0.10
55.00	0.35	0.33	1.06	0.01	0.00	0.01
60.00	2.00	0.32	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf, Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

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LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: P:\Leighton Consulting\602000\602231.002 SR 57 Phase 2\ENG\Liquefaction\CPT-09-107.liq
Title: SR-57 Northbound Widening/RW No 293
Subtitle: 602231-002
Surface Elev.=175
Hole No.=CPT-09-110
Depth of Hole= 70.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration= 0.48 g
Earthquake Magnitude= 6.60

Input Data:

Surface Elev.=175
Hole No.=CPT-09-110
Depth of Hole=70.00 ft
Water Table during Earthquake= 30.00 ft
Water Table during In-Situ Testing= 41.50 ft
Max. Acceleration=0.48 g
Earthquake Magnitude=6.60
1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.1
Plot one CSR curve (fs1=User)

10. Use Curve Smoothing: No
' Recommended Options
In-Situ Test Data:

Depth ft	qc atm	fs atm	gamma pcf	Fines %	D50 mm
0.00	43.50	0.00	120.00	0.00	0.50
0.13	87.10	0.00	120.00	0.00	0.50
0.20	154.30	0.00	120.00	0.00	0.50
0.26	232.10	0.00	120.00	0.00	0.50
0.33	271.50	2.65	120.00	0.00	0.50
0.39	246.90	2.86	120.00	0.00	0.50
0.46	220.50	3.02	120.00	0.00	0.50
0.52	205.30	3.09	120.00	0.00	0.50
0.59	191.10	3.02	120.00	0.00	0.50
0.66	178.20	2.83	120.00	0.00	0.50
0.72	171.40	2.52	120.00	0.00	0.50
0.79	168.60	2.28	120.00	0.00	0.50
0.85	158.20	2.10	120.00	0.00	0.50
0.92	149.40	2.02	120.00	0.00	0.50
0.98	148.80	1.95	120.00	0.00	0.50
1.05	150.40	1.81	120.00	0.00	0.50
1.12	151.90	1.76	120.00	0.00	0.50
1.18	153.00	1.45	120.00	0.00	0.50
1.25	154.30	1.53	120.00	0.00	0.50
1.31	156.50	1.61	120.00	0.00	0.50
1.38	154.50	1.67	120.00	0.00	0.50
1.44	153.60	1.74	120.00	0.00	0.50
1.51	142.10	1.80	120.00	0.00	0.50
1.57	138.90	1.83	120.00	0.00	0.50
1.64	137.80	1.85	120.00	0.00	0.50
1.71	134.20	1.86	120.00	0.00	0.50
1.77	129.90	1.87	120.00	0.00	0.50
1.84	125.40	1.84	120.00	0.00	0.50
1.90	120.20	1.74	120.00	0.00	0.50
1.97	115.00	1.66	120.00	0.00	0.50
2.03	111.70	1.58	120.00	0.00	0.50
2.10	109.20	1.52	120.00	0.00	0.50
2.16	107.00	1.47	120.00	0.00	0.50
2.23	104.00	1.39	120.00	0.00	0.50
2.30	101.50	1.17	120.00	0.00	0.50
2.36	99.80	1.16	120.00	0.00	0.50
2.43	96.30	1.17	120.00	0.00	0.50
2.49	91.90	1.18	120.00	0.00	0.50
2.56	85.20	1.18	120.00	0.00	0.50
2.62	78.30	1.16	120.00	0.00	0.50
2.69	73.70	1.16	120.00	0.00	0.50
2.76	70.80	1.22	120.00	0.00	0.50
2.82	68.40	1.29	120.00	0.00	0.50
2.89	65.70	1.33	120.00	0.00	0.50
2.95	61.90	1.36	120.00	0.00	0.50
3.02	58.40	1.39	120.00	0.00	0.50
3.08	56.50	1.39	120.00	0.00	0.50
3.15	55.50	1.38	120.00	0.00	0.50
3.21	54.30	1.35	120.00	0.00	0.50
3.28	52.60	1.33	120.00	0.00	0.50
3.35	52.90	1.30	120.00	0.00	0.50
3.41	52.30	1.27	120.00	0.00	0.50
3.48	51.70	1.23	120.00	0.00	0.50
3.54	50.00	1.19	120.00	0.00	0.50
3.61	48.30	1.16	120.00	0.00	0.50
3.67	46.60	1.12	120.00	0.00	0.50
3.74	44.40	1.08	120.00	0.00	0.50
3.81	42.50	1.05	120.00	0.00	0.50
3.87	39.90	1.02	120.00	0.00	0.50
3.94	37.80	1.00	120.00	0.00	0.50
4.00	36.00	0.97	120.00	0.00	0.50
4.07	34.40	0.94	120.00	0.00	0.50
4.13	32.70	0.90	120.00	0.00	0.50
4.20	31.40	0.89	120.00	0.00	0.50
4.26	30.60	0.86	120.00	0.00	0.50
4.33	30.10	0.84	120.00	0.00	0.50
4.40	29.30	0.82	120.00	0.00	0.50
4.46	28.30	0.80	120.00	0.00	0.50
4.53	27.30	0.77	120.00	0.00	0.50
4.59	26.00	0.75	120.00	0.00	0.50
4.66	24.40	0.73	120.00	0.00	0.50
4.72	23.30	0.71	120.00	0.00	0.50
4.79	22.20	0.73	120.00	0.00	0.50
4.86	20.80	0.75	120.00	0.00	0.50
4.92	19.40	0.75	120.00	0.00	0.50
4.99	18.30	0.73	120.00	0.00	0.50
5.05	17.80	0.70	120.00	0.00	0.50
5.12	18.60	0.69	120.00	0.00	0.50
5.18	20.60	0.68	120.00	0.00	0.50
5.25	27.20	0.69	120.00	0.00	0.50
5.31	37.20	0.71	120.00	0.00	0.50
5.38	52.60	0.73	120.00	0.00	0.50
5.45	62.40	0.77	120.00	0.00	0.50
5.51	69.30	0.83	120.00	0.00	0.50
5.58	71.70	0.86	120.00	0.00	0.50
5.64	71.60	0.80	120.00	0.00	0.50
5.71	70.00	0.83	120.00	0.00	0.50
5.77	66.70	0.87	120.00	0.00	0.50
5.84	62.30	0.87	120.00	0.00	0.50
5.91	56.70	0.88	120.00	0.00	0.50
5.97	48.60	0.86	120.00	0.00	0.50
6.04	42.60	0.82	120.00	0.00	0.50
6.10	37.90	0.79	120.00	0.00	0.50
6.17	33.60	0.76	120.00	0.00	0.50
6.23	30.20	0.75	120.00	0.00	0.50
6.30	28.30	0.72	120.00	0.00	0.50
6.36	26.10	0.70	120.00	0.00	0.50
6.43	25.40	0.67	120.00	0.00	0.50
6.50	24.30	0.62	120.00	0.00	0.50
6.56	24.60	0.57	120.00	0.00	0.50
6.63	24.40	0.50	120.00	0.00	0.50
6.69	23.70	0.42	120.00	0.00	0.50
6.76	22.30	0.34	120.00	0.00	0.50
6.82	20.10	0.26	120.00	0.00	0.50
6.89	17.60	0.22	120.00	0.00	0.50
6.95	15.80	0.23	120.00	0.00	0.50
7.02	14.60	0.28	120.00	0.00	0.50
7.09	13.70	0.31	120.00	0.00	0.50
7.15	13.50	0.32	120.00	0.00	0.50
7.22	13.90	0.32	120.00	0.00	0.50
7.28	14.40	0.32	120.00	0.00	0.50
7.35	15.70	0.31	120.00	0.00	0.50
7.41	17.20	0.29	120.00	0.00	0.50
7.48	16.40	0.26	120.00	0.00	0.50

7.55	15.70	0.22	120.00	0.00	0.50
7.61	14.90	0.19	120.00	0.00	0.50
7.68	14.20	0.18	120.00	0.00	0.50
7.74	13.40	0.18	120.00	0.00	0.50
7.81	13.10	0.20	120.00	0.00	0.50
7.87	13.00	0.24	120.00	0.00	0.50
7.94	12.70	0.30	120.00	0.00	0.50
8.01	11.80	0.37	120.00	0.00	0.50
8.07	11.00	0.43	120.00	0.00	0.50
8.14	10.60	0.47	120.00	0.00	0.50
8.20	9.70	0.47	120.00	0.00	0.50
8.27	9.20	0.45	120.00	0.00	0.50
8.33	9.50	0.44	120.00	0.00	0.50
8.40	11.70	0.43	120.00	0.00	0.50
8.46	16.90	0.41	120.00	0.00	0.50
8.53	25.20	0.41	120.00	0.00	0.50
8.60	34.30	0.42	120.00	0.00	0.50
8.66	45.00	0.41	120.00	0.00	0.50
8.73	55.40	0.36	120.00	0.00	0.50
8.79	66.60	0.32	120.00	0.00	0.50
8.86	78.60	0.34	120.00	0.00	0.50
8.92	89.50	0.40	120.00	0.00	0.50
8.99	98.30	0.44	120.00	0.00	0.50
9.06	100.40	0.47	120.00	0.00	0.50
9.12	84.80	0.48	120.00	0.00	0.50
9.19	102.90	0.49	120.00	0.00	0.50
9.25	110.80	0.52	120.00	0.00	0.50
9.32	112.00	0.52	120.00	0.00	0.50
9.38	113.50	0.53	120.00	0.00	0.50
9.45	116.90	0.51	120.00	0.00	0.50
9.51	119.20	0.51	120.00	0.00	0.50
9.58	123.30	0.52	120.00	0.00	0.50
9.65	125.00	0.56	120.00	0.00	0.50
9.71	125.30	0.58	120.00	0.00	0.50
9.78	125.10	0.58	120.00	0.00	0.50
9.84	124.80	0.59	120.00	0.00	0.50
9.91	124.00	0.60	120.00	0.00	0.50
9.97	123.30	0.59	120.00	0.00	0.50
10.03	123.70	0.60	120.00	0.00	0.50
10.10	125.20	0.64	120.00	0.00	0.50
10.17	128.90	0.64	120.00	0.00	0.50
10.23	132.00	0.65	120.00	0.00	0.50
10.30	134.90	0.68	120.00	0.00	0.50
10.36	137.60	0.74	120.00	0.00	0.50
10.43	139.50	0.79	120.00	0.00	0.50
10.49	141.40	0.81	120.00	0.00	0.50
10.56	142.50	0.81	120.00	0.00	0.50
10.62	142.50	0.76	120.00	0.00	0.50
10.69	145.90	0.91	120.00	0.00	0.50
10.76	145.10	0.93	120.00	0.00	0.50
10.82	145.80	0.92	120.00	0.00	0.50
10.89	146.20	0.92	120.00	0.00	0.50
10.95	145.40	0.90	120.00	0.00	0.50
11.02	147.40	0.87	120.00	0.00	0.50
11.08	151.40	0.86	120.00	0.00	0.50
11.15	155.40	0.87	120.00	0.00	0.50
11.22	161.20	0.86	120.00	0.00	0.50
11.28	165.00	0.90	120.00	0.00	0.50
11.35	167.70	0.95	120.00	0.00	0.50
11.41	168.80	1.00	120.00	0.00	0.50
11.48	168.80	1.06	120.00	0.00	0.50
11.54	167.80	1.11	120.00	0.00	0.50
11.61	167.30	1.12	120.00	0.00	0.50
11.67	168.90	1.16	120.00	0.00	0.50
11.74	171.30	1.16	120.00	0.00	0.50
11.81	170.00	1.17	120.00	0.00	0.50
11.87	171.30	1.17	120.00	0.00	0.50
11.94	172.50	1.18	120.00	0.00	0.50
12.00	176.10	1.18	120.00	0.00	0.50
12.07	177.50	1.11	120.00	0.00	0.50
12.13	177.80	0.94	120.00	0.00	0.50
12.20	177.70	1.00	120.00	0.00	0.50
12.27	176.60	1.01	120.00	0.00	0.50
12.33	173.80	1.02	120.00	0.00	0.50
12.40	166.80	0.99	120.00	0.00	0.50
12.46	155.70	0.93	120.00	0.00	0.50
12.53	152.70	0.87	120.00	0.00	0.50
12.59	153.60	0.81	120.00	0.00	0.50
12.66	154.50	0.74	120.00	0.00	0.50
12.72	155.20	0.72	120.00	0.00	0.50
12.79	155.60	0.73	120.00	0.00	0.50
12.86	156.30	0.75	120.00	0.00	0.50
12.92	154.30	0.73	120.00	0.00	0.50
12.99	150.90	0.75	120.00	0.00	0.50
13.05	146.70	0.75	120.00	0.00	0.50
13.12	147.70	0.75	120.00	0.00	0.50
13.18	149.30	0.78	120.00	0.00	0.50
13.25	148.80	0.79	120.00	0.00	0.50
13.32	149.60	0.76	120.00	0.00	0.50
13.38	152.50	0.78	120.00	0.00	0.50
13.45	155.60	0.78	120.00	0.00	0.50
13.51	160.40	0.79	120.00	0.00	0.50
13.58	165.30	0.75	120.00	0.00	0.50
13.64	163.30	0.70	120.00	0.00	0.50
13.71	168.50	0.67	120.00	0.00	0.50
13.77	171.90	0.68	120.00	0.00	0.50
13.84	173.80	0.69	120.00	0.00	0.50
13.91	177.20	0.67	120.00	0.00	0.50
13.97	180.40	0.69	120.00	0.00	0.50
14.04	180.30	0.71	120.00	0.00	0.50
14.10	180.40	0.68	120.00	0.00	0.50
14.17	180.80	0.71	120.00	0.00	0.50
14.23	173.50	0.73	120.00	0.00	0.50
14.30	175.80	0.75	120.00	0.00	0.50
14.37	174.90	0.79	120.00	0.00	0.50
14.43	170.70	0.85	120.00	0.00	0.50
14.50	169.30	0.88	120.00	0.00	0.50
14.56	169.80	0.85	120.00	0.00	0.50
14.63	167.80	0.86	120.00	0.00	0.50
14.69	163.80	0.80	120.00	0.00	0.50
14.76	163.60	0.79	120.00	0.00	0.50
14.82	160.50	0.77	120.00	0.00	0.50
14.89	156.30	0.71	120.00	0.00	0.50
14.96	159.50	0.67	120.00	0.00	0.50
15.02	162.60	0.61	120.00	0.00	0.50
15.09	167.70	0.53	120.00	0.00	0.50
15.15	174.30	0.59	120.00	0.00	0.50
15.22	179.40	0.68	120.00	0.00	0.50
15.28	183.70	0.84	120.00	0.00	0.50
15.35	186.50	0.80	120.00	0.00	0.50

15.41	185.50	0.96	120.00	0.00	0.50
15.48	184.70	1.08	120.00	0.00	0.50
15.55	190.10	1.17	120.00	0.00	0.50
15.61	192.50	1.27	120.00	0.00	0.50
15.68	192.20	1.42	120.00	0.00	0.50
15.74	191.10	1.62	120.00	0.00	0.50
15.81	191.80	1.82	120.00	0.00	0.50
15.87	194.10	1.98	120.00	0.00	0.50
15.94	195.80	2.05	120.00	0.00	0.50
16.01	197.20	2.13	120.00	0.00	0.50
16.07	201.60	2.15	120.00	0.00	0.50
16.14	206.50	2.13	120.00	0.00	0.50
16.20	212.00	2.11	120.00	0.00	0.50
16.27	217.50	2.10	120.00	0.00	0.50
16.33	222.00	2.09	120.00	0.00	0.50
16.40	225.60	2.10	120.00	0.00	0.50
16.46	225.40	2.10	120.00	0.00	0.50
16.53	224.00	2.09	120.00	0.00	0.50
16.60	223.00	2.05	120.00	0.00	0.50
16.66	223.00	1.98	120.00	0.00	0.50
16.73	225.70	1.90	120.00	0.00	0.50
16.79	230.90	1.88	120.00	0.00	0.50
16.86	236.50	1.85	120.00	0.00	0.50
16.92	241.60	1.78	120.00	0.00	0.50
16.99	243.50	1.75	120.00	0.00	0.50
17.06	241.80	1.75	120.00	0.00	0.50
17.12	243.50	1.77	120.00	0.00	0.50
17.19	246.00	1.76	120.00	0.00	0.50
17.25	247.20	1.74	120.00	0.00	0.50
17.32	246.40	1.74	120.00	0.00	0.50
17.38	244.70	1.72	120.00	0.00	0.50
17.45	240.90	1.71	120.00	0.00	0.50
17.51	235.80	1.72	120.00	0.00	0.50
17.58	234.90	1.67	120.00	0.00	0.50
17.65	235.90	1.62	120.00	0.00	0.50
17.71	232.40	1.59	120.00	0.00	0.50
17.78	234.00	1.54	120.00	0.00	0.50
17.84	237.20	1.50	120.00	0.00	0.50
17.91	239.40	1.50	120.00	0.00	0.50
17.97	240.70	1.52	120.00	0.00	0.50
18.04	241.00	1.53	120.00	0.00	0.50
18.11	238.90	1.54	120.00	0.00	0.50
18.17	235.30	1.55	120.00	0.00	0.50
18.24	230.40	1.61	120.00	0.00	0.50
18.30	224.10	1.82	120.00	0.00	0.50
18.37	220.50	0.96	120.00	0.00	0.50
18.43	222.10	0.94	120.00	0.00	0.50
18.50	227.30	1.20	120.00	0.00	0.50
18.56	243.20	1.55	120.00	0.00	0.50
18.63	246.70	2.02	120.00	0.00	0.50
18.70	221.70	2.33	120.00	0.00	0.50
18.76	211.30	2.44	120.00	0.00	0.50
18.83	229.40	2.60	120.00	0.00	0.50
18.89	242.70	2.65	120.00	0.00	0.50
18.96	236.80	2.57	120.00	0.00	0.50
19.02	242.10	2.57	120.00	0.00	0.50
19.09	244.50	2.43	120.00	0.00	0.50
19.16	245.20	2.01	120.00	0.00	0.50
19.22	246.40	1.75	120.00	0.00	0.50
19.29	249.30	1.67	120.00	0.00	0.50
19.35	251.80	1.63	120.00	0.00	0.50
19.42	254.90	1.62	120.00	0.00	0.50
19.48	258.40	1.63	120.00	0.00	0.50
19.55	264.00	1.60	120.00	0.00	0.50
19.61	270.50	1.58	120.00	0.00	0.50
19.68	271.90	1.65	120.00	0.00	0.50
19.75	267.40	1.74	120.00	0.00	0.50
19.81	266.20	1.78	120.00	0.00	0.50
19.88	265.40	1.78	120.00	0.00	0.50
19.94	264.70	1.78	120.00	0.00	0.50
20.01	262.70	1.77	120.00	0.00	0.50
20.07	257.70	1.76	120.00	0.00	0.50
20.14	253.40	1.76	120.00	0.00	0.50
20.20	250.60	1.71	120.00	0.00	0.50
20.27	245.40	1.69	120.00	0.00	0.50
20.34	242.10	1.65	120.00	0.00	0.50
20.40	240.80	1.61	120.00	0.00	0.50
20.47	240.80	1.57	120.00	0.00	0.50
20.53	237.50	1.53	120.00	0.00	0.50
20.60	237.60	1.58	120.00	0.00	0.50
20.66	240.70	1.70	120.00	0.00	0.50
20.73	242.50	1.78	120.00	0.00	0.50
20.80	246.70	1.86	120.00	0.00	0.50
20.86	252.10	1.96	120.00	0.00	0.50
20.93	257.40	2.09	120.00	0.00	0.50
20.99	261.60	2.23	120.00	0.00	0.50
21.06	263.50	2.34	120.00	0.00	0.50
21.12	264.80	2.44	120.00	0.00	0.50
21.19	265.80	2.52	120.00	0.00	0.50
21.25	263.70	2.53	120.00	0.00	0.50
21.32	259.80	2.41	120.00	0.00	0.50
21.39	255.70	2.31	120.00	0.00	0.50
21.45	249.20	2.31	120.00	0.00	0.50
21.52	242.00	2.20	120.00	0.00	0.50
21.58	233.40	2.05	120.00	0.00	0.50
21.65	218.40	1.89	120.00	0.00	0.50
21.71	194.60	1.70	120.00	0.00	0.50
21.78	186.80	1.55	120.00	0.00	0.50
21.85	168.90	1.42	120.00	0.00	0.50
21.91	150.30	1.30	120.00	0.00	0.50
21.98	134.70	1.21	120.00	0.00	0.50
22.04	119.20	1.13	120.00	0.00	0.50
22.11	106.70	1.07	120.00	0.00	0.50
22.17	97.20	1.03	120.00	0.00	0.50
22.24	89.20	1.01	120.00	0.00	0.50
22.30	82.50	1.05	120.00	0.00	0.50
22.37	76.00	1.06	120.00	0.00	0.50
22.44	69.10	1.06	120.00	0.00	0.50
22.50	64.90	1.05	120.00	0.00	0.50
22.57	62.10	1.01	120.00	0.00	0.50
22.63	59.90	0.98	120.00	0.00	0.50
22.70	58.00	0.95	120.00	0.00	0.50
22.76	56.30	0.93	120.00	0.00	0.50
22.83	54.70	0.89	120.00	0.00	0.50
22.90	53.20	0.86	120.00	0.00	0.50
22.96	52.10	0.84	120.00	0.00	0.50
23.03	50.60	0.81	120.00	0.00	0.50
23.09	50.30	0.76	120.00	0.00	0.50
23.16	48.50	0.73	120.00	0.00	0.50
23.22	47.00	0.70	120.00	0.00	0.50

23.29	47.00	0.66	120.00	0.00	0.50
23.35	47.00	0.63	120.00	0.00	0.50
23.42	45.90	0.61	120.00	0.00	0.50
23.49	45.30	0.59	120.00	0.00	0.50
23.55	45.80	0.61	120.00	0.00	0.50
23.62	45.20	0.62	120.00	0.00	0.50
23.68	45.20	0.63	120.00	0.00	0.50
23.75	44.80	0.62	120.00	0.00	0.50
23.81	44.60	0.64	120.00	0.00	0.50
23.88	44.90	0.66	120.00	0.00	0.50
23.95	45.00	0.67	120.00	0.00	0.50
24.01	44.60	0.67	120.00	0.00	0.50
24.08	43.60	0.65	120.00	0.00	0.50
24.14	43.40	0.65	120.00	0.00	0.50
24.21	44.40	0.65	120.00	0.00	0.50
24.27	45.10	0.63	120.00	0.00	0.50
24.34	45.90	0.63	120.00	0.00	0.50
24.40	46.80	0.63	120.00	0.00	0.50
24.47	47.30	0.63	120.00	0.00	0.50
24.54	48.80	0.64	120.00	0.00	0.50
24.60	48.70	0.63	120.00	0.00	0.50
24.67	48.40	0.61	120.00	0.00	0.50
24.73	48.20	0.62	120.00	0.00	0.50
24.80	48.10	0.64	120.00	0.00	0.50
24.86	48.20	0.66	120.00	0.00	0.50
24.93	48.40	0.67	120.00	0.00	0.50
25.00	47.90	0.67	120.00	0.00	0.50
25.06	48.80	0.68	120.00	0.00	0.50
25.13	50.90	0.72	120.00	0.00	0.50
25.19	53.60	0.78	120.00	0.00	0.50
25.26	56.40	0.82	120.00	0.00	0.50
25.32	59.30	0.85	120.00	0.00	0.50
25.39	62.10	0.88	120.00	0.00	0.50
25.45	66.20	0.91	120.00	0.00	0.50
25.52	70.80	0.97	120.00	0.00	0.50
25.59	75.80	1.00	120.00	0.00	0.50
25.65	81.00	1.02	120.00	0.00	0.50
25.72	85.80	1.04	120.00	0.00	0.50
25.78	89.90	1.06	120.00	0.00	0.50
25.85	90.40	1.05	120.00	0.00	0.50
25.91	87.50	1.02	120.00	0.00	0.50
25.98	82.50	0.97	120.00	0.00	0.50
26.04	76.10	0.91	120.00	0.00	0.50
26.11	68.70	0.85	120.00	0.00	0.50
26.18	61.70	0.81	120.00	0.00	0.50
26.24	55.00	0.81	120.00	0.00	0.50
26.31	48.60	0.87	120.00	0.00	0.50
26.37	43.30	0.98	120.00	0.00	0.50
26.44	38.20	1.01	120.00	0.00	0.50
26.50	32.70	1.00	120.00	0.00	0.50
26.57	27.00	0.98	120.00	0.00	0.50
26.64	22.80	0.98	120.00	0.00	0.50
26.70	21.90	0.98	120.00	0.00	0.50
26.77	22.20	0.98	120.00	0.00	0.50
26.83	22.70	0.96	120.00	0.00	0.50
26.90	22.70	0.93	120.00	0.00	0.50
26.96	21.70	0.88	120.00	0.00	0.50
27.03	19.90	0.82	120.00	0.00	0.50
27.09	17.90	0.78	120.00	0.00	0.50
27.16	15.70	0.69	120.00	0.00	0.50

27.23	14.60	0.62	120.00	0.00	0.50
27.29	13.50	0.57	120.00	0.00	0.50
27.36	12.00	0.57	120.00	0.00	0.50
27.42	12.30	0.55	120.00	0.00	0.50
27.49	13.60	0.54	120.00	0.00	0.50
27.55	16.40	0.55	120.00	0.00	0.50
27.62	20.90	0.55	120.00	0.00	0.50
27.69	30.90	0.51	120.00	0.00	0.50
27.75	43.10	0.57	120.00	0.00	0.50
27.82	55.80	0.65	120.00	0.00	0.50
27.88	66.40	0.73	120.00	0.00	0.50
27.95	72.20	0.78	120.00	0.00	0.50
28.01	74.60	0.81	120.00	0.00	0.50
28.08	75.90	0.86	120.00	0.00	0.50
28.14	79.40	0.91	120.00	0.00	0.50
28.21	82.30	0.95	120.00	0.00	0.50
28.28	84.30	1.01	120.00	0.00	0.50
28.34	86.50	1.05	120.00	0.00	0.50
28.41	89.10	1.08	120.00	0.00	0.50
28.47	92.50	1.12	120.00	0.00	0.50
28.54	94.80	1.15	120.00	0.00	0.50
28.60	99.20	1.19	120.00	0.00	0.50
28.67	104.20	1.23	120.00	0.00	0.50
28.74	109.50	1.28	120.00	0.00	0.50
28.80	116.70	1.34	120.00	0.00	0.50
28.87	124.80	1.40	120.00	0.00	0.50
28.93	135.30	1.50	120.00	0.00	0.50
29.00	147.50	1.62	120.00	0.00	0.50
29.06	161.40	1.75	120.00	0.00	0.50
29.13	175.80	1.91	120.00	0.00	0.50
29.19	189.70	2.06	120.00	0.00	0.50
29.26	200.60	2.21	120.00	0.00	0.50
29.33	208.70	2.33	120.00	0.00	0.50
29.39	212.90	2.41	120.00	0.00	0.50
29.46	214.60	2.45	120.00	0.00	0.50
29.52	214.50	2.46	120.00	0.00	0.50
29.59	213.30	2.44	120.00	0.00	0.50
29.65	212.10	2.40	120.00	0.00	0.50
29.72	210.70	2.35	120.00	0.00	0.50
29.79	208.50	2.31	120.00	0.00	0.50
29.85	206.30	2.27	120.00	0.00	0.50
29.92	204.00	2.23	120.00	0.00	0.50
29.98	201.30	2.24	120.00	0.00	0.50
30.05	201.30	2.25	120.00	0.00	0.50
30.11	201.70	2.25	120.00	0.00	0.50
30.18	201.90	2.27	120.00	0.00	0.50
30.24	201.60	2.32	120.00	0.00	0.50
30.31	200.90	2.40	120.00	0.00	0.50
30.38	200.00	2.42	120.00	0.00	0.50
30.44	200.20	2.46	120.00	0.00	0.50
30.51	200.50	2.44	120.00	0.00	0.50
30.57	201.40	2.41	120.00	0.00	0.50
30.64	204.30	2.35	120.00	0.00	0.50
30.70	205.70	2.28	120.00	0.00	0.50
30.77	207.60	2.23	120.00	0.00	0.50
30.83	207.80	2.21	120.00	0.00	0.50
30.90	207.30	2.19	120.00	0.00	0.50
30.97	205.50	1.98	120.00	0.00	0.50
31.03	201.20	1.99	120.00	0.00	0.50
31.10	197.90	1.93	120.00	0.00	0.50

31.16	193.30	1.89	120.00	0.00	0.50
31.23	190.90	1.83	120.00	0.00	0.50
31.29	183.90	1.75	120.00	0.00	0.50
31.36	183.10	1.77	120.00	0.00	0.50
31.43	184.40	1.85	120.00	0.00	0.50
31.49	185.20	1.83	120.00	0.00	0.50
31.56	185.60	1.85	120.00	0.00	0.50
31.62	185.80	1.89	120.00	0.00	0.50
31.69	184.90	1.89	120.00	0.00	0.50
31.75	179.60	1.92	120.00	0.00	0.50
31.82	178.90	1.97	120.00	0.00	0.50
31.88	177.70	1.96	120.00	0.00	0.50
31.95	175.60	1.95	120.00	0.00	0.50
32.02	174.90	1.98	120.00	0.00	0.50
32.08	175.40	2.03	120.00	0.00	0.50
32.15	177.60	2.09	120.00	0.00	0.50
32.21	182.60	2.15	120.00	0.00	0.50
32.28	187.30	2.24	120.00	0.00	0.50
32.34	191.20	2.32	120.00	0.00	0.50
32.41	198.80	2.37	120.00	0.00	0.50
32.48	206.70	2.43	120.00	0.00	0.50
32.54	212.40	2.48	120.00	0.00	0.50
32.61	218.00	2.55	120.00	0.00	0.50
32.67	220.40	2.57	120.00	0.00	0.50
32.74	220.10	2.61	120.00	0.00	0.50
32.80	220.70	2.69	120.00	0.00	0.50
32.87	220.30	2.78	120.00	0.00	0.50
32.93	220.30	2.87	120.00	0.00	0.50
33.00	219.00	2.99	120.00	0.00	0.50
33.07	216.80	3.11	120.00	0.00	0.50
33.13	216.00	3.18	120.00	0.00	0.50
33.20	215.40	3.20	120.00	0.00	0.50
33.26	213.80	3.22	120.00	0.00	0.50
33.33	214.00	3.17	120.00	0.00	0.50
33.39	217.10	3.10	120.00	0.00	0.50
33.46	221.00	3.06	120.00	0.00	0.50
33.53	223.30	3.02	120.00	0.00	0.50
33.59	225.60	2.96	120.00	0.00	0.50
33.66	226.80	2.94	120.00	0.00	0.50
33.72	225.50	2.91	120.00	0.00	0.50
33.79	223.40	2.87	120.00	0.00	0.50
33.85	223.20	2.83	120.00	0.00	0.50
33.92	219.80	2.76	120.00	0.00	0.50
33.98	216.80	2.64	120.00	0.00	0.50
34.05	213.20	2.26	120.00	0.00	0.50
34.12	206.90	2.18	120.00	0.00	0.50
34.18	197.30	2.09	120.00	0.00	0.50
34.25	187.50	1.96	120.00	0.00	0.50
34.31	181.30	1.79	120.00	0.00	0.50
34.38	168.30	1.61	120.00	0.00	0.50
34.44	158.40	1.45	120.00	0.00	0.50
34.51	149.60	1.31	120.00	0.00	0.50
34.58	138.80	1.21	120.00	0.00	0.50
34.64	123.40	1.09	120.00	0.00	0.50
34.71	109.20	0.98	120.00	0.00	0.50
34.77	96.00	0.89	120.00	0.00	0.50
34.84	83.70	0.85	120.00	0.00	0.50
34.90	70.10	0.84	120.00	0.00	0.50
34.97	59.00	0.85	120.00	0.00	0.50
35.03	50.00	0.88	120.00	0.00	0.50
35.10	42.00	0.95	120.00	0.00	0.50
35.17	36.20	1.04	120.00	0.00	0.50
35.23	30.90	1.13	120.00	0.00	0.50
35.30	25.60	1.07	120.00	0.00	0.50
35.36	22.20	1.06	120.00	0.00	0.50
35.43	23.50	1.07	120.00	0.00	0.50
35.49	29.60	1.11	120.00	0.00	0.50
35.56	41.30	1.17	120.00	0.00	0.50
35.62	72.50	1.24	120.00	0.00	0.50
35.69	106.10	1.30	120.00	0.00	0.50
35.76	137.80	1.33	120.00	0.00	0.50
35.82	153.80	1.35	120.00	0.00	0.50
35.89	163.30	1.39	120.00	0.00	0.50
35.95	169.40	1.44	120.00	0.00	0.50
36.02	174.60	1.56	120.00	0.00	0.50
36.08	177.90	1.69	120.00	0.00	0.50
36.15	180.40	1.84	120.00	0.00	0.50
36.22	182.30	1.99	120.00	0.00	0.50
36.28	185.60	2.10	120.00	0.00	0.50
36.35	187.00	2.21	120.00	0.00	0.50
36.41	187.70	2.32	120.00	0.00	0.50
36.48	188.90	2.42	120.00	0.00	0.50
36.54	190.20	2.51	120.00	0.00	0.50
36.61	190.90	2.59	120.00	0.00	0.50
36.67	191.30	2.68	120.00	0.00	0.50
36.74	194.40	2.76	120.00	0.00	0.50
36.81	196.60	2.83	120.00	0.00	0.50
36.87	197.80	2.90	120.00	0.00	0.50
36.94	197.90	2.92	120.00	0.00	0.50
37.00	201.10	2.90	120.00	0.00	0.50
37.07	205.50	2.84	120.00	0.00	0.50
37.13	210.80	2.77	120.00	0.00	0.50
37.20	216.90	2.73	120.00	0.00	0.50
37.27	221.70	2.54	120.00	0.00	0.50
37.33	225.20	2.21	120.00	0.00	0.50
37.40	226.50	2.28	120.00	0.00	0.50
37.46	225.40	2.38	120.00	0.00	0.50
37.53	223.60	2.50	120.00	0.00	0.50
37.59	221.40	2.62	120.00	0.00	0.50
37.66	216.70	2.67	120.00	0.00	0.50
37.72	221.50	2.65	120.00	0.00	0.50
37.79	227.20	2.56	120.00	0.00	0.50
37.86	232.10	2.46	120.00	0.00	0.50
37.92	237.50	2.38	120.00	0.00	0.50
37.99	244.40	2.35	120.00	0.00	0.50
38.05	253.00	2.33	120.00	0.00	0.50
38.12	261.50	2.35	120.00	0.00	0.50
38.18	266.60	2.39	120.00	0.00	0.50
38.25	265.50	2.43	120.00	0.00	0.50
38.32	266.20	2.43	120.00	0.00	0.50
38.38	268.40	2.39	120.00	0.00	0.50
38.45	271.50	2.29	120.00	0.00	0.50
38.51	273.40	2.16	120.00	0.00	0.50
38.58	275.50	2.02	120.00	0.00	0.50
38.64	277.00	1.90	120.00	0.00	0.50
38.71	277.40	1.81	120.00	0.00	0.50
38.77	274.00	1.75	120.00	0.00	0.50
38.84	271.40	1.69	120.00	0.00	0.50
38.91	270.00	1.70	120.00	0.00	0.50
38.97	269.60	1.69	120.00	0.00	0.50

39.04	269.60	1.65	120.00	0.00	0.50
39.10	272.30	1.59	120.00	0.00	0.50
39.17	270.70	1.53	120.00	0.00	0.50
39.23	269.90	1.49	120.00	0.00	0.50
39.30	270.30	1.45	120.00	0.00	0.50
39.37	271.60	1.46	120.00	0.00	0.50
39.43	270.00	1.51	120.00	0.00	0.50
39.50	268.20	1.60	120.00	0.00	0.50
39.56	266.60	1.71	120.00	0.00	0.50
39.63	267.00	1.84	120.00	0.00	0.50
39.69	264.20	1.99	120.00	0.00	0.50
39.76	260.80	2.13	120.00	0.00	0.50
39.82	260.30	2.25	120.00	0.00	0.50
39.89	260.50	2.38	120.00	0.00	0.50
39.96	261.70	2.53	120.00	0.00	0.50
40.02	264.40	2.71	120.00	0.00	0.50
40.09	264.40	2.86	120.00	0.00	0.50
40.15	263.40	2.98	120.00	0.00	0.50
40.22	261.70	3.07	120.00	0.00	0.50
40.28	260.10	2.89	120.00	0.00	0.50
40.35	258.30	2.74	120.00	0.00	0.50
40.41	256.00	2.85	120.00	0.00	0.50
40.48	252.90	2.92	120.00	0.00	0.50
40.55	251.80	2.82	120.00	0.00	0.50
40.61	245.40	2.64	120.00	0.00	0.50
40.68	231.50	2.57	120.00	0.00	0.50
40.74	241.50	2.54	120.00	0.00	0.50
40.81	248.90	2.56	120.00	0.00	0.50
40.87	257.10	2.62	120.00	0.00	0.50
40.94	265.20	2.70	120.00	0.00	0.50
41.01	275.90	2.82	120.00	0.00	0.50
41.07	286.40	3.00	120.00	0.00	0.50
41.14	296.70	3.22	120.00	0.00	0.50
41.20	309.80	3.43	120.00	0.00	0.50
41.27	321.00	3.52	120.00	0.00	0.50
41.33	329.90	3.59	120.00	0.00	0.50
41.40	333.60	3.64	120.00	0.00	0.50
41.46	338.60	3.70	120.00	0.00	0.50
41.53	337.50	3.67	120.00	0.00	0.50
41.60	339.90	3.59	120.00	0.00	0.50
41.66	340.60	3.56	120.00	0.00	0.50
41.73	341.80	3.57	120.00	0.00	0.50
41.79	341.60	3.55	120.00	0.00	0.50
41.86	340.00	3.50	120.00	0.00	0.50
41.92	338.40	3.50	120.00	0.00	0.50
41.99	335.10	3.51	120.00	0.00	0.50
42.06	333.60	3.59	120.00	0.00	0.50
42.12	332.60	3.62	120.00	0.00	0.50
42.19	327.30	3.63	120.00	0.00	0.50
42.25	326.80	3.56	120.00	0.00	0.50
42.32	321.90	3.40	120.00	0.00	0.50
42.38	316.70	3.18	120.00	0.00	0.50
42.45	308.50	2.84	120.00	0.00	0.50
42.51	299.40	2.48	120.00	0.00	0.50
42.58	290.50	2.11	120.00	0.00	0.50
42.65	278.60	1.70	120.00	0.00	0.50
42.71	268.10	1.36	120.00	0.00	0.50
42.78	254.30	1.13	120.00	0.00	0.50
42.84	238.30	1.00	120.00	0.00	0.50
42.91	221.40	1.01	120.00	0.00	0.50

42.97	201.90	1.08	120.00	0.00	0.50
43.04	182.40	1.21	120.00	0.00	0.50
43.11	163.40	1.36	120.00	0.00	0.50
43.17	143.10	1.48	120.00	0.00	0.50
43.24	129.60	1.62	120.00	0.00	0.50
43.30	123.60	1.78	120.00	0.00	0.50
43.37	128.50	1.96	120.00	0.00	0.50
43.43	137.10	2.12	120.00	0.00	0.50
43.50	146.10	2.26	120.00	0.00	0.50
43.56	154.30	2.39	120.00	0.00	0.50
43.63	158.00	1.85	120.00	0.00	0.50
43.70	160.30	1.46	120.00	0.00	0.50
43.76	159.60	1.51	120.00	0.00	0.50
43.83	153.80	1.61	120.00	0.00	0.50
43.89	144.70	1.69	120.00	0.00	0.50
43.96	132.00	1.68	120.00	0.00	0.50
44.02	116.60	1.66	120.00	0.00	0.50
44.09	105.90	1.78	120.00	0.00	0.50
44.16	94.10	2.03	120.00	0.00	0.50
44.22	81.80	2.26	120.00	0.00	0.50
44.29	69.40	2.43	120.00	0.00	0.50
44.35	57.40	2.40	120.00	0.00	0.50
44.42	49.70	2.14	120.00	0.00	0.50
44.48	48.00	1.94	120.00	0.00	0.50
44.55	53.20	1.67	120.00	0.00	0.50
44.61	71.40	1.52	120.00	0.00	0.50
44.68	101.10	1.48	120.00	0.00	0.50
44.75	129.10	1.47	120.00	0.00	0.50
44.81	150.40	1.41	120.00	0.00	0.50
44.88	166.50	1.38	120.00	0.00	0.50
44.94	178.60	1.42	120.00	0.00	0.50
45.01	188.90	1.50	120.00	0.00	0.50
45.07	198.10	1.59	120.00	0.00	0.50
45.14	210.70	1.66	120.00	0.00	0.50
45.20	223.00	1.71	120.00	0.00	0.50
45.27	235.40	1.78	120.00	0.00	0.50
45.34	246.70	1.81	120.00	0.00	0.50
45.40	255.50	1.85	120.00	0.00	0.50
45.47	263.30	1.88	120.00	0.00	0.50
45.53	267.60	1.91	120.00	0.00	0.50
45.60	271.00	1.94	120.00	0.00	0.50
45.66	272.80	1.97	120.00	0.00	0.50
45.73	273.10	1.97	120.00	0.00	0.50
45.80	272.30	1.95	120.00	0.00	0.50
45.86	271.10	1.95	120.00	0.00	0.50
45.93	269.90	1.88	120.00	0.00	0.50
45.99	268.60	1.78	120.00	0.00	0.50
46.06	267.30	1.91	120.00	0.00	0.50
46.12	259.70	2.01	120.00	0.00	0.50
46.19	251.10	2.08	120.00	0.00	0.50
46.25	240.40	2.11	120.00	0.00	0.50
46.32	224.00	2.08	120.00	0.00	0.50
46.39	211.90	1.98	120.00	0.00	0.50
46.45	198.70	1.78	120.00	0.00	0.50
46.52	184.80	1.51	120.00	0.00	0.50
46.58	172.20	1.30	120.00	0.00	0.50
46.65	160.70	1.17	120.00	0.00	0.50
46.71	153.10	1.00	120.00	0.00	0.50
46.78	148.80	0.79	120.00	0.00	0.50
46.85	147.00	0.78	120.00	0.00	0.50

46.91	146.60	0.77	120.00	0.00	0.50
46.98	145.90	0.77	120.00	0.00	0.50
47.04	144.30	0.80	120.00	0.00	0.50
47.11	139.30	0.88	120.00	0.00	0.50
47.17	139.20	1.02	120.00	0.00	0.50
47.24	140.10	1.20	120.00	0.00	0.50
47.30	142.10	1.42	120.00	0.00	0.50
47.37	145.10	1.64	120.00	0.00	0.50
47.44	151.20	1.88	120.00	0.00	0.50
47.50	161.30	2.14	120.00	0.00	0.50
47.57	173.50	2.49	120.00	0.00	0.50
47.63	183.80	2.74	120.00	0.00	0.50
47.70	197.30	2.79	120.00	0.00	0.50
47.76	211.60	2.62	120.00	0.00	0.50
47.83	225.90	2.30	120.00	0.00	0.50
47.90	234.00	2.02	120.00	0.00	0.50
47.96	235.80	1.79	120.00	0.00	0.50
48.03	231.80	1.67	120.00	0.00	0.50
48.09	221.10	1.68	120.00	0.00	0.50
48.16	204.40	1.77	120.00	0.00	0.50
48.22	185.80	1.92	120.00	0.00	0.50
48.29	167.40	2.05	120.00	0.00	0.50
48.35	152.60	2.24	120.00	0.00	0.50
48.42	142.40	2.47	120.00	0.00	0.50
48.49	136.40	2.73	120.00	0.00	0.50
48.55	129.40	2.96	120.00	0.00	0.50
48.62	121.30	3.20	120.00	0.00	0.50
48.68	111.80	3.54	120.00	0.00	0.50
48.75	99.70	3.76	120.00	0.00	0.50
48.81	89.90	3.79	120.00	0.00	0.50
48.88	80.80	3.59	120.00	0.00	0.50
48.95	71.90	3.23	120.00	0.00	0.50
49.01	61.90	2.90	120.00	0.00	0.50
49.08	60.50	2.59	120.00	0.00	0.50
49.14	67.30	2.29	120.00	0.00	0.50
49.21	87.90	2.07	120.00	0.00	0.50
49.27	100.40	1.91	120.00	0.00	0.50
49.34	111.70	1.80	120.00	0.00	0.50
49.40	127.00	1.74	120.00	0.00	0.50
49.47	141.10	1.64	120.00	0.00	0.50
49.54	155.30	1.51	120.00	0.00	0.50
49.60	169.50	1.34	120.00	0.00	0.50
49.67	179.80	1.24	120.00	0.00	0.50
49.73	186.10	1.19	120.00	0.00	0.50
49.80	189.40	1.19	120.00	0.00	0.50
49.86	190.30	1.31	120.00	0.00	0.50
49.93	186.80	1.12	120.00	0.00	0.50
50.00	180.50	1.06	120.00	0.00	0.50
50.06	171.60	1.18	120.00	0.00	0.50
50.13	159.60	1.28	120.00	0.00	0.50
50.19	143.00	1.38	120.00	0.00	0.50
50.26	131.70	1.45	120.00	0.00	0.50
50.32	133.20	1.50	120.00	0.00	0.50
50.39	134.30	1.59	120.00	0.00	0.50
50.45	133.50	1.69	120.00	0.00	0.50
50.52	133.20	1.74	120.00	0.00	0.50
50.59	135.60	1.83	120.00	0.00	0.50
50.65	141.00	1.92	120.00	0.00	0.50
50.72	140.70	1.99	120.00	0.00	0.50
50.78	135.00	2.05	120.00	0.00	0.50
50.85	124.90	2.20	120.00	0.00	0.50
50.91	109.40	2.33	120.00	0.00	0.50
50.98	89.20	2.11	120.00	0.00	0.50
51.04	74.00	1.98	120.00	0.00	0.50
51.11	64.20	1.88	120.00	0.00	0.50
51.18	62.50	1.79	120.00	0.00	0.50
51.24	74.20	1.79	120.00	0.00	0.50
51.31	92.30	1.79	120.00	0.00	0.50
51.37	104.40	1.77	120.00	0.00	0.50
51.44	109.10	1.79	120.00	0.00	0.50
51.50	107.70	1.96	120.00	0.00	0.50
51.57	105.60	2.21	120.00	0.00	0.50
51.64	103.60	2.52	120.00	0.00	0.50
51.70	102.70	2.87	120.00	0.00	0.50
51.77	103.60	3.14	120.00	0.00	0.50
51.83	108.70	3.33	120.00	0.00	0.50
51.90	119.10	3.44	120.00	0.00	0.50
51.96	142.10	3.46	120.00	0.00	0.50
52.03	165.20	3.35	120.00	0.00	0.50
52.09	186.60	3.04	120.00	0.00	0.50
52.16	203.00	2.57	120.00	0.00	0.50
52.23	216.10	2.24	120.00	0.00	0.50
52.29	227.90	2.10	120.00	0.00	0.50
52.36	238.60	2.17	120.00	0.00	0.50
52.42	247.60	2.28	120.00	0.00	0.50
52.49	257.10	2.42	120.00	0.00	0.50
52.55	266.40	2.54	120.00	0.00	0.50
52.62	274.50	2.65	120.00	0.00	0.50
52.69	278.90	2.73	120.00	0.00	0.50
52.75	281.40	2.79	120.00	0.00	0.50
52.82	282.60	2.84	120.00	0.00	0.50
52.88	280.50	2.86	120.00	0.00	0.50
52.95	278.00	2.74	120.00	0.00	0.50
53.01	274.80	2.45	120.00	0.00	0.50
53.08	270.10	2.49	120.00	0.00	0.50
53.14	268.10	2.55	120.00	0.00	0.50
53.21	267.00	2.51	120.00	0.00	0.50
53.28	265.20	2.42	120.00	0.00	0.50
53.34	261.60	2.28	120.00	0.00	0.50
53.41	262.60	2.13	120.00	0.00	0.50
53.47	261.10	2.02	120.00	0.00	0.50
53.54	260.30	1.95	120.00	0.00	0.50
53.60	260.80	1.93	120.00	0.00	0.50
53.67	263.00	1.98	120.00	0.00	0.50
53.74	263.70	2.04	120.00	0.00	0.50
53.80	263.60	2.10	120.00	0.00	0.50
53.87	262.80	2.20	120.00	0.00	0.50
53.93	259.30	2.26	120.00	0.00	0.50
54.00	256.10	2.35	120.00	0.00	0.50
54.06	252.60	2.49	120.00	0.00	0.50
54.13	247.90	2.71	120.00	0.00	0.50
54.19	245.60	2.91	120.00	0.00	0.50
54.26	246.00	3.09	120.00	0.00	0.50
54.33	249.10	3.14	120.00	0.00	0.50
54.39	255.00	3.13	120.00	0.00	0.50
54.46	261.30	3.08	120.00	0.00	0.50
54.52	267.30	3.00	120.00	0.00	0.50
54.59	271.90	2.84	120.00	0.00	0.50
54.65	277.40	2.66	120.00	0.00	0.50
54.72	280.70	2.49	120.00	0.00	0.50

54.79	281.00	2.54	120.00	0.00	0.50
54.85	279.60	2.54	120.00	0.00	0.50
54.92	276.00	2.53	120.00	0.00	0.50
54.98	270.90	2.51	120.00	0.00	0.50
55.05	264.40	2.61	120.00	0.00	0.50
55.11	255.80	2.69	120.00	0.00	0.50
55.18	249.00	2.73	120.00	0.00	0.50
55.24	244.80	2.59	120.00	0.00	0.50
55.31	239.70	2.44	120.00	0.00	0.50
55.38	231.70	2.29	120.00	0.00	0.50
55.44	222.10	2.15	120.00	0.00	0.50
55.51	212.40	2.09	120.00	0.00	0.50
55.57	202.60	2.06	120.00	0.00	0.50
55.64	193.70	2.06	120.00	0.00	0.50
55.70	186.00	2.14	120.00	0.00	0.50
55.77	176.40	2.15	120.00	0.00	0.50
55.83	166.20	2.14	120.00	0.00	0.50
55.90	154.70	2.12	120.00	0.00	0.50
55.97	138.50	2.19	120.00	0.00	0.50
56.03	122.70	2.28	120.00	0.00	0.50
56.10	107.20	2.35	120.00	0.00	0.50
56.16	91.80	2.72	120.00	0.00	0.50
56.23	79.50	2.66	120.00	0.00	0.50
56.29	69.70	2.54	120.00	0.00	0.50
56.36	61.80	2.72	120.00	0.00	0.50
56.43	53.30	2.80	120.00	0.00	0.50
56.49	43.00	2.82	120.00	0.00	0.50
56.56	35.20	2.53	120.00	0.00	0.50
56.62	34.00	2.26	120.00	0.00	0.50
56.69	32.60	2.02	120.00	0.00	0.50
56.75	30.20	1.75	120.00	0.00	0.50
56.82	26.60	1.47	120.00	0.00	0.50
56.88	22.90	1.21	120.00	0.00	0.50
56.95	19.50	1.00	120.00	0.00	0.50
57.02	17.40	0.86	120.00	0.00	0.50
57.08	17.20	0.81	120.00	0.00	0.50
57.15	17.40	0.79	120.00	0.00	0.50
57.21	17.90	0.69	120.00	0.00	0.50
57.28	19.70	0.92	120.00	0.00	0.50
57.34	22.80	1.19	120.00	0.00	0.50
57.41	25.40	1.36	120.00	0.00	0.50
57.48	25.00	1.33	120.00	0.00	0.50
57.54	23.00	1.27	120.00	0.00	0.50
57.61	20.90	1.21	120.00	0.00	0.50
57.67	19.00	1.19	120.00	0.00	0.50
57.74	18.40	1.16	120.00	0.00	0.50
57.80	18.20	1.14	120.00	0.00	0.50
57.87	18.40	1.12	120.00	0.00	0.50
57.93	19.00	1.10	120.00	0.00	0.50
58.00	19.50	1.05	120.00	0.00	0.50
58.07	20.50	0.99	120.00	0.00	0.50
58.13	22.20	0.93	120.00	0.00	0.50
58.20	23.80	0.96	120.00	0.00	0.50
58.26	25.60	0.97	120.00	0.00	0.50
58.33	27.00	0.91	120.00	0.00	0.50
58.39	27.80	0.94	120.00	0.00	0.50
58.46	28.60	0.99	120.00	0.00	0.50
58.53	29.20	1.06	120.00	0.00	0.50
58.59	29.80	1.12	120.00	0.00	0.50
58.66	32.20	1.24	120.00	0.00	0.50
58.72	34.50	1.42	120.00	0.00	0.50
58.79	37.10	1.67	120.00	0.00	0.50
58.85	40.20	1.93	120.00	0.00	0.50
58.92	43.90	2.21	120.00	0.00	0.50
58.98	47.20	2.51	120.00	0.00	0.50
59.05	49.60	2.74	120.00	0.00	0.50
59.12	48.30	2.92	120.00	0.00	0.50
59.18	46.60	2.94	120.00	0.00	0.50
59.25	44.70	2.60	120.00	0.00	0.50
59.31	43.80	2.61	120.00	0.00	0.50
59.38	43.70	2.54	120.00	0.00	0.50
59.44	43.60	2.49	120.00	0.00	0.50
59.51	43.20	2.54	120.00	0.00	0.50
59.58	37.60	2.61	120.00	0.00	0.50
59.64	38.70	2.70	120.00	0.00	0.50
59.71	40.50	2.79	120.00	0.00	0.50
59.77	40.50	2.69	120.00	0.00	0.50
59.84	40.00	2.54	120.00	0.00	0.50
59.90	39.30	2.42	120.00	0.00	0.50
59.97	38.10	2.36	120.00	0.00	0.50
60.03	35.70	2.29	120.00	0.00	0.50
60.10	33.20	2.19	120.00	0.00	0.50
60.17	30.20	2.05	120.00	0.00	0.50
60.23	26.90	1.86	120.00	0.00	0.50
60.30	24.70	1.67	120.00	0.00	0.50
60.36	22.20	1.51	120.00	0.00	0.50
60.43	19.90	1.39	120.00	0.00	0.50
60.49	19.00	1.26	120.00	0.00	0.50
60.56	19.00	1.17	120.00	0.00	0.50
60.62	19.50	1.13	120.00	0.00	0.50
60.69	20.20	1.14	120.00	0.00	0.50
60.76	20.50	1.15	120.00	0.00	0.50
60.82	20.50	1.17	120.00	0.00	0.50
60.89	20.10	1.21	120.00	0.00	0.50
60.95	19.10	1.25	120.00	0.00	0.50
61.02	19.20	1.28	120.00	0.00	0.50
61.08	19.10	1.32	120.00	0.00	0.50
61.15	18.20	1.29	120.00	0.00	0.50
61.22	18.00	1.30	120.00	0.00	0.50
61.28	17.90	1.33	120.00	0.00	0.50
61.35	17.70	1.32	120.00	0.00	0.50
61.41	17.40	1.29	120.00	0.00	0.50
61.48	16.50	1.27	120.00	0.00	0.50
61.54	15.80	1.26	120.00	0.00	0.50
61.61	15.60	1.22	120.00	0.00	0.50
61.67	14.70	1.17	120.00	0.00	0.50
61.74	13.90	1.11	120.00	0.00	0.50
61.81	13.30	1.04	120.00	0.00	0.50
61.87	13.00	0.98	120.00	0.00	0.50
61.94	12.50	0.95	120.00	0.00	0.50
62.00	12.10	0.93	120.00	0.00	0.50
62.07	12.10	0.94	120.00	0.00	0.50
62.13	12.40	0.95	120.00	0.00	0.50
62.20	13.00	0.97	120.00	0.00	0.50
62.27	14.00	1.01	120.00	0.00	0.50
62.33	14.70	1.07	120.00	0.00	0.50
62.40	16.00	1.13	120.00	0.00	0.50
62.46	17.90	1.20	120.00	0.00	0.50
62.53	18.80	1.23	120.00	0.00	0.50
62.59	19.30	1.27	120.00	0.00	0.50

62.66	19.60	1.35	120.00	0.00	0.50
62.72	19.10	1.39	120.00	0.00	0.50
62.79	20.70	1.45	120.00	0.00	0.50
62.86	23.30	1.51	120.00	0.00	0.50
62.92	26.00	1.53	120.00	0.00	0.50
62.99	27.20	1.62	120.00	0.00	0.50
63.05	26.00	1.70	120.00	0.00	0.50
63.12	23.80	1.76	120.00	0.00	0.50
63.18	21.20	1.72	120.00	0.00	0.50
63.25	19.10	1.65	120.00	0.00	0.50
63.32	17.50	1.55	120.00	0.00	0.50
63.38	16.60	1.43	120.00	0.00	0.50
63.45	16.60	1.32	120.00	0.00	0.50
63.51	16.40	1.24	120.00	0.00	0.50
63.58	16.30	1.18	120.00	0.00	0.50
63.64	17.10	1.14	120.00	0.00	0.50
63.71	17.10	1.12	120.00	0.00	0.50
63.77	16.70	1.09	120.00	0.00	0.50
63.84	15.80	1.05	120.00	0.00	0.50
63.91	15.30	1.01	120.00	0.00	0.50
63.97	15.30	0.98	120.00	0.00	0.50
64.04	15.80	0.97	120.00	0.00	0.50
64.10	17.40	0.94	120.00	0.00	0.50
64.17	17.30	0.91	120.00	0.00	0.50
64.23	17.10	0.89	120.00	0.00	0.50
64.30	16.90	0.81	120.00	0.00	0.50
64.37	16.40	0.79	120.00	0.00	0.50
64.43	16.00	0.78	120.00	0.00	0.50
64.50	16.00	0.74	120.00	0.00	0.50
64.56	16.60	0.72	120.00	0.00	0.50
64.63	16.80	0.70	120.00	0.00	0.50
64.69	17.10	0.69	120.00	0.00	0.50
64.76	17.70	0.68	120.00	0.00	0.50
64.82	16.70	0.67	120.00	0.00	0.50
64.89	16.00	0.67	120.00	0.00	0.50
64.96	15.70	0.65	120.00	0.00	0.50
65.02	14.80	0.60	120.00	0.00	0.50
65.09	14.40	0.55	120.00	0.00	0.50
65.15	14.50	0.55	120.00	0.00	0.50
65.22	15.20	0.55	120.00	0.00	0.50
65.28	15.10	0.56	120.00	0.00	0.50
65.35	14.90	0.57	120.00	0.00	0.50
65.41	15.10	0.57	120.00	0.00	0.50
65.48	14.90	0.58	120.00	0.00	0.50
65.55	14.50	0.58	120.00	0.00	0.50
65.61	14.20	0.60	120.00	0.00	0.50
65.68	14.80	0.55	120.00	0.00	0.50
65.74	14.90	0.52	120.00	0.00	0.50
65.81	14.70	0.53	120.00	0.00	0.50
65.87	15.20	0.55	120.00	0.00	0.50
65.94	15.40	0.57	120.00	0.00	0.50
66.01	15.80	0.61	120.00	0.00	0.50
66.07	16.30	0.67	120.00	0.00	0.50
66.14	16.80	0.75	120.00	0.00	0.50
66.20	16.40	0.77	120.00	0.00	0.50
66.27	16.10	0.76	120.00	0.00	0.50
66.33	15.80	0.72	120.00	0.00	0.50
66.40	14.90	0.69	120.00	0.00	0.50
66.46	14.90	0.69	120.00	0.00	0.50
66.53	14.70	0.70	120.00	0.00	0.50
66.60	14.20	0.67	120.00	0.00	0.50
66.66	14.40	0.64	120.00	0.00	0.50
66.73	14.40	0.60	120.00	0.00	0.50
66.79	14.40	0.57	120.00	0.00	0.50
66.86	14.30	0.58	120.00	0.00	0.50
66.92	14.40	0.58	120.00	0.00	0.50
66.99	14.50	0.58	120.00	0.00	0.50
67.06	14.80	0.56	120.00	0.00	0.50
67.12	14.90	0.52	120.00	0.00	0.50
67.19	15.00	0.47	120.00	0.00	0.50
67.25	15.20	0.43	120.00	0.00	0.50
67.32	15.40	0.42	120.00	0.00	0.50
67.38	14.70	0.42	120.00	0.00	0.50
67.45	14.30	0.44	120.00	0.00	0.50
67.51	14.20	0.46	120.00	0.00	0.50
67.58	14.90	0.53	120.00	0.00	0.50
67.65	16.00	0.61	120.00	0.00	0.50
67.71	17.20	0.71	120.00	0.00	0.50
67.78	18.80	0.78	120.00	0.00	0.50
67.84	21.30	0.85	120.00	0.00	0.50
67.91	23.50	0.91	120.00	0.00	0.50
67.97	25.20	0.95	120.00	0.00	0.50
68.04	26.90	1.00	120.00	0.00	0.50
68.11	27.90	1.07	120.00	0.00	0.50
68.17	28.40	1.19	120.00	0.00	0.50
68.24	28.50	1.19	120.00	0.00	0.50
68.30	28.50	1.25	120.00	0.00	0.50
68.37	29.70	1.40	120.00	0.00	0.50
68.43	32.70	1.48	120.00	0.00	0.50
68.50	35.60	1.55	120.00	0.00	0.50
68.56	38.20	1.62	120.00	0.00	0.50
68.63	40.20	1.65	120.00	0.00	0.50
68.70	40.20	1.45	120.00	0.00	0.50
68.76	38.90	1.45	120.00	0.00	0.50
68.83	37.20	1.61	120.00	0.00	0.50
68.89	35.50	1.56	120.00	0.00	0.50
68.96	33.50	1.55	120.00	0.00	0.50
69.02	33.50	1.61	120.00	0.00	0.50
69.09	35.40	1.75	120.00	0.00	0.50
69.16	39.10	2.01	120.00	0.00	0.50
69.22	43.50	2.15	120.00	0.00	0.50
69.29	50.80	1.88	120.00	0.00	0.50
69.35	63.80	1.79	120.00	0.00	0.50
69.42	92.10	2.07	120.00	0.00	0.50
69.48	126.20	2.58	120.00	0.00	0.50
69.55	150.20	3.24	120.00	0.00	0.50
69.61	164.70	3.96	120.00	0.00	0.50
69.68	179.40	4.57	120.00	0.00	0.50
69.75	175.30	4.72	120.00	0.00	0.50
69.81	168.10	4.73	120.00	0.00	0.50
69.88	167.40	0.00	120.00	0.00	0.50
69.94	173.00	0.00	120.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.25 in.
Settlement of Unsaturated Sands=0.23 in.
Total Settlement of Saturated and Unsaturated Sands=0.48 in.
Differential Settlement=0.240 to 0.317 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.34	5.00	0.25	0.23	0.48
5.00	1.35	0.34	5.00	0.25	0.23	0.47
10.00	0.63	0.34	5.00	0.25	0.20	0.44
15.00	0.72	0.33	5.00	0.25	0.17	0.42
20.00	1.93	0.33	5.00	0.25	0.15	0.40
25.00	0.17	0.32	5.00	0.25	0.07	0.32
30.00	0.68	0.32	5.00	0.25	0.00	0.25
35.00	0.17	0.33	0.51*	0.19	0.00	0.19
40.00	0.77	0.33	2.29	0.17	0.00	0.17
45.00	0.32	0.34	0.94*	0.14	0.00	0.14
50.00	0.29	0.33	0.88*	0.03	0.00	0.03
55.00	0.64	0.33	1.96	0.00	0.00	0.00
60.00	2.00	0.32	5.00	0.00	0.00	0.00
65.00	2.00	0.31	5.00	0.00	0.00	0.00
70.00	2.00	0.29	5.00	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)
Units: Depth = ft, Stress or Pressure = atm (tsf), Unit Weight = pcf,
Settlement = in.

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

602231-002/SR 57 N Widening/Type 1 RW No1/ STA 25/ H=12 feet/ Static Condition

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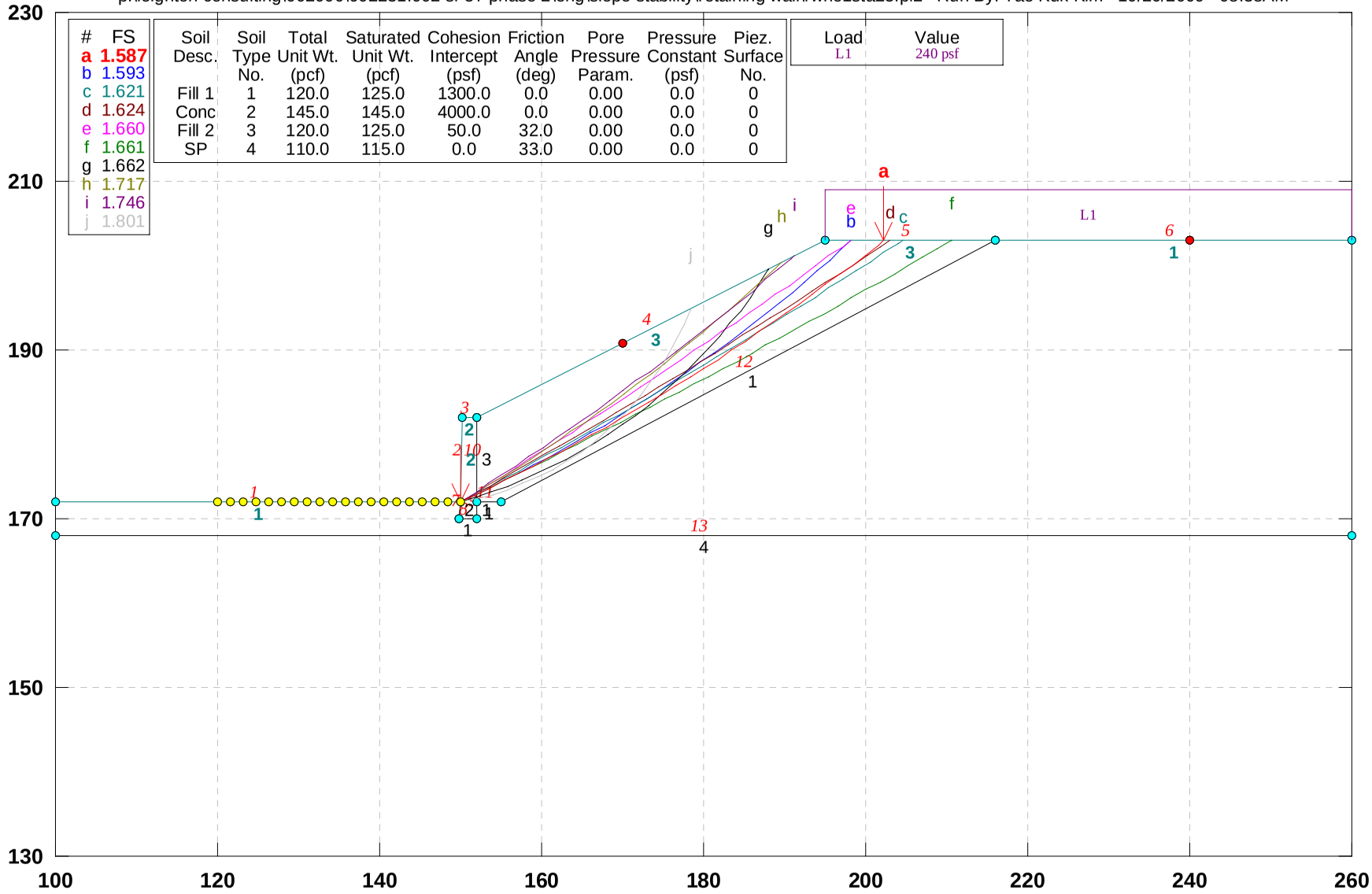

GSTABL7 v.2 FSmin=1.587

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/SR 57 N Widening/Type 1 RW No1/ STA 25/ H=12 feet/ Pseudostatic Cond

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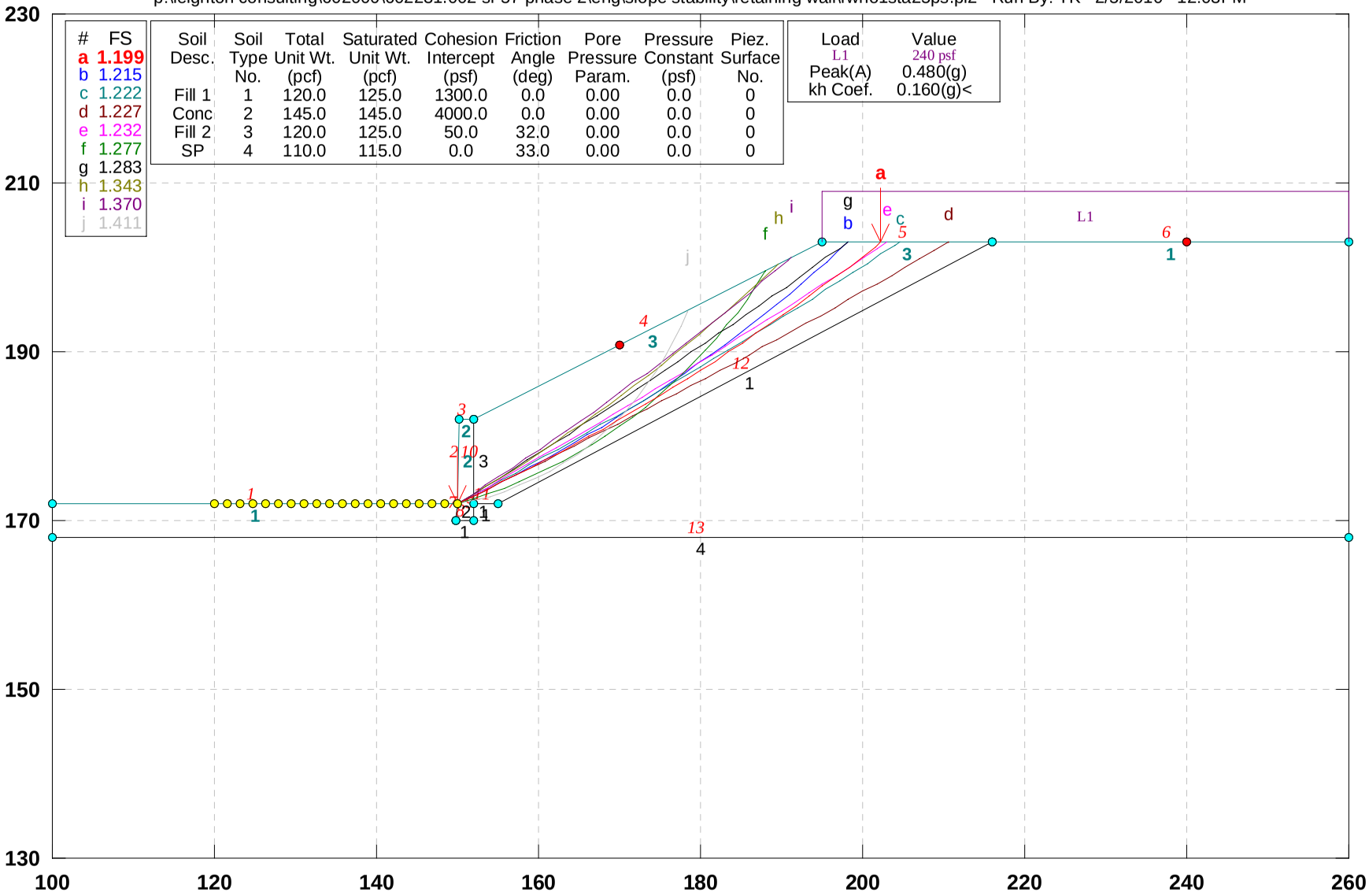
#	FS
a	1.199
b	1.215
c	1.222
d	1.227
e	1.232
f	1.277
g	1.283
h	1.343
i	1.370
j	1.411

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
Fill 1	1	120.0	125.0	1300.0	0.0	0.00	0.0	0
Conc	2	145.0	145.0	4000.0	0.0	0.00	0.0	0
Fill 2	3	120.0	125.0	50.0	32.0	0.00	0.0	0
SP	4	110.0	115.0	0.0	33.0	0.00	0.0	0

Load	Value
L1	240 psf
Peak(A)	0.480(g)
kh Coef.	0.160(g)<



GSTABL7 v.2 FSmin=1.199

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/SR 57 N Widening/ Existing Condition/ STA 25/ Static Condition

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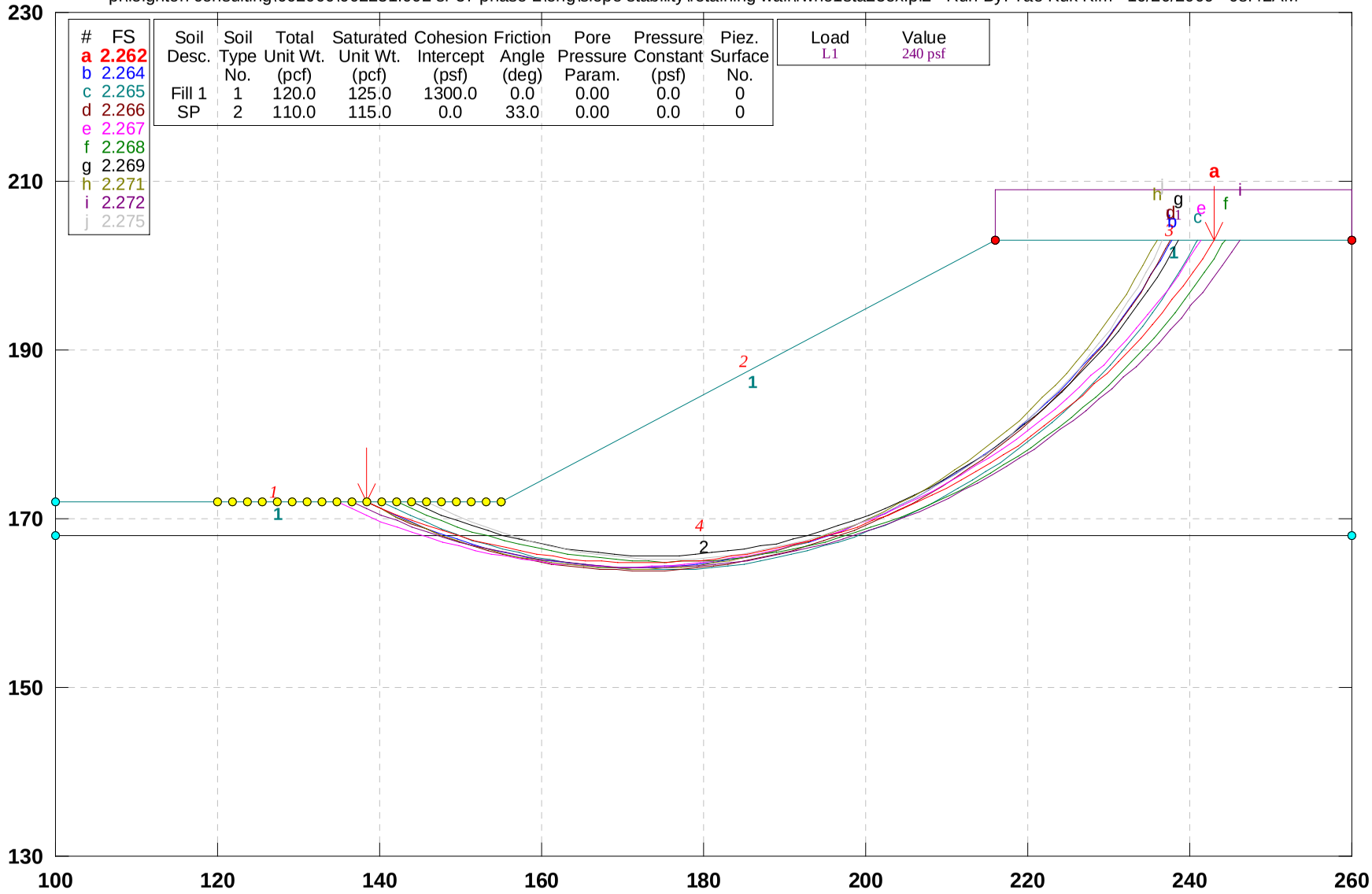

GSTABL7 v.2 FSmin=2.262

Safety Factors Are Calculated By The Modified Bishop Method

602231-002/SR 57 N Widening/ Existing Condition/ STA 25/ Pseudostatic Condition

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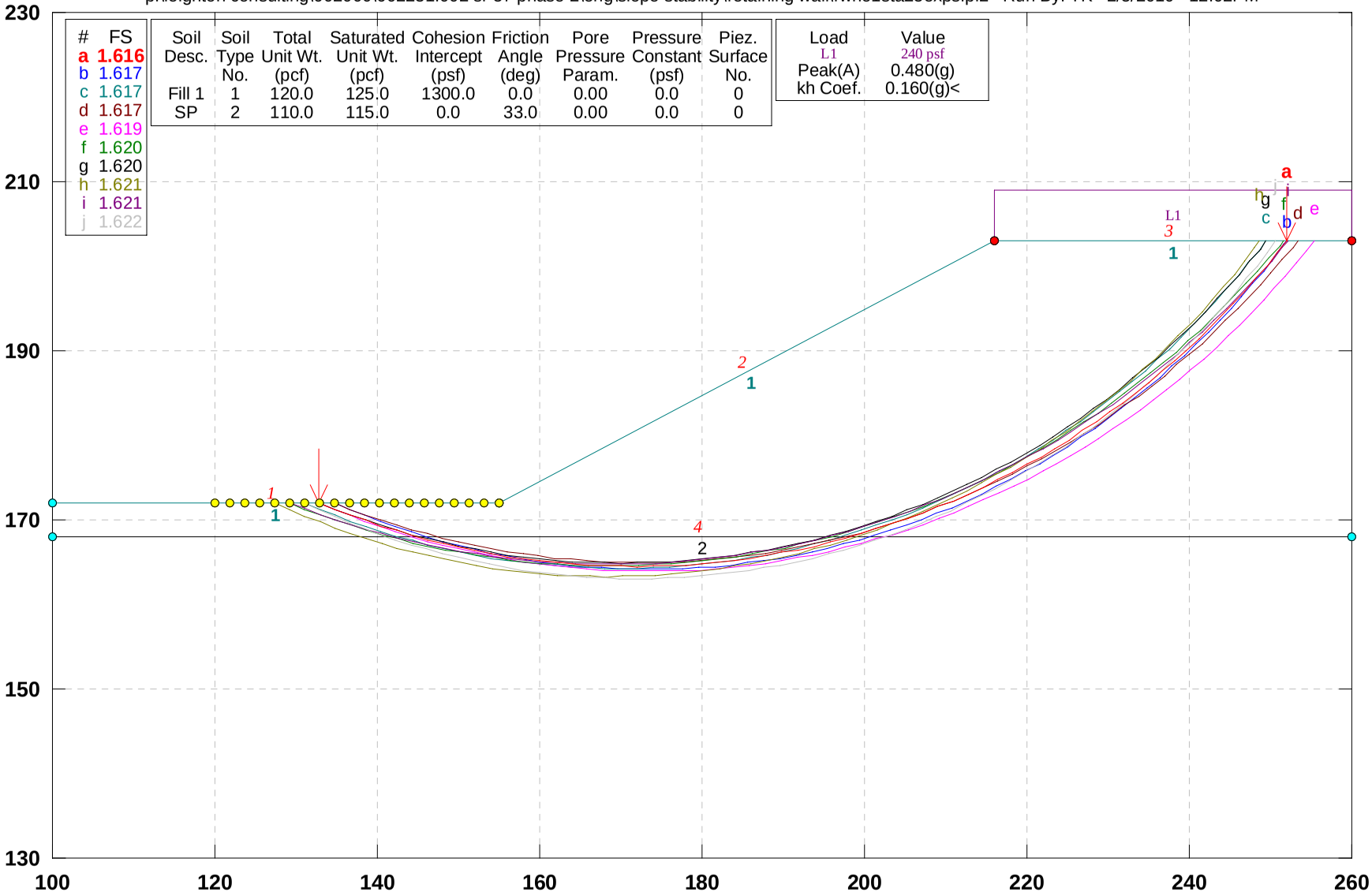


GSTABL7 v.2 FSmin=1.616

Safety Factors Are Calculated By The Modified Bishop Method

SETTLEMENT CALCULATIONS

INPUT:

Unit Weight of Soil =	120	pcf
Width of Footing, B =	45.0	ft
Length of Footing, L =	1000.0	ft
Total Height of Fill, H =	0.0	ft
Depth of Footing, D =	0.0	ft
Footing Contact Pressure =	1440.0	psf
Footing Contact Net Pressure, Pf =	1440.0	psf

Project Name:	SR-57 Retaining Wall No 1
Project No.	602231-002
Location:	Anahrim, CA
Design Section:	STA 25

CALCULATION AND OUTPUT:

Sublayer No.	Sublayer Thickness (ft)	Depth (feet)	Soil Description	Initial Normal Stress (psf)	Consolidation State Before Applying Footing Load	Stress Increment (psf)	P'c (psf)	Final Normal Stress (psf)	Consolidation State After Applying Footing Load	Cc (%)	P0 (psf)	Cr (%)	Settlement If (NC)before Applying Load (in)	Settlement If (OC)before Applying Load (in)	Expected Settlement (in)
1	0.0	5.0		0.6	(OC)before	1439.8	2800.0	1440.4	(OC)after	7.8	2800	1.07	0.00	0.00	0.00
2	2.0	7.0		360.0	(OC)before	1346.0	2800.0	1706.0	(OC)after	7.8	2800	1.07	0.00	0.17	0.17
3	2.0	9.0		600.0	(OC)before	1289.6	2800.0	1889.6	(OC)after	7.8	2800	1.07	0.00	0.13	0.13
4	1.0	10.0		420.0	(OC)before	1331.4	2800.0	1751.4	(OC)after	7.8	2800	1.07	0.00	0.08	0.08
													Total Settlement =		0.39

IMMEDIATE SETTLEMENT DUE TO EMBANKMENT FILL
(Schmertmann Approximation)

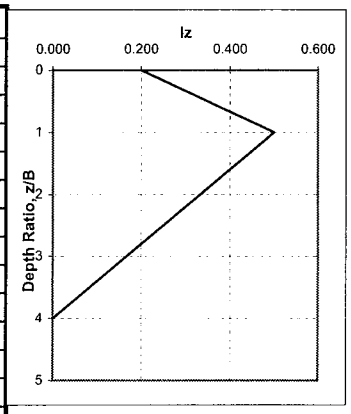
Project:	SR 57 N Widening/ Retaining Wall -Embankment Fill
Project Number:	602231-002
Date:	October 20, 2009

Total Settlement	**0.86 inches**
under a load of	**1.44 ksf**

L (ft)	B (ft)	D (ft)	γ (pcf)	q (tsf)	Time (years)	q (psf)
1000	45	0	120	0.72	0.1	**1440**

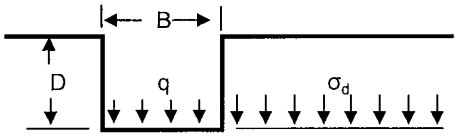
Δp (tsf)	σ_{izp} (tsf)	Izp	Iz_0	z/B_0	Izp depth (ft)	c_1	c_t	σ_d (tsf)
0.72	2.700	0.500	0.200	5.00	180.00	1.000	1.00	0

Layers	Top (ft)	Bottom (ft)	z/B	E_s (tsf)	I_z	$I_{zavg.}$	$I_{za}*\Delta_z/E_s$ (in/tsf)
	0	0.0	0.0		0.200		
Sand	0.0	5.0	0.1	200.00	0.233	0.217	6.50E-02
Clay	5.0	10.0	0.2	225.00	0.267	0.250	6.67E-02
Sand	10.0	60.0	1.3	200.00	0.444	0.356	1.07E+00



Based on equation

$$\rho_i = C_1 \cdot C_t \cdot \Delta p \cdot \sum_{i=1}^{n} \frac{\Delta z_i}{E_{si}} \cdot Izi$$



SETTLEMENT CALCULATIONS

INPUT:

Unit Weight of Soil =	120	pcf
Width of Footing, B =	7.3	ft
Length of Footing, L =	1000.0	ft
Total Height of Fill, H =	0.0	ft
Depth of Footing, D =	0.0	ft
Footing Contact Pressure =	2900.0	psf
Footing Contact Net Pressure, Pf =	2900.0	psf

Project Name:	SR-57 Retaining Wall No 1
Project No.	602231-002
Location:	Anahrim, CA
Design Section:	STA 25

CALCULATION AND OUTPUT:

Sublayer No.	Sublayer Thickness (ft)	Depth (feet)	Soil Description	Initial Normal Stress (psf)	Consolidation State Before Applying Footing Load	Stress Increment (psf)	P'c (psf)	Final Normal Stress (psf)	Consolidation State After Applying Footing Load	Cc (%)	P0 (psf)	Cr (%)	Settlement If (NC)before Applying Load (in)	Settlement If (OC)before Applying Load (in)	Expected Settlement (in)
1	0.0	5.0		0.6	(OC)before	2898.0	2800.0	2898.6	(NC)after	7.8	2800	1.07	0.00	0.00	0.00
2	2.0	7.0		360.0	(OC)before	2045.1	2800.0	2405.1	(OC)after	7.8	2800	1.07	0.00	0.21	0.21
3	2.0	9.0		600.0	(OC)before	1707.8	2800.0	2307.8	(OC)after	7.8	2800	1.07	0.00	0.15	0.15
4	1.0	10.0		420.0	(OC)before	1949.0	2800.0	2369.0	(OC)after	7.8	2800	1.07	0.00	0.10	0.10
													Total Settlement =		0.46

IMMEDIATE SETTLEMENT FOR RETAINING WALL SHALLOW FOOTINGS

(Schmertmann Approximation)

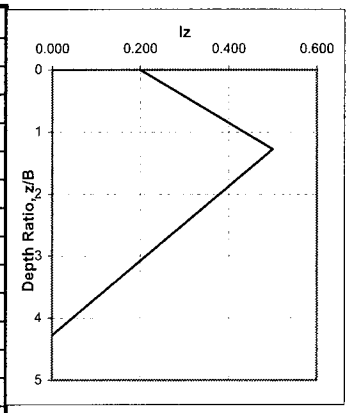
Project:	SR 57 N Widening/ Retaining Wall
Project Number:	602231-002
Date:	October 20, 2009

Total Settlement	0.63 inches
under a load of	2.9 ksf

L (ft)	B (ft)	D (ft)	γ (pcf)	q (tsf)	Time (years)	q (psf)
1000	7.25	2	120	1.45	0.1	2900

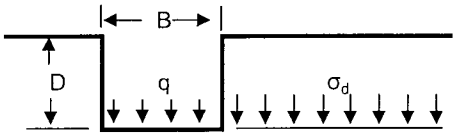
Δp (tsf)	σ_{izp} (tsf)	Izp	Iz_0	z/B_0	Izp depth (ft)	c_1	c_t	σ_d (tsf)
1.33	0.555	0.500	0.200	5.00	31.00	0.955	1.00	0.12

Layers	Top (ft)	Bottom (ft)	z/B	E_s (tsf)	I_z	$I_{zavg.}$	$I_{za}*\Delta_z/E_s$ (in/tsf)
	0	2.0	0.0		0.200		
Sand	2.0	5.0	0.7	185.00	0.362	0.281	5.47E-02
Clay	5.0	10.0	1.4	225.00	0.483	0.422	1.13E-01
Sand	10.0	31.0	4.3	185.00	0.000	0.241	3.29E-01



Based on equation

$$\rho_i = C_1 \cdot C_t \cdot \Delta p \cdot \sum_{i=1}^{n} \frac{\Delta z_i}{E_{si}} \cdot Izi$$



APPENDIX C

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. KAMRAN MAZHAR
Branch Chief – Design F

Attn: MR. SIDNEY DADRAS

Date: December 8, 2009
File: 12-ORA-57-PM 12.2/15.2
12-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Retaining Wall Nos. 1 & 2

Subject: Review of the Geotechnical Design Report

On November 3, 2009, we received a Geotechnical Design Report for retaining wall Nos. 1 and 2 between Katella Ave. and Ball Road. The proposed Type 1 retaining walls are part of the northbound SR-57 widening between Katella Avenue and Lincoln Avenue. The following comments are based on review of the subject report dated October 20, 2009, prepared by Leighton Consulting, Inc. for HDR Engineering, Inc.

3.3 Table 2

- In second column Station No. should be changed to stationing.
- As built groundwater and bottom elevation of borings should not be modified.

3.5.3 Seismically Induced Settlement

- Show raw/tabulated calculations that settlement data from CPT soundings are justified and settlements from borings can be discounted.
- Mitigation methods should be addressed regardless of cost, because even though these walls may not experience catastrophic failure due to seismically-induced settlement, they may not be serviceable afterward.

3.9 Corrosion Potential

- Representative samples from native soil at and below wall footings and complete section of fill material have not been tested for corrosion evaluation.

Appendix C

- 2008 USGS Deaggregated Hazard (Beta) curve should be used as design curve since there is a difference of >10% between USGS and ARS online probabilistic data.

- QC/QA sheets should be included for all faults listed in calculated Spectra.

Log of Test Borings (LOTB)

- A separate LOTB including borings and CPTs with Soil Legend sheets should be provided for each wall.

- Boring and CPT can not have the same number (i.e. A-09-001 and CPT-09-001). Corrections should also be made in the report, tables and test results.

- As built and current LOTBs for Douglas OH. with title blocks and wall number should be included separately in each wall's LOTB.

- Hammer efficiency, correction factor for conversion of ring sample blow counts to split spoon blow counts and pertinent wall numbers should be provided in Geotechnical Boring Logs (also applies to LOTB).

- Apparent density and consistency of soils should be based on corrected blow counts for hammer efficiency and sampler type. However, the actual blow counts presented in Log of Borings and LOTB should be the raw field blow counts.

- LOTB format and soil descriptions should comply with Caltrans Soil and Rock Logging, Classification, and Presentation Manual, June 2007. Please refer to Katella Ave. and Douglas OH. LOTBs including Caltrans comments in memos dated December 3, 2009.

Any questions regarding the above comments should be directed to Faramarz Gerami at (213) 620-2149 or Ted Liu at (213) 620-2136.

Report by:

FARAMARZ GERAMI, P.G., C.E.G.
Engineering Geologist
Office of Geotechnical Design - South 1
Branch C

Reviewed by: Date: 12/8/2009

CHI-TSENG TED LIU, Ph.D., P.E., G.E.
Senior Transportation Engineer
Office of Geotechnical Design - South 1
Branch C

c: OGDS1 - LA. File
OGDS1 - Sac. File
GS – Sac. File

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 8, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Geotechnical Design Report for Retaining Walls 1 and 2, between Katella Avenue and Ball Road, dated October 20, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	3.3 Table 2	Faramarz Gerami	In second column Station No. should be changed to stationing. As built groundwater and bottom elevation of borings should not be modified.	We will revise our report accordingly.
2	3.5.3	Faramarz Gerami	Show raw/tabulated calculations that settlement data from CPT soundings are justified and settlements from borings can be discounted. Mitigation methods should be addressed regardless of cost, because even though these walls may not experience catastrophic failure due to seismically-induced settlement, they may not be serviceable afterward.	We are not discounting settlement data from borings. Mitigation measures are discussed in the report.
3	3.9	Faramarz Gerami	Representative samples from native soil at and below wall footings and complete section of fill material have not been tested for corrosion evaluation.	We have performed the corrosion tests at depths of 0 to 5 feet where the footings will be potentially in contact with the footings. Tests were not performed on the embankment fill since the walls will be backfilled with imported soils.
4	Appendix C	Faramarz Gerami	200R USGS Deaggregated Hazard (Beta) curve should be used as design curve since there is a difference of> 1 0% between USGS and ARS online probabilistic data. QC/QA sheets should be included for all faults listed in calculated Spectra.	ARS curve is not required for the retaining wall design.
5	Log of Test Borings (LOTB)	Faramarz Gerami	A separate LOTB including borings and CPTs with Soil Legend sheets should be provided for each wall. Boring and CPT can not have the same number (i.e. A-09-00 1 and CPT-09-00l).	We will comply.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED DECEMBER 8, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of the Geotechnical Design Report for Retaining Walls 1 and 2, between Katella Avenue and Ball Road, dated October 20, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			Corrections should also be made in the report, tables and test results. As built and current LOTBs for Douglass OH. with title blocks and wall number should be included separately in each wall's LOTB. Hammer efficiency, correction factor for conversion of ring sample blow counts to split spoon blow counts and pertinent wall numbers should be provided in Geotechnical Boring Logs (also applies to LOTB). Apparent density and consistency of soils should be based on corrected blow counts for hammer efficiency and sampler type. However, the actual blow counts presented in Log of Borings and LOTB should be the raw field blow counts. LOTB format and soil descriptions should comply with Caltrans Soil and Rock Logging, Classification, and Presentation Manual, June 2007. Please refer to Katella Ave. and Douglas OH. LOTBs including Caltrans comments in memos dated December 3, 2009.	We will comply.

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

T R A N S M I T T A L

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: July 6, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail/Overnight		Draft Report		Your Use
X	Courier	X	Final Report	X	As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Materials Report for Proposed Widening of Northbound State Route 57, Orange County, California

LEIGHTON CONSULTING, INC.

By: Djan Chandra

Distribution: (6) Addressee

17781 Cowan ■ Irvine, CA 92614-6009
949.250.1421 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

MATERIALS REPORT FOR PROPOSED WIDENING OF NORTHBOUND STATE ROUTE 57, ORANGE COUNTY, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 57
PROJECT POST MILES: 12.3/15.2, EA # 0F0401

Prepared For:

HDR ENGINEERING, INC.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

October 9, 2009
(Revised July 6, 2010)

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

October 9, 2009
(Revised July 6, 2010)

Project No. 602231-002

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Attention: Mr. Scott Bacsikin

Subject: Materials Report for Proposed Widening of Northbound State Route 57, Orange County, California

In response to your request, Leighton Consulting, Inc. has performed a geotechnical exploration for the proposed widening of northbound State Route 57 (SR-57) in Orange County, California. The proposed widening extends from approximately 0.3 miles south of Katella Avenue (Post Mile 12.3) to approximately 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project is sponsored by OCTA and Leighton Consulting has been retained as the geotechnical consultant by HDR Engineering, Inc. This report addresses the materials conditions and issues described in Topic 114 of the California Department of Transportation (Caltrans) *Highway Design Manual*. A draft version of this report was issued on October 9, 2009, and February 15, 2010, for review by Caltrans and the design team. Caltrans review comments and our response are included in Appendix D of this report.

It is our professional opinion that the site can be developed as planned from a geotechnical perspective, provided the recommendations presented in this report are incorporated into design and construction.

17781 Cowan ■ Irvine, CA 92614-6009
949.250.1421 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/lr

Distribution: (6) Addressee

Leighton

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1.0 GENERAL

1.1 Purpose and Scope

This report presents the results of our geotechnical exploration for the proposed widening of northbound State Route 57 (SR-57) in Orange County, California. This work has been performed under subcontract to HDR for the Orange County Transportation Authority (OCTA). Geotechnical recommendations provided herein are based on the subsurface data collected from our exploration and design information provided by HDR. Recommendations for structures along the alignment, such as widening of the existing bridges and retaining walls, are provided in separate foundation reports.

Our scope of services consisted of the following tasks:

- Site reconnaissance, selection of boring locations, and marking of the boring locations at the site.
- Notification of Underground Service Alert (USA) of marked boring locations prior to the commencement of our field exploration and coordination of a drilling contractor.
- Obtaining Standard Encroachment Permit from Caltrans.
- Subsurface exploration consisting of excavation, logging, and sampling of eight hollow-stem borings and four hand-auger borings, collection of Standard Penetration Test (SPT), relatively undisturbed ring and/or bulk soil samples at selected depth intervals from the borings and transporting the samples to our laboratory for testing.
- Laboratory testing of selected samples to evaluate engineering characteristics of the onsite soils.
- Evaluation of collected data and relevant engineering analyses.
- Preparation of this report summarizing our findings and conclusions, and presenting our recommendations.

1.2 Project Description

The California Department of Transportation (Caltrans), District 12, in cooperation with OCTA, proposes to widen northbound SR-57 between 0.3 miles south of Katella Avenue (Post Mile 12.3) and approximately 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project segment of SR-57 is approximately 3 miles long, passing through the City of Anaheim in Orange County, California. The location of the site is shown on Figure 1,

Site Location Map. The purpose of the proposed project is to improve both existing and future mobility, reduce congestion and improve mainline merge and diverge movements.

SR-57 was constructed in 1974 and currently has four general purpose lanes and a high-occupancy vehicle (HOV) lane in each direction. Six grade separations exist within this segment; namely at Katella Avenue, Douglass Road, Ball Road, Wagner Avenue, South Street and Lincoln Avenue.

We understand that the project consists of widening of approximately 3 miles of northbound SR-57 by approximately 30 feet to provide standard lane widths, an additional general purpose lane (fifth lane) and a standard 10-foot wide shoulder. The existing asphalt concrete shoulder will be removed and an approximately 20-foot wide concrete pavement and 10-foot wide asphalt concrete shoulder will be constructed.

To accommodate the roadway widening, the existing bridges at Katella Avenue and Douglass Road undercrossings will be widened. The southern segment of the project south of Ball Road is on an elevated embankment. Widening of this segment will require import material and a retaining wall to keep the widened embankment within the existing right-of-way. The retaining wall will consist of Caltrans Type 1 retaining wall along the freeway embankment from Katella Avenue to Ball Road. The maximum height of the retaining wall is approximately 12 feet. Additionally, tie-back walls will be constructed under Ball Road overcrossing and north of Ball Road at Wagner Avenue, South Street and Lincoln Avenue overcrossings to provide space for the proposed improvements.

1.3 Land Use and Terrain

This portion of SR-57 is located in a densely populated urban area surrounded by residential and commercial developments. The proposed improvements will be located within Caltrans right-of-way.

This segment of SR-57 is relatively flat and slopes gently to the south, with elevations ranging from 195 feet above mean sea level (msl) at Katella Avenue to 200 feet msl at Lincoln Avenue. The southern portion of this segment is higher than the surrounding areas while the northern portion is lower.

1.4 Climatic Conditions

The climate in the project area is typical of coastal regions in southern California and classified as Mediterranean because of its characteristically warm, dry summers and mild winters, with moderate precipitation. The semi-arid southern California coastal region receives most of its precipitation from moisture-laden air masses that originate in the northern Pacific Ocean, occurring predominantly during the cool winter season, with an annual rate of about 11 inches of rainfall per year (www.weather.com). The temperatures range from an average low of 45 degrees Fahrenheit in January to an average high of 86 degrees Fahrenheit in August. Snowfall is rare and the project area is considered frost-free. Based on Caltrans *Pavement Climate Regions Map*, the site is located within "South Coast" climate region. This type of climate is not expected to significantly affect pavement structural design. As a result, no freeze-thaw recommendations are required.

1.5 Limitations

This report has been prepared for the use of HDR, OCTA and Caltrans for the proposed widening of Northbound SR-57 between Katella Avenue and Lincoln Avenue and the associated improvements. The report may not be used by others without the written consent of our client and our firm.

The conclusions and recommendations presented in this report have been based upon the generally accepted principles and practices of geotechnical engineering utilized by other competent engineers at this time and place. No other warranty is either expressed or implied.

Additionally, the conclusions and recommendations presented in this report have been based upon the subsurface conditions encountered at discrete and widely spaced locations and at specific intervals below the ground surface. Due to the inherent variance in soil conditions, variability may be encountered during construction. Where encountered during construction, such variances should be brought to our attention to evaluate the impact upon the recommendations presented in this report.

2.0 GEOTECHNICAL FIELD AND LABORATORY EXPLORATIONS

2.1 Subsurface Exploration

An initial site reconnaissance was performed to mark the proposed boring locations and to evaluate the proposed boring locations with respect to access for drilling equipment and subsurface structures. USA was then notified of the marked locations. We also coordinated with Caltrans personnel during our field exploration.

Our field exploration consisted of advancing eight 8-inch diameter hollow-stem borings and four 4-inch diameter hand-auger borings to a maximum depth of 111½ feet below the current grade. The approximate location of these borings is shown on Figure 2.

Standard Penetration Test (SPT) was performed within the hollow-stem borings using a 140-pound automatic hammer falling freely for 30 inches. The samplers were driven for a total penetration of 18 inches and the blow counts were recorded for every 6 inches of penetration. Relatively undisturbed samples were collected from the borings using the Modified California Ring sampler. The field sampling procedures were conducted in accordance with ASTM D 1586 and D 3550 for SPT and split-barrel sampling of soil. In addition to driven samples, representative bulk soil samples were also collected from the borings.

The test borings were logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. The samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the borings were backfilled with soil cutting mixed with cement, tamped and capped with rapid set concrete, where asphalt was penetrated. Geotechnical logs of the borings are included in Appendix A.

Elevation datum for all ground surfaces elevations referenced herein is mean sea level (msl). A summary of the boring locations, elevations and depths is presented in Table 1.

Table 1 - Field Exploration Summary

Boring No.	SR-57 Station No.	Offset[1]	Approximate Ground Surface Elevation (feet, msl)	Exploration Depth (feet)
B-3	275+20	70 feet Right	184	51.5
B-4	289+90	70 feet Right	203	111.5
B-6	305+35	75 feet Right	189	5.0
B-8	319+50	90 feet Right	186	5.0
B-9	329+50	127 feet Right	188	6.5
B-11	346+00	112 feet Right	192	6.5
B-12	352+70	117 feet Right	193	6.5
B-13	361+40	114 feet Right	194	6.5
B-15	372+50	98 feet Right	196	6.5
B-16	377+05	140 feet Right	197	6.5
B-18	391+50	83 feet Right	200	5.0
B-19	396+60	142 feet Right	199	5.0

[1]Offsets were measured from the indicated station line.

2.2 Laboratory Testing

Laboratory tests were performed on representative soil samples to determine the geotechnical engineering properties of subsurface materials. The following laboratory tests were performed:

- In-situ moisture content and density;
- Atterberg Limits;
- Grain-size distribution;
- Percent passing No. 200 sieve;
- Direct shear;
- Consolidation;

- Expansion Index; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests were performed in general conformance with ASTM or California Test Methods. The results of the in-situ moisture and density tests are presented on our geotechnical boring logs (Appendix A). The results of other laboratory tests are presented in Appendix B of this report.

3.0 SUBSURFACE CONDITIONS

3.1 Regional and Site Geology

The subject site is located in the Tustin Plain within the southeastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. In general, the Tustin Plain consists of approximately 1,400 feet of unconsolidated to semi-consolidated Quaternary-age alluvial sediments. Underlying the Quaternary alluvial deposits are Tertiary-age bedrock units consisting of sandstone, siltstone, shale and conglomerate on the order of 31,000 feet in thickness.

The site lies near the lower reaches of the Santa Ana River. The surface distribution of Holocene sediments, as recorded in early editions of regional soil survey maps (Eckmann et al., 1916), suggests that the Santa Ana River has recently wandered back and forth across the Orange County coastal plain from Alamitos Bay to Newport Bay. Historical accounts and documents further support the process of widespread sheet flooding being the dominant depositional process associated with the Santa Ana River prior to the construction of Prado Dam in 1941 (California Department of Water Resources, 1957). Currently, the Santa Ana River is located approximately 1,000 feet and 4,000 feet east of the southern and northern end of the alignment, respectively.

3.2 Subsurface Earth Material

Two of our borings (B-3 and B-4) were drilled within the existing shoulder of the freeway and the remaining borings were drilled within the landscaped area adjacent to the shoulder. The pavement sections encountered in our borings B-3 and B-4 consisted of 4 to 5 inches of hot-mixed asphalt (HMA) over 2 to 13 inches of aggregate base (AB). The existing pavement sections encountered in our borings B-3 and B-4 are shown in Table 2.

Table 2 – Existing Pavement Sections

Boring No.	SR-57 Station No.	Location of Boring	Existing Pavement Section
B-3	275+20	Shoulder	4 inches HMA over 2 inches AB
B-4	289+90	Shoulder	5 inches HMA over 13 inches AB

Based on our borings and previous borings by others, the upper 5 feet of the subsurface soils between the southern end of the project and Ball Road consist primarily of sandy clay and clayey sand. The near-surface soils between Ball Road and the northern end of the project consists primarily of silty sand and sand with silt. The location of the borings is summarized in Table 1.

3.3 Groundwater

Groundwater was encountered in our borings between Katella Avenue and Ball Road at depths ranging from 40½ to 49 feet below the existing grade. Groundwater was not encountered in our borings north of Ball Road. Based on the *California Seismic Hazard Zone Report* (CDMG, 1997), the southern portion of the project site between Katella Avenue and Ball Road falls within the area that is mapped with historically high groundwater contours varying from 30 to 50 feet. The historically high groundwater level for the project segment north of Ball Road is greater than 50 feet below the ground surface. Groundwater is not expected to be an issue for design and construction of the pavement sections for the proposed widening.

4.0 GEOTECHNICAL ANALYSES AND DESIGN

Presented in this section are our evaluation of the corrosion potential of the onsite soils and recommendations for pavement structural sections for the project. The geotechnical parameters used in our analyses were selected based on the laboratory test results and field data from the current investigation, and our geotechnical experience with similar material. Based on the Life Cycle Cost Analysis by others, the existing pavements are not planned for rehabilitation; thus, deflection testing was not performed.

4.1 Corrosion Potential

Representative soil samples were tested for pH, sulfate content, chloride content, and minimum resistivity. The results of these tests are summarized in Table 3 and presented in Appendix B. Section 5.5 of Caltrans *Corrosion Guidelines* states that a site is considered to be corrosive to foundation elements if one or more of the following conditions exist for the soil and/or water samples taken at the site (Caltrans, 2003b):

- Chloride concentration greater than or equal to 500 ppm.
- Sulfate concentration greater than or equal to 2,000 ppm.
- pH of 5.5 or less.

Based on results of the tested samples, the soils at the project site are not considered corrosive.

Using Caltrans *CULVERT4* program, we have estimated the service life of Corrugated Steel Pipe and Corrugated Aluminum Pipe culvert using the corrosivity test results. If materials different than the tested soils are used for backfilling of the culvert, additional corrosivity tests should be performed. Results of the corrosion analysis are summarized in the Table 3 and the computer printouts of the *CULVERT4* program are presented in Appendix C. The metal gauges listed in Table 3 are minimum value with respect to the corrosion potential. Thicker gauges may be required from a structural design standpoint. Plastic pipe may be used for a service life of 50 years for corrosive conditions.

Recommended cement type for reinforced concrete culvert is also listed in Table 3. A minimum 3 inches of concrete cover should be provided over reinforcement in accordance with Caltrans *Bridge Design Specifications* (Caltrans, 2004).

Table 3 – Summary of Corrosion Test Results

Boring No.	SR-57 Station No.	Offset	Sample Depth (feet)	pH	Minimum Resistivity (Ohm-cm)	Chloride Content (ppm)	Sulfate Content (ppm)	Reinforced Concrete Cement Type	Estimated Minimum Gauge for 50-yr Service Life of Metal Pipe			
									CSP	CSP w/ Bituminous Coating	CSP w/ Polymer 90° Invert	CAP/ CASP
B-3	275+20	70 feet RT	0.5 to 5	6.56	774	23	950	Type IP(MS) Modified or Type II Modified[1]	NA	10	18	NA
B-4	289+90	70 feet RT	1.5 to 5	6.64	804	41	271		NA	12	18	NA
			10 to 20	5.73	574	82	383		NA	NA	18	NA
B-6	305+35	75 feet RT	0 to 5	6.35	446	417	787		NA	NA	18	NA
B-8	319+50	90 feet RT	0 to 5	5.92	458	108	919		NA	NA	18	NA
B-9	329+50	127 feet RT	0 to 5	6.87	8,080	43	58		12	18	18	16
B-11	346+00	112 feet RT	0 to 5	7.09	12,817	32	62		14	18	18	16
B-12	352+70	117 feet RT	0 to 5	7.55	7,400	22	62		18	18	18	16
B-13	361+40	114 feet RT	0 to 5	6.98	10,200	43	44		12	18	18	16
B-15	372+50	98 feet RT	0 to 5	7.39	7,400	32	62		18	18	18	16
B-16	377+05	140 feet RT	0 to 5	7.48	5,000	44	73		16	18	18	16
B-18	391+50	83 feet RT	0 to 5	7.18	1,752	111	96		12	16	18	16
B-19	396+60	142 feet RT	0 to 5	8.28	16,600	137	35		18	18	18	16

[1] Maximum water-to-cementitious material ratio of 0.45
CSP: Corrugated Steel Pipe, CAP: Corrugated Aluminum Pipe, and CASP: Corrugated Aluminum Steel Pipe

4.2 Pavement Design

4.2.1 Traffic Indices

Based on the information provided by HDR, the following Traffic Indices (TIs) were used for our pavement design.

Northbound SR-57 Shoulder TIs = 9.5 and 10
Northbound SR-57 Ramps and Connectors TI = 12
Northbound SR-57 General Purpose Lane TI = 15.5

4.2.2 R-Values

During our exploration, twelve subgrade soil samples were selected for R-value testing. The description of the near-surface soils and results of our laboratory tests are summarized in Table 4. As shown in the table, the laboratory test results indicate R-values of representative subgrade soils varying from 25 to 38 at the southern portion of the project (south of Ball Road) and 41 to 79 at the northern portion of the project (north of Ball Road). Due to the low R-values and relatively high clay contents, the upper 4 feet of subsurface soils below the finished grade for the segment south of Ball Road should be overexcavated and replaced with imported material with R-value greater than 40 (e.g., Class 3 aggregate subbase). The existing topography within this segment will require import material anyway for the proposed widening. With this remedial grading, we have selected an R-value of 40 for subgrade and 78 for aggregate base for the pavement design.

Table 4 – Laboratory Test Results

Boring No.	Soil Type	Tested R-value	Percent Fines	Expansion Index	Sand Equivalent
B-3	Sandy Clay	25	54	37	-
B-4	Clayey Sand	28	34	48	15
B-6	Clayey Sand	38	33	50	-
B-8	Clayey Sand	41	34	52	-
B-9	Silty Sand	74	14	-	35
B-11	Silty Sand	78	17	-	34
B-12	Silty Sand	76	22	-	24
B-13	Silty Sand	74	17	-	31
B-15	Silty Sand	74	20	-	26
B-16	Silty Sand	73	26	-	22
B-18	Silty Sand	67	28	-	26
B-19	Sand with silt	79	10	-	48

4.2.3 Recommended Minimum Pavement Sections

Based on the provided plan, the proposed shoulder and ramps will consist of flexible pavements and the general purpose lane will have rigid jointed plain concrete pavement (JPCP). We have designed the flexible pavement sections for TIs of 9.5, 10 and 12.0 per the design procedures outlined in Chapter 630 of the *Highway Design Manual* (*HDM*) using the computer program *CalFP Version 1.1*. Computer printouts of the pavement design are presented in Appendix C and the recommended pavement sections are presented in Tables 5a and 5b. Pavement sections with ATPB should be considered where the as-built sections have ATPB.

We understand that pavement section for the proposed shoulder will have Rubberized Hot Mixed Asphalt (RHMA) over Hot Mixed Asphalt (HMA). Per Table 612.2 and Section 613.5 of *HDM*, for shoulder width of 5 feet or less, the same pavement sections or TI of the adjacent travel lane should be used for the entire shoulder. For shoulder width wider than 5 feet, the same pavement sections or TI of the adjacent travel lane should be used for the first two feet of shoulder measured from the edge of the travel lane, and the rest of the shoulder should be designed with the provided TIs.

Table 5a – Design Flexible Pavement Sections
South of Ball Road (Stations 254+59.19 to 325+00)

Location	Traffic Index	RHMA (feet)	HMA-A (feet)	ATPB, AB and AS Thickness (feet)
Shoulder	9.5	0.15	0.20	0.80 AB or
				0.75 AB over 0.35 AS
	10	0.15	0.20	0.95 AB or
				0.80 AB over 0.35 AS
On-Ramp	12	-	0.60	0.25 ATPB over 0.85 AB or
				1.15 AB or
				1.00 AB over 0.35 AS

RHMA: Rubberized Hot Mix Asphalt (Type G); HMA-A: Hot-Mixed Asphalt (Type A); ATPB: Asphalt Treated Permeable Base; AB: Class 2 Aggregate Base; and AS: Class 2 Aggregate Subbase

Note: The upper 4 feet of subsurface soils below the finished grade for this segment should be overexcavated and replaced with imported material with R-value greater than 40 (e.g., Class 3 aggregate subbase).

Based on the provided information, we understand that the existing Chantilly Storm Drain box will be located within the widening portion of the on-ramp at Ball Road. The available vertical space between the finished grade and top of the storm drain box is approximately 1.15 feet. To reduce the thickness, the pavement section of the Ball Road on-ramp is designed with RHMA over HMA. Additionally, to provide a uniform support and reduce the potential for differential settlement, a layer of geogrid is recommended below the pavement section. The geogrid should satisfy the requirements of *Standard Specification for Public Works Construction* (Greenbook) Table 213.2.2 (B) Biaxial S1 or approved equivalent (e.g., Tensar BX 1100).

Table 5b – Design Flexible Pavement Sections
North of Ball Road (Stations 325+00 to STA 400+20)

Location	Traffic Index	RHMA (feet)	HMA-A (feet)	ATPB, AB and AS Thickness (feet)
Shoulder	9.5	0.15	0.20	0.80 AB
	10	0.15	0.20	0.95 AB
Ball Road On-Ramp	12	0.20	0.55	0.40 AB
Other On-Ramps	12	-	0.60	0.25 ATPB over 0.85 AB or
				1.15 AB

RHMA: Rubberized Hot Mix Asphalt (Type G); HMA-A: Hot-Mixed Asphalt (Type A); ATPB: Asphalt Treated Permeable Base; and AB: Class 2 Aggregate Base

For design of rigid pavement, we have followed Chapter 620 of the HDM. Type II soil subgrade with R-values between 10 and 40 was used for the entire alignment. Design sections of rigid jointed plain concrete pavement (JPCP) with and without lateral support and the underlying base courses for the proposed general purpose lane are listed in Table 6. Again, due to the presence of Chantilly Storm Drain box north of Ball Road from approximate Stations 330+00 to 332+00, limited vertical space is available for construction of the new pavement for the proposed widening. For this segment, the aggregate subbase layer may be eliminated. Such approach is considered reasonable since the R-value north of Ball Road is relatively high and the subgrade soil may actually be considered as Type I soil.

Details of the JPCP pavement sections should follow Chapter 620 of the HDM. Based on the HDM, if an ATPB layer is needed to perpetuate an existing treated permeable layer, the ATPB layer can be placed between the surface layer (JPCP) and the base layer. No deduction of the thickness of the base and subbase layers is allowed to account for the ATPB.

Table 6 – Design Rigid Pavement Sections

Location	Traffic Index	With Lateral Support (feet)	Without Lateral Support (feet)
General Purpose Lane	15.5	0.95 JPCP over 0.35 LCB over 0.7 AS[1]	1.05 JPCP over 0.35 LCB over 0.7 AS[1]

JPCP: Jointed Plain Concrete Pavement; LCB: Lean Concrete Base; and AS: Class 2 Aggregate Subbase

[1]Approximately 200 feet north of Ball Road between Stations 330+00 to 332+00, due to the presence of Chantilly Storm Drain box below the new pavement section, the 0.7 feet AS can be eliminated.

Note: The upper 4 feet of subsurface soils below the finished grade for the segment south of Ball Road (Station 254+59.19 to Station 325+00) should be overexcavated and replaced with imported material with R-value greater than 40 (e.g., Class 3 aggregate subbase).

4.2.4 Pavement Materials and Compaction

Recommended structural pavement materials should conform to the specified provisions in the Caltrans *Standard Specifications* and Caltrans *Asphalt Rubber Usage Guide* (Caltrans 2003a) including grading and quality requirements, shown below:

- Portland Cement Concrete Pavement (PCCP) should conform to Section 40 of the *Standard Specifications*. The PCCP materials (pavement, structures, and minor concrete) should conform to Section 90 of the *Standard Specifications*.
- RHMA for pavement should be Type G and conform to Caltrans *Asphalt Rubber Usage Guide*.
- HMA for pavement should be Type A with maximum aggregate size of ¾ inches and conform to Section 39 of the *Standard Specifications*. Asphalt concrete specimens should be tested for surface abrasion in accordance with California Test Method 360.
- Aggregate base (AB) should be Class 2 aggregate with a minimum R-value of 78 as specified in Section 26-1.02A of the Caltrans *Standard Specifications*.

- Lean Concrete Base (LCB) should conform to Section 28 of the *Standard Specifications*.
- Asphalt Treated Permeable Base (ATPB) should conform to Section 29-1.02A of the *Standard Specifications*.
- Classs 2 and 3 aggregate subbase (AS) should conform to Sections 25-1.02A of the *Standard Specifications*.

Subgrade and base compaction shall be in compliance with Section 19-5.03 "Relative Compaction (95 percent)" of Caltrans *Standard Specifications* and Section 614.6 of *HDM*.

4.2.5 Material Sources

Grading for the southern portion of the improvements will require imported fill. The imported materials within the upper 4 feet of roadway finished grade should have a minimum R-value of 40 and should be non-corrosive and of low expansion. Class 3 aggregate subbase can be used for the imported material and import material shall be in compliance with Section 19-7.02 of Caltrans *Standard Specifications*.

Other construction materials such as aggregates, asphalt, and Portland cement should be imported from local commercial sources. No potential sources for import materials have been pre-tested for this project. Prior to import, the materials should be tested and approved by the Geotechnical Engineer and the District Materials Engineer.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Construction Advisories

On-site soils are considered rippable and excavations are feasible with conventional excavation equipment.

5.2 Construction Considerations that Influence Specifications

Storing, proportioning and mixing material shall comply with Section 39-3 of Caltrans *Standard Specifications* and spreading and compacting of the asphalt concrete shall comply with Section 39-6 of Caltrans *Standard Specifications* (Caltrans, 2006).

Slopes to receive erosion control should have all loose rocks larger than 2 inches in maximum dimension, roots and other debris on the surface removed and disposed of prior to applying erosion control materials.

The contractor should be aware of water pollution control work as defined in "Section 7-1.01G, Water Pollution" in Caltrans *Standard Specifications*.

5.3 Pre-Construction Survey and Construction Monitoring

Prior to any site work and excavations, conditions of existing structures and improvements that may be impacted by the construction should be surveyed and photo/video documented. Structures and improvements that are to be left in-place and within a distance equal to the height of excavations, including back cuts for retaining walls, should be surveyed prior to start of construction and monitored during construction.

Final project Plans and Specifications should be reviewed prior to construction to verify that the full intent of the recommendations presented in this Materials Report have been incorporated. Following review of Plans and Specifications, sufficient and timely observation during construction should be performed by a qualified geotechnical consultant to correlate findings of the exploration with actual subsurface conditions exposed during construction.

5.4 Differing Site Conditions

Soil and groundwater conditions were observed and interpreted at the exploration locations only. This information was used as the basis of analyses and recommendations provided herein. Conditions may vary between the exploration locations and seasonal fluctuations in the groundwater level may occur due to variations in rainfall and local groundwater management practices. If conditions encountered during construction differ from those described herein, our recommendations may be subject to modification.

6.0 EARTHWORK RECOMMENDATIONS AND SPECIFICATIONS

6.1 Grading and Earthwork

All grading and earthwork activities should be performed in accordance with the applicable portions of Sections 16 and 19 of the latest Caltrans *Standard Specifications* and the recommendations contained in this report.

6.2 Clearing and Grubbing

Debris, organic material or other unsuitable material should be removed and disposed of in accordance with Sections 16 and 19-2.02 of Caltrans *Standard Specifications*, or the material can be removed and delivered to an approved sanitary landfill.

6.3 Remedial Grading

The existing topography of the southern portion of the project segment (south of Ball Road) is such that import material will be required for the proposed widening. Due to the low R-values and relatively high clay contents, the upper 4 feet of subsurface soils below the finished grade for the project segment south of Ball Road should be overexcavated and replaced with imported material with R-value of 40 or greater. Per Caltrans review comment dated March 16, 2010, if unsuitable material (loose/soft or wet soils) is encountered at the removal bottom of 4 feet below the finished grade, the unsuitable material should be removed and replaced with imported material with R-value of 40 or greater (e.g., Class 2 aggregate subbase).

For other areas, after clearing and stripping, loose/soft or wet soils, if encountered, should be removed. The thickness of unsuitable subgrade soils is generally expected to range from 1 to 2 feet; however, locally, deeper removals may be required. The exposed surface should be proof-rolled with loaded heavy equipment. Areas of loose or yielding soils should be overexcavated and recompacted. Soils that cannot be compacted or are otherwise unsuitable for the planned use, should be excavated and disposed from the project site. Soft/loose and wet subgrade conditions may require stabilization using rock and/or geotextiles prior to fill placement.

6.4 Materials Specifications

All engineered fill, including imported soils, to be used in this project should be well-graded soils with maximum dimension of 4 inches and less than 50 percent passing the No. 200 sieve, free of organic and other deleterious debris, essentially non-plastic (Liquid Limit less than 30, Plasticity Index less than 12), and an Expansion Index (EI) of less than 50. In general, well-graded mixtures of gravel, sand, and non-plastic silt meeting the above requirements are acceptable for use as general embankment fill. Additionally, imported material within the upper 4 feet of the roadway finished grade for the proposed widening south of Ball Road should have R-value greater than 40.

Structure backfill should conform to Section 19-3.06 of Caltrans *Standard Specifications*. All structure backfill (including fill placed behind walls) should be placed in thin, loose lifts, moisture-conditioned, and compacted per Section 19-5.03 of Caltrans *Standard Specifications*. Ponding and jetting of structure fill should not be allowed.

6.5 Subgrade Compaction

Structural pavement sections within Caltrans right-of-way should be compacted to a minimum of 95 percent in accordance with Section 19-5.03 "Relative Compaction (95 Percent)" of Caltrans *Standard Specifications* and Section 614.6 of the *HDM*. This compaction criterion applies in the upper 3 feet of materials below finished grade for the width of the traveled way or widening plus 3 feet on each side within Caltrans right-of-way, or to a depth of 1 foot below top of subgrade for pavement sections outside of Caltrans right-of-way. All materials and placement should conform to Caltrans *Standard Specifications* and *HDM*.

6.6 Geotechnical Observation

It is recommended that observation and testing be performed by the geotechnical engineer's representative during the following stages of construction:

- Grading operations, including excavations and fill placement;
- Excavations for utility trenches;
- Placement of utility trench bedding and backfill;
- Removal of buried utilities or structures, if any;
- Subgrade preparation and pavement construction; and
- When any unusual conditions are encountered.

7.0 REFERENCES

The following references were used in preparation of this report:

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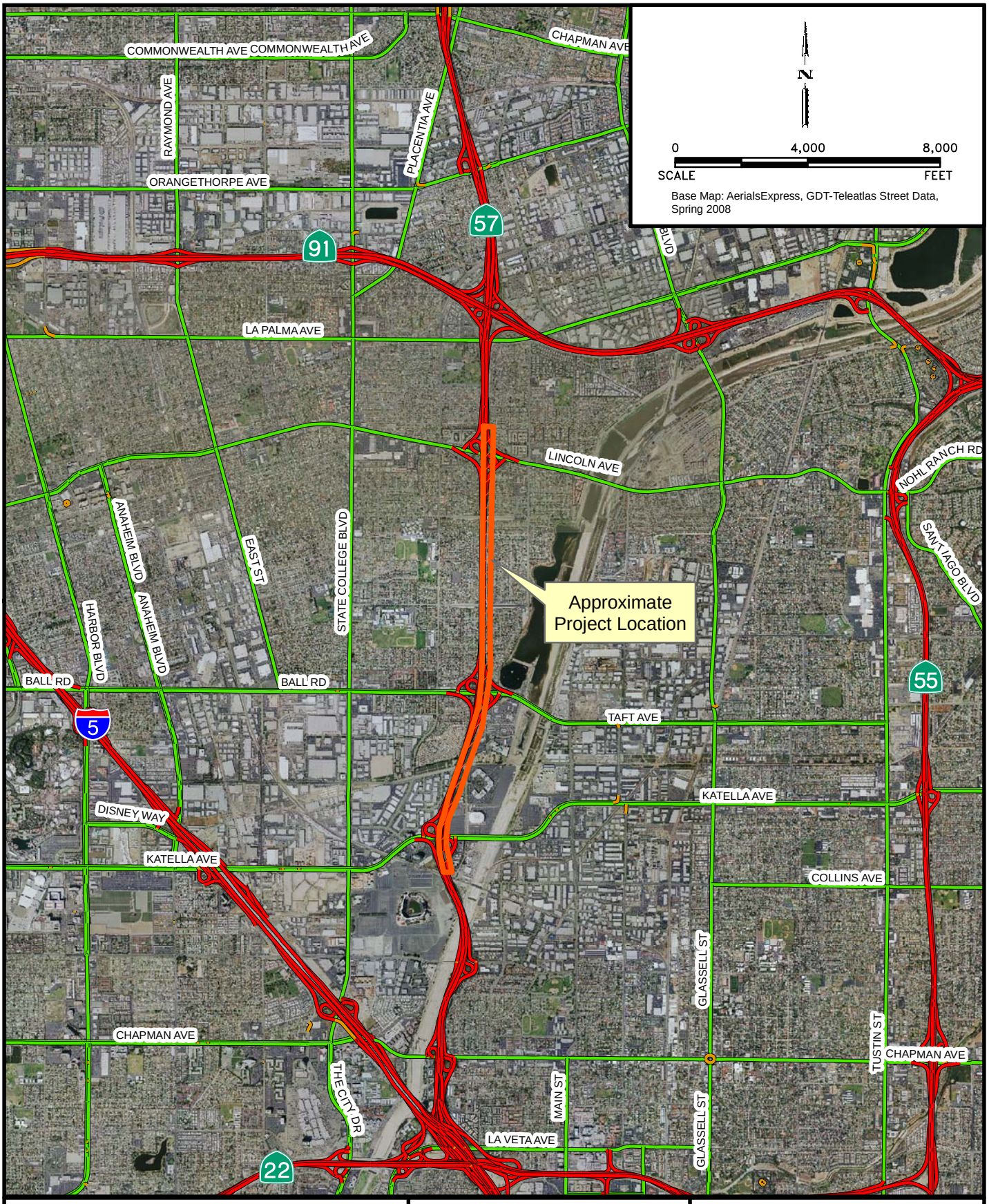
University of Florida Transportation Research Center, McTrans, CULVERT4 program, Version 4.00, Released on April 16, 1998.



SR-57 Northbound Widening
Katella Avenue to Lincoln Avenue
Orange County, California

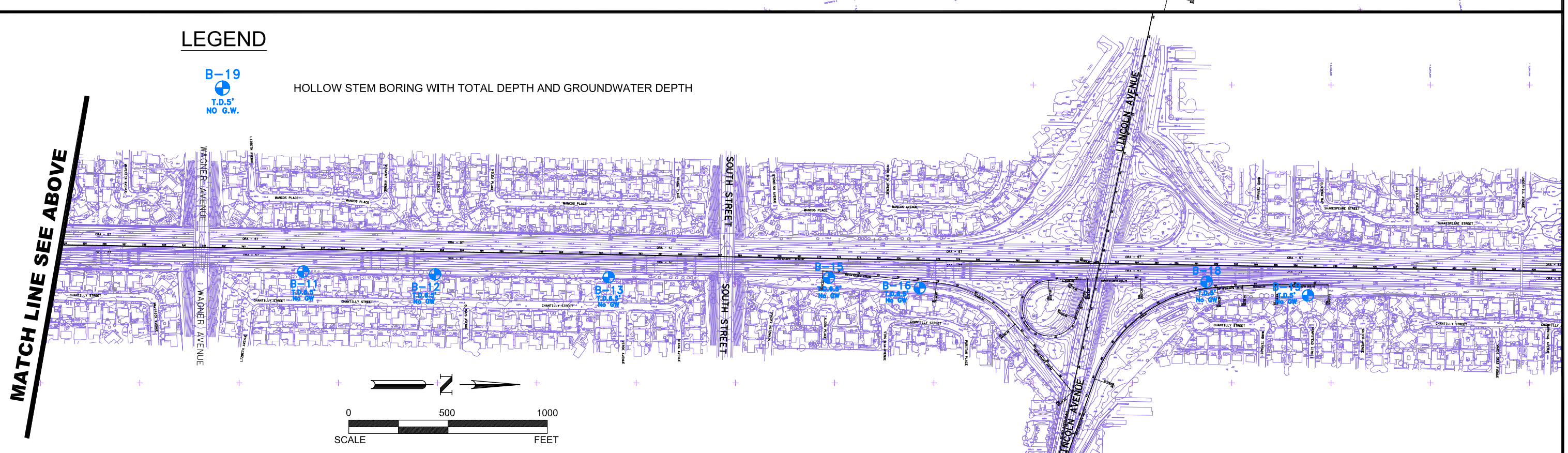
SITE LOCATION MAP

Project No.
602231-002

Date
June 2009

Figure 1

\\GIS\Drafting\602231\002\GIS\of_09-06-16\Figure1-SiteLocationMap.mxd



Proj: 602231-002	Eng/Geol: DJC/ELB	**BORING LOCATION MAP** SR-57 NORTHBOUND WIDENING BETWEEN KATELLA AVENUE AND LINCOLN AVENUE ORANGE COUNTY, CALIFORNIA	FIGURE 2
Scale: 1"=500'	Date: 6/09		Leighton
Drafted By: BQT	Checked By: BQT	P:\DRAFTING\602231\002\OF_2009-06-17\11X17-FIGURE\FIGURE2.DWG (06-23-09 3:12:50PM) Plotted by: btran	

APPENDIX A

GEOTECHNICAL BORING LOG B- 3

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	184'
Location	70' RT of SR 57 STA 275+20	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0								4-inch of Asphalt Concrete over 2-inch of Aggregate Base	
				Bag-1				ML	SANDY SILT (ML), gray, moist to wet, fine grained sand, some fine gravel	SA, RV, EI, CR
180										
	5			R-1	3 6 10	97.5	28.4	CL-ML	SILTY CLAY (CL-ML), stiff, gray, wet, some fine to medium sand, micaceous	CN
175										
	10			R-2	4 10 12	97	28			DS
170										
	15			S-1	2 3 4				medium stiff	
165										
	20			R-3	4 11 28	102	20		stiff, dark olive gray, moist	
160										
	25			S-2	1 1 2			SM	SILTY SAND (SM), very loose, brown, moist, fine sand	
								ML	SANDY SILT with Gravel (ML), soft, brown, moist, fine sand	
155										
	30									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- UC UNCONFINED COMPRESSIVE STRENGTH
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- EI EXPANSION INDEX
- RV R VALUE
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CO COLLAPSE
- PP POCKET PENETROMETER

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG B- 3

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	184'
Location	70' RT of SR 57 STA 275+20	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	30			R-4	4 10 15	112	24	ML	CLAYEY SILT (ML), stiff, brown, moist to wet, some fine sand	
								SM	SILTY SAND (SM), medium dense, brown, moist to wet, fine sand	
150										
	35			S-3	1 2 3			CL-ML	SILTY CLAY (CL-ML), medium stiff, brown, moist	
								SM	SILTY SAND (SM), loose, brown, moist, fine sand	
145										
	40			R-5	4 7 8	110	16.8	ML	SANDY SILT (ML), medium stiff, reddish brown, moist, fine sand	DS
140										
	45			S-4	2 3 3			CL-ML	SILTY CLAY (CL-ML), medium stiff, brown, moist to wet	
135										
	50			S-5	2 4 6			ML	SANDY SILT with Clay (ML), stiff, brown, moist to wet	
								SM	SILTY SAND, loose, brown, moist, fine sand	
									Total Depth : 51.5 feet No free groundwater encountered during drilling Boring backfilled with soil-cement mix and capped with 4-inch Rapid Set Concrete	
130										
	55									
125										
	60									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER
UC	UNCONFINED COMPRESSIVE STRENGTH				

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG B- 4

Project No.	602231-002	**Date Drilled**	3-2-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	203'
Location	70' RT of SR 57 STA 289+90	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0								5-inch of Asphalt Concrete over 13-inch of Aggregate Base	
				Bag-1				SC	CLAYEY SAND with gravel (SC), gray, moist, coarse sand, fine gravel	SE, RV, EI, CR
200										
	5			R-1	8 12 18	104	22		medium dense, gray, moist to wet, fine to coarse sand	
								CL-ML	SILTY CLAY (CL-ML), hard, gray, moist, with fine gravel, angular, low plasticity	
195										
	10			R-2	7 24 26	114	16			CR
								SC	CLAYEY SAND (SC), medium dense, gray, moist, fine to coarse sand with fine gravel	
190										
	15			S-1	7 8 8			CL-ML	SILTY CLAY (CL-ML), soft, gray, moist, low plasticity	CR
185										
	20			R-3	5 11 23	101	2	SC	CLAYEY SAND (SC), medium dense, dark grayish brown, dry to moist, fine to coarse sand with fine gravel, angular	
								CL-ML	SILTY CLAY (CL-ML), stiff, gray, dry to moist, with fine gravel, low plasticity	
180										
	25			S-2	2 6 7					
175										
	30									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER
UC	UNCONFINED COMPRESSIVE STRENGTH				

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GEOTECHNICAL BORING LOG B- 4

Project No.	602231-002	**Date Drilled**	3-2-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	203'
Location	70' RT of SR 57 STA 289+90	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	30			R-4	4 9 16	109	20	CL-ML	SILTY CLAY (CL-ML), hard, gray, moist, with fine gravel, low plasticity	
170										
	35			S-3	5 9 14			SP	SAND (SP), medium dense, gray, moist, fine to coarse sand	
165										
	40			R-5	5 8 8	115	9		brown, moist	
160										
	45			S-4	4 5 6				light brown	
155										
	50			S-5	5 7 10					
150										
	55			S-6	12 16 16				dense	
145										
	60									

SAMPLE TYPES:

S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
C CORE SAMPLE

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
UC UNCONFINED COMPRESSIVE STRENGTH
SA SIEVE ANALYSIS
SE SAND EQUIVALENT
EI EXPANSION INDEX
RV R VALUE
-200 % FINES PASSING
AL ATTERBERG LIMITS
CO COLLAPSE
PP POCKET PENETROMETER

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GEOTECHNICAL BORING LOG B- 4

Project No.	602231-002	**Date Drilled**	3-2-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	203'
Location	70' RT of SR 57 STA 289+90	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	60			S-7	9 7 6			SP	SAND (SP), medium dense, gray, moist, fine to coarse sand	
								CL-ML	SILTY CLAY (CL-ML), medium stiff, brown, moist, low plasticity	
								SC	CLAYEY SAND (SC), medium dense, fine to medium sand	
140										
	65			S-8	8 12 14			SP	SAND with Silt (SP-SM), medium dense, brown, dry to moist, medium sand	-200
135										
	70			S-9	3 6 7			SM	SILTY SAND with Clay (SC-SM), medium dense, brown, moist to wet, fine sand	SA
130										
	75			S-10	4 8 30			SP	SAND (SP), dense, grayish brown, wet, fine to coarse sand	
125										
	80			S-11	3 3 5				with Silt (SP-SM), medium dense, brown, fine to medium sand	-200
								CL-ML	SILTY CLAY (CL-ML), medium stiff, brown, wet, low plasticity	
120										
	85			S-12	3 9 20			SC	CLAYEY SAND (SC), dense, brown, wet, fine to medium sand	-200
115										
	90									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER
UC	UNCONFINED COMPRESSIVE STRENGTH				

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG B- 4

Project No.	602231-002	**Date Drilled**	3-2-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	203'
Location	70' RT of SR 57 STA 289+90	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N–S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	90			S-13	4 4 5			SM	SILTY SAND (SM), medium dense, brown, wet, fine to medium sand	-200
110										
	95			S-14	2 4 5			CL	SANDY CLAY (CL), stiff, reddish brown, moist, low plasticity	SA
105										
	100			S-15	3 6 9			SC	CLAYEY SAND (SC), medium dense, brown, wet, fine to medium sand	-200
100										
	105			S-16	5 6 7			CL-ML	SILTY CLAY (CL-ML), stiff, reddish brown, moist to wet, low plasticity	AL
95										
	110			S-17	7 11 15			SC	SILTY SAND with Clay (SC-SM), medium dense, reddish brown, wet, fine to medium sand, with clay	SA
								CL-ML	SILTY CLAY (CL-ML), hard, reddish brown, moist to wet, low plasticity	
90									Free groundwater encountered at 72 feet below existing grade during drilling. Boring backfilled with soil-cement mix and capped with 5-inch Rapid Set Concrete	
	115									
85										
	120									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- UC UNCONFINED COMPRESSIVE STRENGTH
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- EI EXPANSION INDEX
- RV R VALUE
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CO COLLAPSE
- PP POCKET PENETROMETER

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GEOTECHNICAL BORING LOG B- 6

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	AB
Drilling Co.	N/A	**Hole Diameter**	4"
Drilling Method	Hand Auger	**Ground Elevation**	189'
Location	75' RT of SR 57 STA 305+35	**Sampled By**	BM

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			Bag-1				SC	CLAYEY SAND with Gravel (SC), dark gray, moist, fine to coarse sand	SA, RV, EI, CR
185	5								Total Depth: 5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
180	10									
175	15									
170	20									
165	25									
160	30									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG B- 8

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	AB
Drilling Co.	N/A	**Hole Diameter**	4"
Drilling Method	Hand Auger	**Ground Elevation**	186'
Location	90' RT of SR 57 STA 319+50	**Sampled By**	BM

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
185	0			Bag-1				SC	CLAYEY SAND (SC), dark gray, moist, some fine gravel	SA, RV, EI, CR
	5								Total Depth: 5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
180										
	10									
175										
	15									
170										
	20									
165										
	25									
160										
	30									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG B-9

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	188'
Location	127' RT of SR 57 STA 329+50	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			Bag-1				SM	SILTY SAND (SM), brown, moist, fine to medium sand, some fine gravel trace of coarse sand	SE, SA, CR, RV
185				R1	8 11 14	111.0	7.0		medium dense	
	5			R2	3 3 4	99.0	9.0		very loose, moist, fine to coarse sand, trace of cobble	
									Total Depth: 6.5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
180										
	10									
175										
	15									
170										
	20									
165										
	25									
160										
	30									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG B-11

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	192'
Location	112' RT of SR 57 STA 346+00	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			Bag-1				SM	SILTY SAND (SM), brown, moist, fine to medium sand, some fine gravel	SE, SA, RV, CR
190				R-1	10 17 22	114.0	8.0		medium dense	
	5			R-2	3 4 5	101.0	5.0		loose, fine to coarse sand	
185									Total Depth: 6.5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
	10									
180										
	15									
175										
	20									
170										
	25									
165										
	30									

The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

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GEOTECHNICAL BORING LOG B-12

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	193'
Location	117' RT of SR 57 STA 352+70	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			Bag-1				SM	SILTY SAND (SM), brown, moist to wet, fine to medium sand, some fine gravel	SE, SA, RV, CR
190				R-1	15 25 23	124.0	6.0		medium dense, moist	
	5			R-2	3 3 4	107.0	5.0		with Gravel, very loose, light brown, fine to coarse sand, fine gravel	
185									Total Depth: 6.5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
	10									
180										
	15									
175										
	20									
170										
	25									
165										
	30									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG B-13

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	194'
Location	114' RT of SR 57 STA 361+40	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N – S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			Bag-1				SM	SILTY SAND (SM), brown, moist, fine sand, some fine gravel	SA, SE, CR, RV
				R-1	7 9 10	105.0	5.0		medium dense	
190	5			R-2	2 3 4	103.0	6.0		very loose	
									Total Depth: 6.5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
185	10									
180	15									
175	20									
170	25									
165	30									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG B-15

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	196'
Location	98' RT of SR 57 STA 372+50	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N–S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
195	0			Bag-1				SM	SILTY SAND (SM), brown, moist, fine and coarse sand, some fine gravel	SA, SE, CR, RV
				R-1	18 25 33	118.0	5.0		dense	
190	5			R-2	8 8 10	108.0	2.0		medium dense, dry to moist	
									Total Depth: 6.5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
185	10									
180	15									
175	20									
170	25									
	30									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG B-16

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	CDL
Drilling Co.	Martini Drilling Corp.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	197'
Location	140' RT of SR 57 STA 377+05	**Sampled By**	CDL

Elevation Feet	Depth Feet	Graphic Log (N–S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			Bag-1				SM	SILTY SAND (SM), brown, moist, fine to coarse sand, some fine gravel	SA, SE, CR, RV
195				R-1	11 21 28	111.0	5.0		medium dense	
	5			R-2	2 3 3	106.0	12.0			
190									Total Depth: 6.5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
	10									
185										
	15									
180										
	20									
175										
	25									
170										
	30									

The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG B-18

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	AB
Drilling Co.	N/A	**Hole Diameter**	4"
Drilling Method	Hand Auger	**Ground Elevation**	200'
Location	83' RT of SR 57 STA 391+50	**Sampled By**	BM

Elevation Feet	Depth Feet	Graphic Log (N–S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
200	0			Bag-1				SM	SILTY SAND (SM), light brown, moist, fine to coarse sand	SA, SE, RV, CR
195	5								Total Depth: 5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
190	10									
185	15									
180	20									
175	25									
170	30									

The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG B-19

Project No.	602231-002	**Date Drilled**	3-3-09
Project	SR 57 Northbound Widening between Katella Ave and Lincoln Ave	**Logged By**	AB
Drilling Co.	N/A	**Hole Diameter**	4"
Drilling Method	Hand Auger	**Ground Elevation**	199'
Location	142' RT of SR 57 STA 396+60	**Sampled By**	BM

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *The Soil Description applies only to a location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			Bag-1				SP	SAND with Silt (SP), light brown, moist, fine to coarse sand	SA, SE, RV, CR
195										
	5								Total Depth: 5 feet No free groundwater encountered during drilling. Boring backfilled with soil-cement mix.	
190										
	10									
185										
	15									
180										
	20									
175										
	25									
170										
	30									

SAMPLE TYPES:

S	SPLIT SPOON	G	GRAB SAMPLE
R	RING SAMPLE	C	CORE SAMPLE
B	BULK SAMPLE		
T	TUBE SAMPLE		

TYPE OF TESTS:

DS	DIRECT SHEAR	SA	SIEVE ANALYSIS	-200	% FINES PASSING
MD	MAXIMUM DENSITY	SE	SAND EQUIVALENT	AL	ATTERBERG LIMITS
CN	CONSOLIDATION	EI	EXPANSION INDEX	CO	COLLAPSE
CR	CORROSION	RV	R VALUE	PP	POCKET PENETROMETER

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

APPENDIX B

Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	03/17/09
Project No. :	602231-002	Input By:	J. Ward	Date:	03/18/09
Boring No.:	A-09-004	Checked By:	J. Ward		
Sample No.:	S-16	Depth (ft.)	105.0		
Soil Identification:	Reddish brown silty clay (CL-ML)				

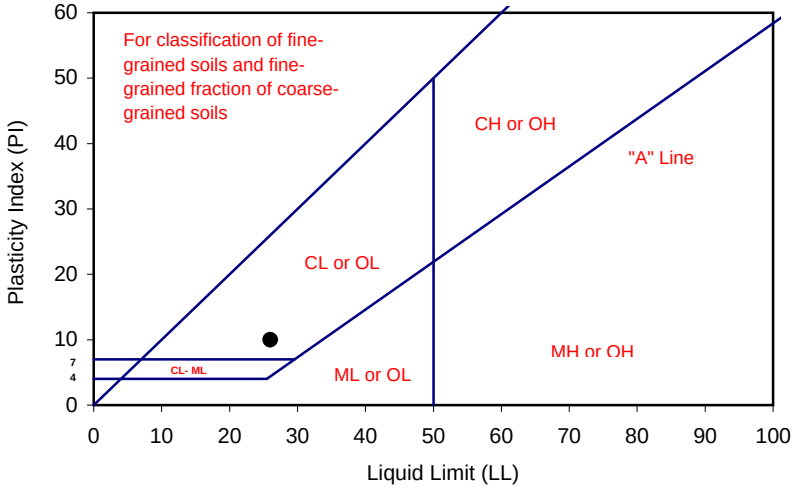
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			30	24	16	
Wet Wt. of Soil + Cont. (g)	9.95	10.13	20.45	19.08	23.62	
Dry Wt. of Soil + Cont. (g)	8.72	8.88	16.60	15.40	18.79	
Wt. of Container (g)	1.06	1.04	1.06	1.07	1.08	
Moisture Content (%) [Wn]	16.06	15.94	24.77	25.68	27.27	

Liquid Limit	**26**
Plastic Limit	**16**
Plasticity Index	**10**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 4.38

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



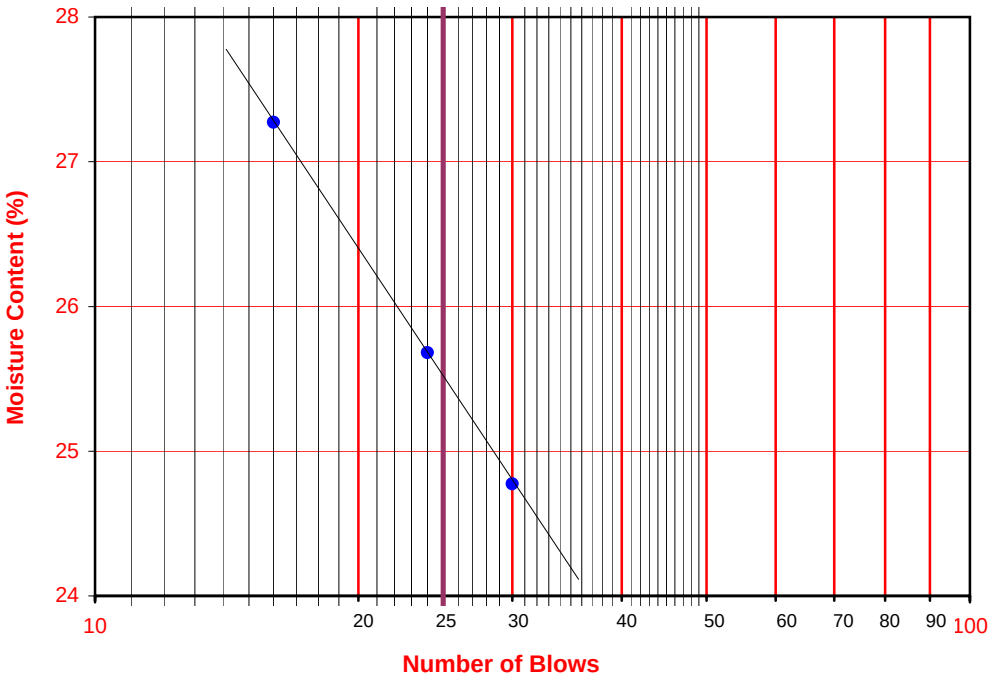
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

SAND EQUIVALENT TEST

DOT CA Test 217

Project Name: SR-57 Widening

Tested By: G. Bathala

Date: 03/11/09

Project No. : 602231-002

Input By: J. Ward

Date: 06/10/10

Boring No.	Sample No.	Depth (ft.)	Soil Type	T1	T2	T3	T4	R1	R2	SE	Average SE
A-09-004	Bag-1	1.5-5	Clayey sand with gravel (SC)	13:16	13:26	13:28	13:48	12.6	1.7	14	**15**
				13:19	13:29	13:31	13:51	11.7	1.7	15	

T1 = Starting Time

T2 = (T1 + 10 min) Begin Agitation

(131 cycles in 45 sec)

T3 = Settlement Starting Time

T4 = (T3 + 20 min) Take Clay Reading (R1)

and Sand Reading (R2)

Sand Equivalent = R2 / R1 * 100

Record SE as Next Higher Integer

Leighton

SAND EQUIVALENT TEST

DOT CA Test 217

Project Name: SR-57 Widening

Tested By: G. Bathala

Date: 03/12/09

Project No. : 602231-002

Input By: J. Ward

Date: 06/10/10

Boring No.	Sample No.	Depth (ft.)	Soil Type	T1	T2	T3	T4	R1	R2	SE	Average SE
B-15	Bag-1	1.5-5	Brown silty sand (SM)	07:20	07:30	07:32	07:52	10.9	2.8	26	**26**
				07:23	07:33	07:35	07:55	11.0	2.8	26	
B-16	Bag-1	0-5	Brown silty sand (SM)	07:26	07:36	07:38	07:58	11.4	2.4	22	**22**
				07:29	07:39	07:41	08:01	11.6	2.4	21	
B-18	Bag-1	0-5	Light brown silty sand (SM)	07:32	07:42	07:44	08:04	9.4	2.3	25	**26**
				07:35	07:45	07:47	08:07	9.9	2.5	26	
B-19	Bag-1	0-5	Light brown sand with silt (SP)	07:38	07:48	07:50	08:10	7.5	3.5	47	**48**
				07:42	07:52	07:54	08:14	7.4	3.5	48	

T1 = Starting Time

T2 = (T1 + 10 min) Begin Agitation

(131 cycles in 45 sec)

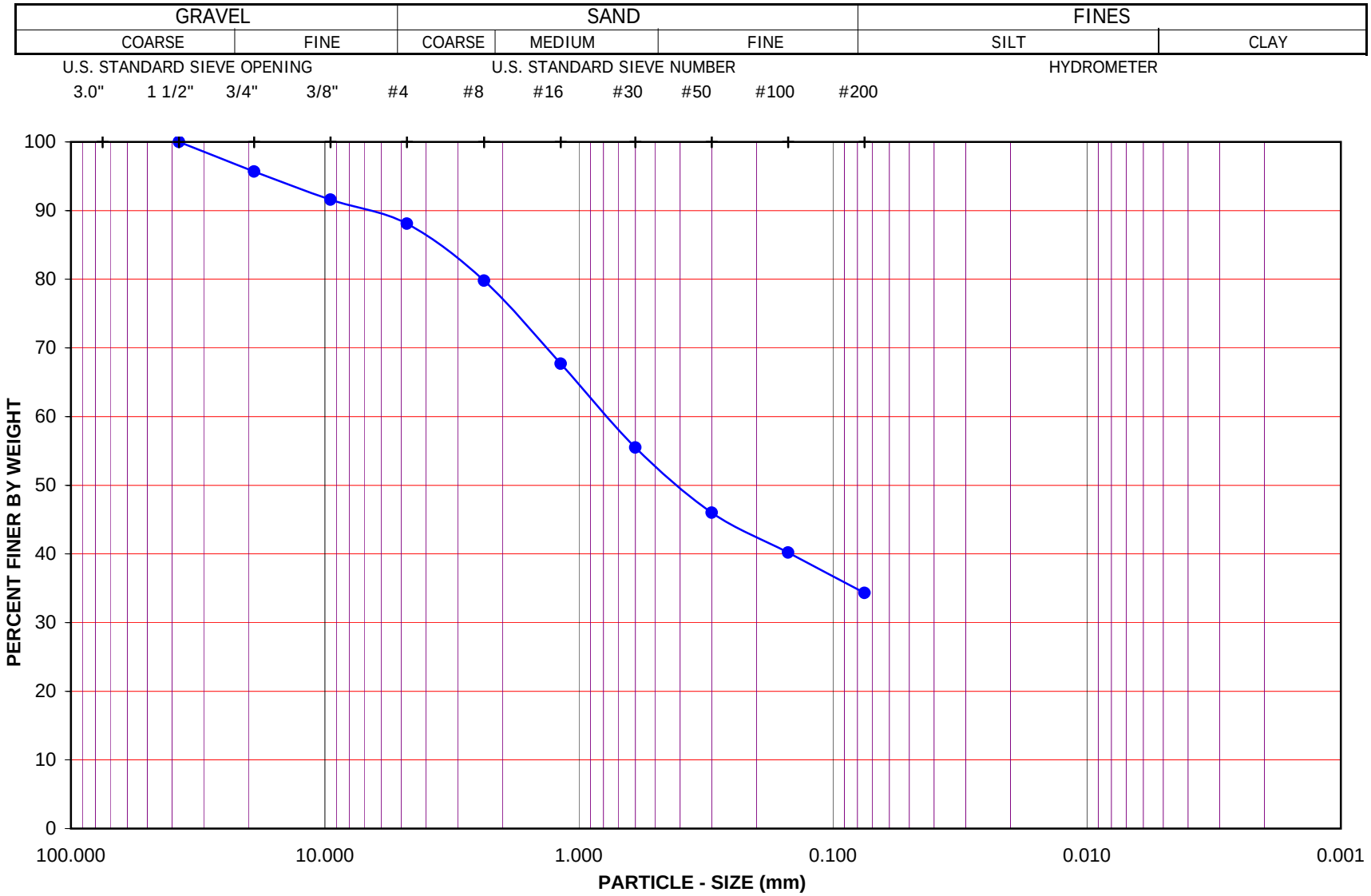
T3 = Settlement Starting Time

T4 = (T3 + 20 min) Take Clay Reading (R1)

and Sand Reading (R2)

Sand Equivalent = R2 / R1 * 100

Record SE as Next Higher Integer



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-004 Sample No.: Bag-1

Depth (feet): 0-5 Soil Type : (SC)

Soil Identification: Gray clayey sand with gravel (SC)

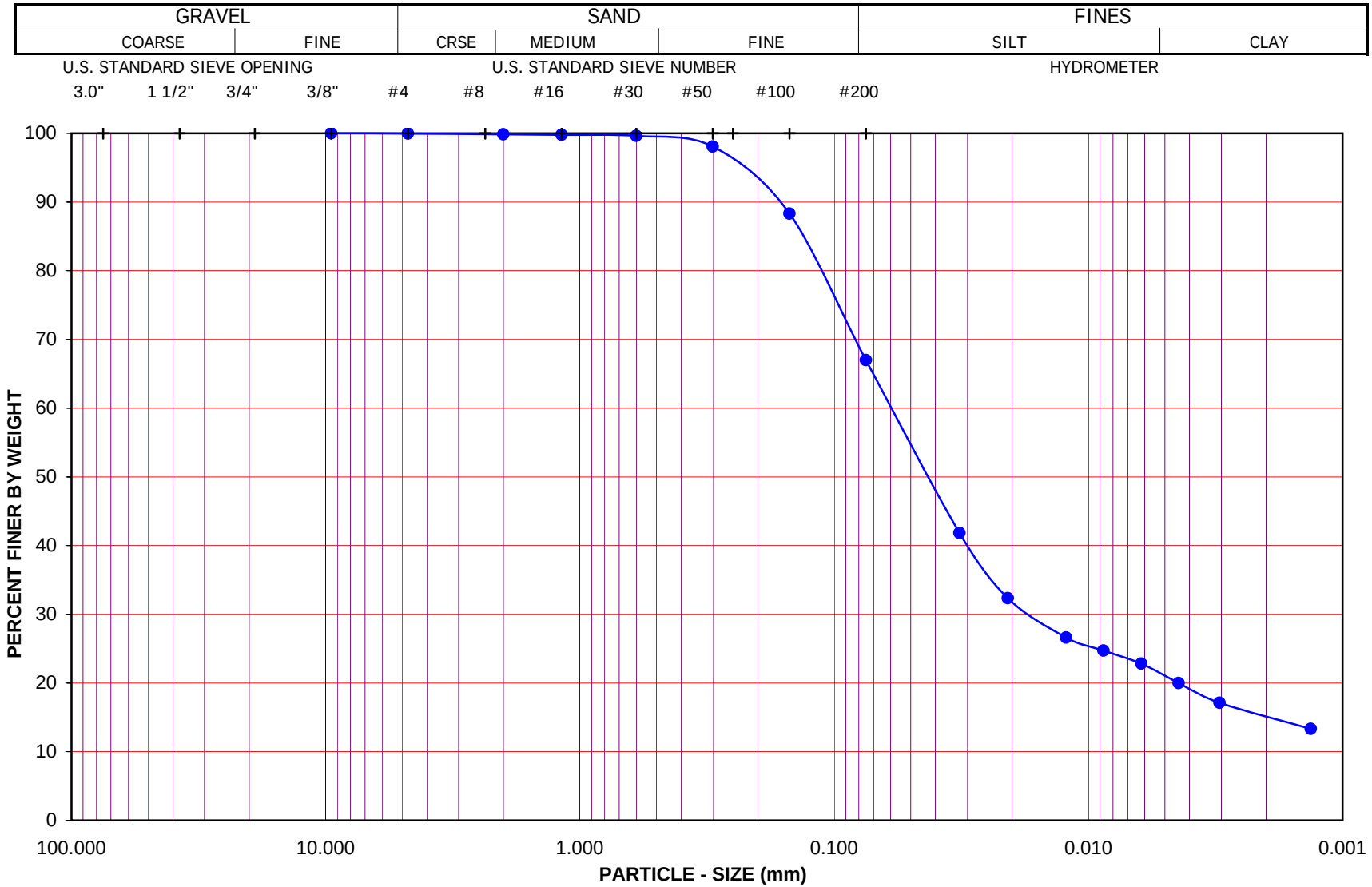
GR:SA:FI : (%) 12 : 54 : 34

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10

SA B-4 BB-1.xls



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-005 Sample No.: S-9

Depth (feet) : 70.0 Soil Type : (ML)

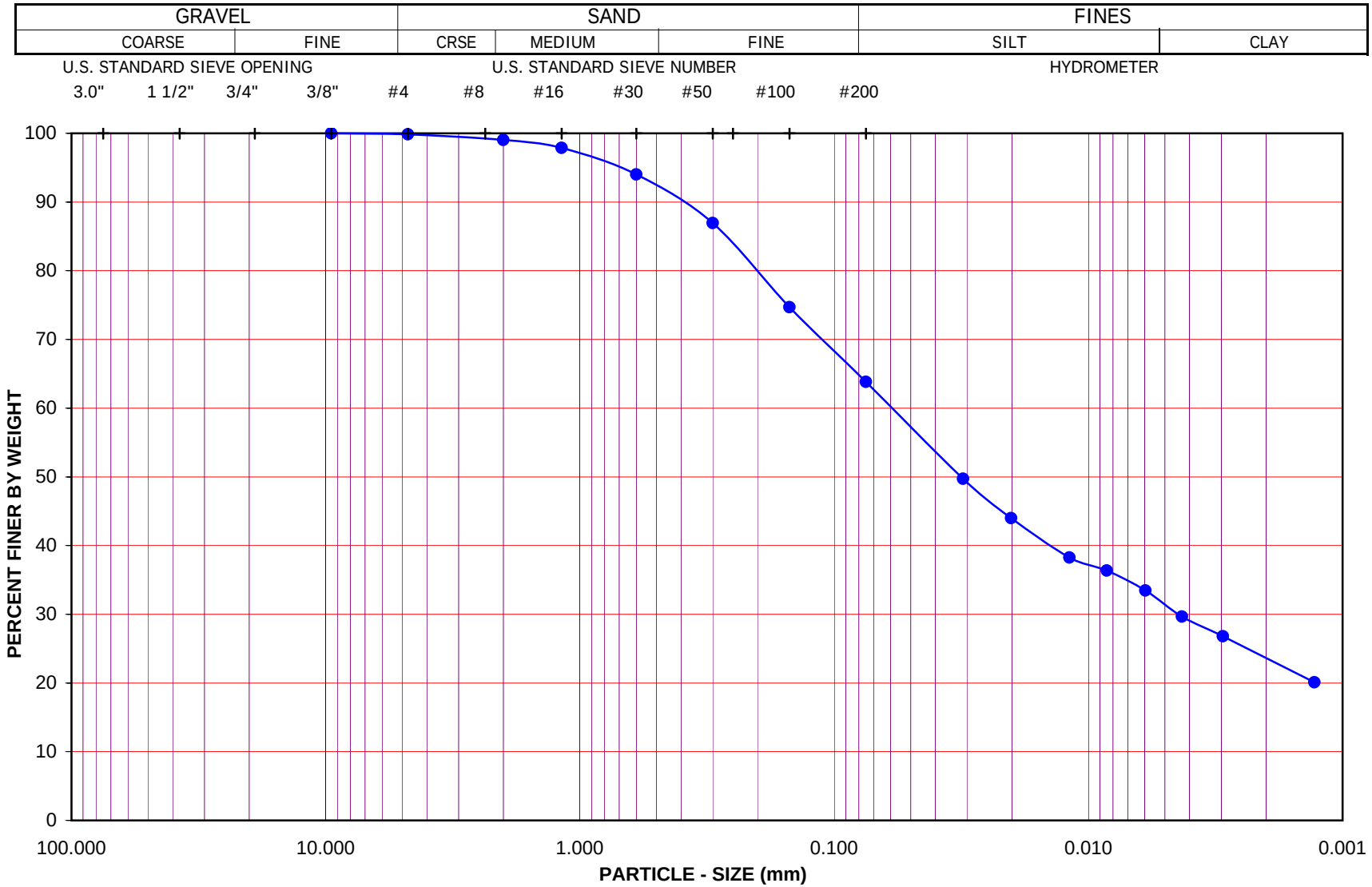
Soil Identification: Yellowish red sandy silt (ML)

GR:SA:FI : (%) 0 : 33 : 67

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-004 Sample No.: S-14

Depth (feet) : 95.0 Soil Type : (CL-ML)

Soil Identification: Reddish brown sandy clay (CL-ML)

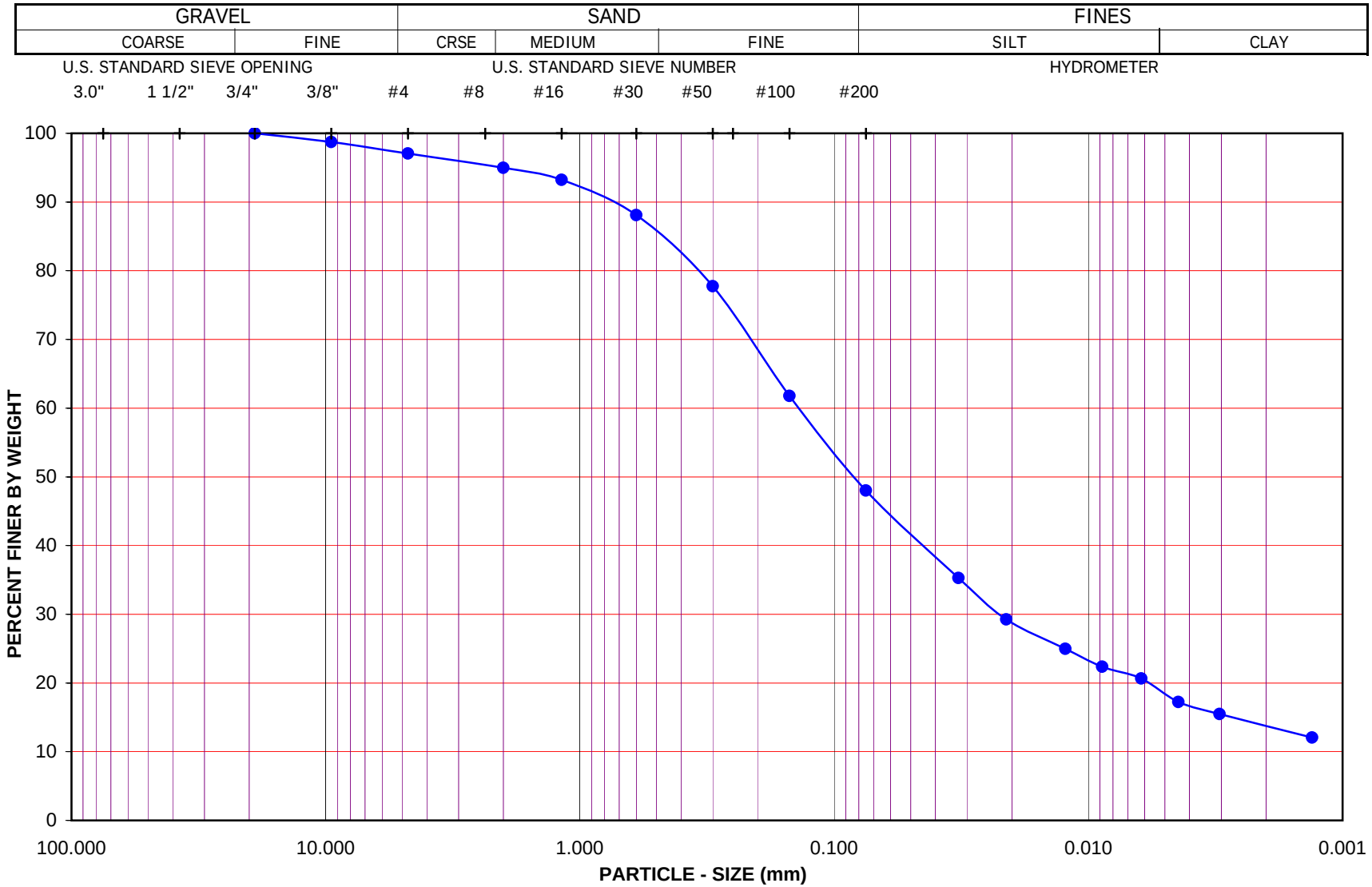
GR:SA:FI : (%) 0 : 36 : 64

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10

S&H B-4 S-14.xls



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: A-09-004 Sample No.: S-17

Depth (feet) : 110.0 Soil Type : (SM)

Soil Identification: Reddish brown silty sand (SM)

GR:SA:FI : (%) 3 : 49 : 48

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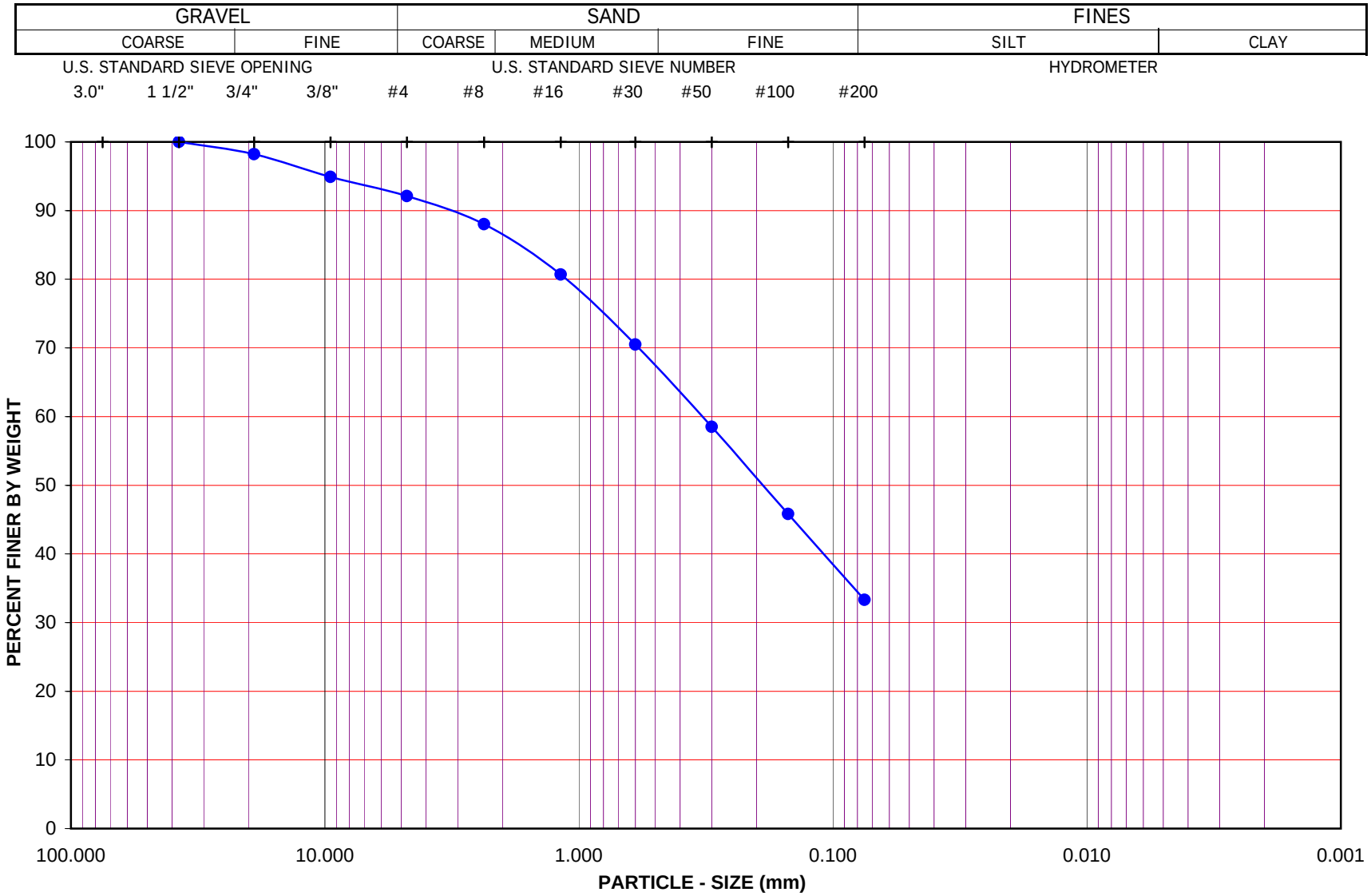
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: B-6

Sample No.: Bag-1

Depth (feet): 0-5

Soil Type : SC

Soil Identification: Dark gray clayey sand (SC)

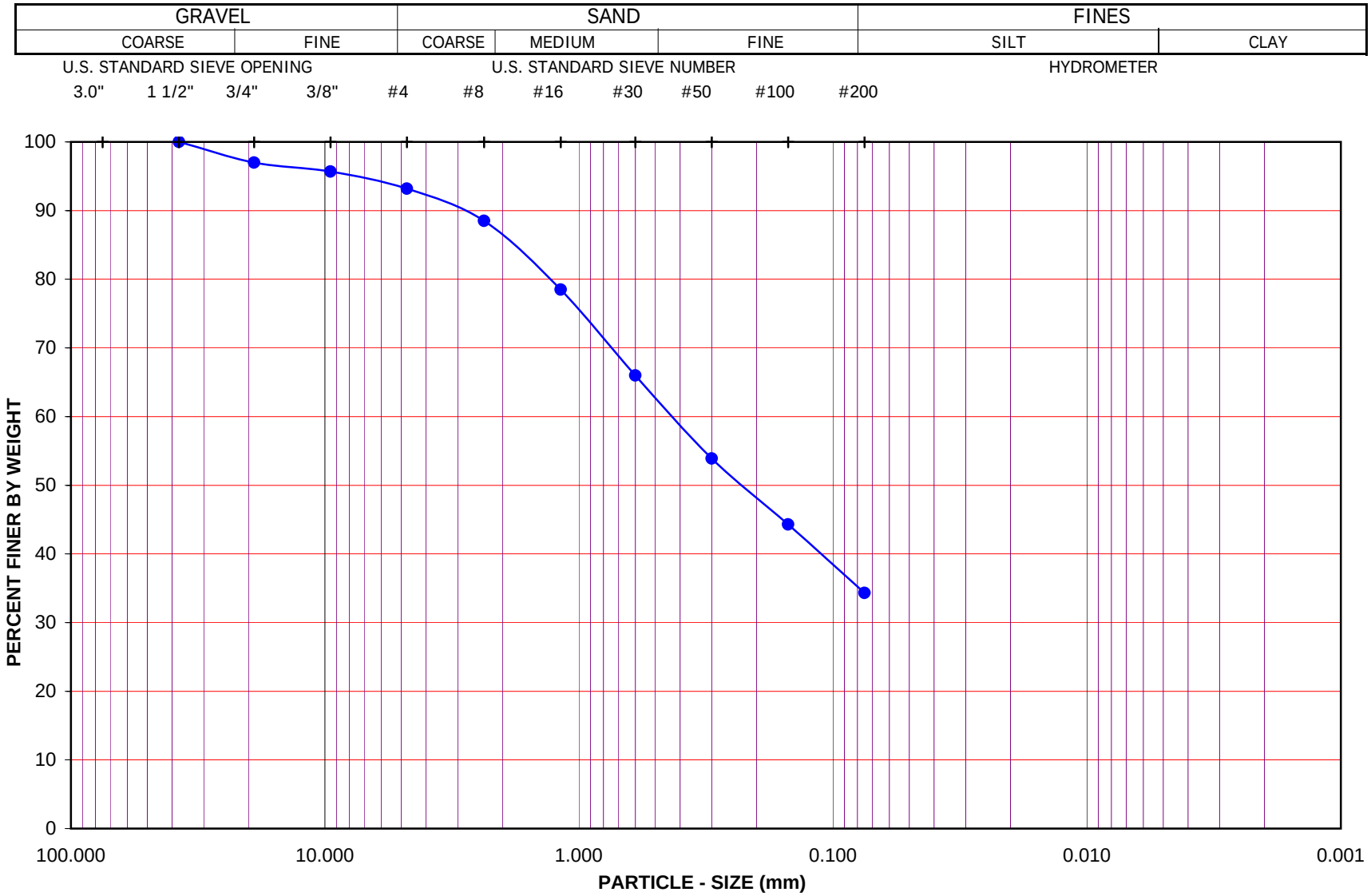
GR:SA:FI : (%) 8 : 59 : 33

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10

SA B-6 Bag-1.xls



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: B-8

Sample No.: Bag-1

Depth (feet): 0-5

Soil Type : SC

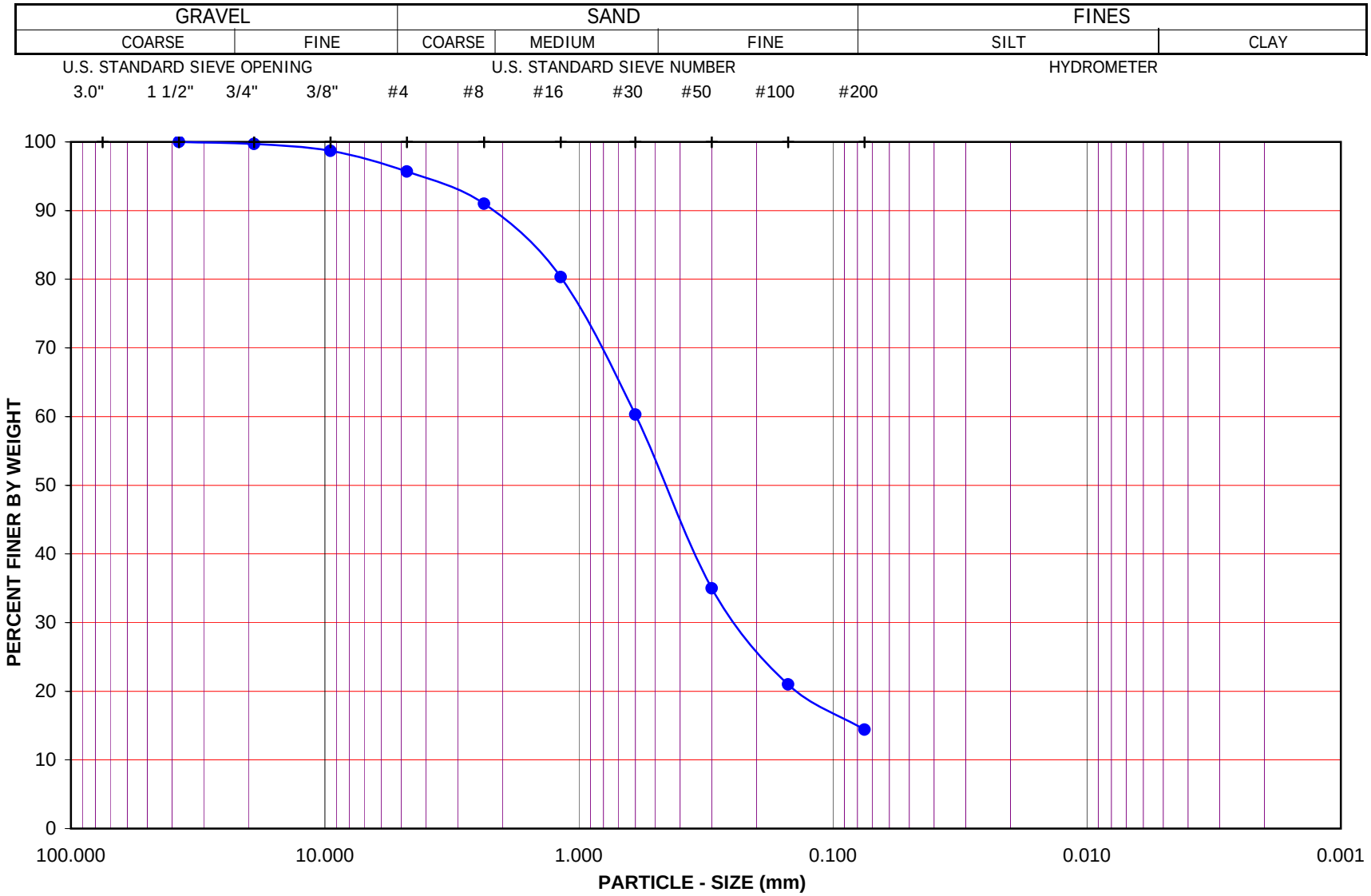
Soil Identification: Dark gray clayey sand (SC)

GR:SA:FI : (%) 7 : 59 : 34

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: B-9

Sample No.: Bag-1

Depth (feet): 0-5

Soil Type : SM

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 4 : 82 : 14

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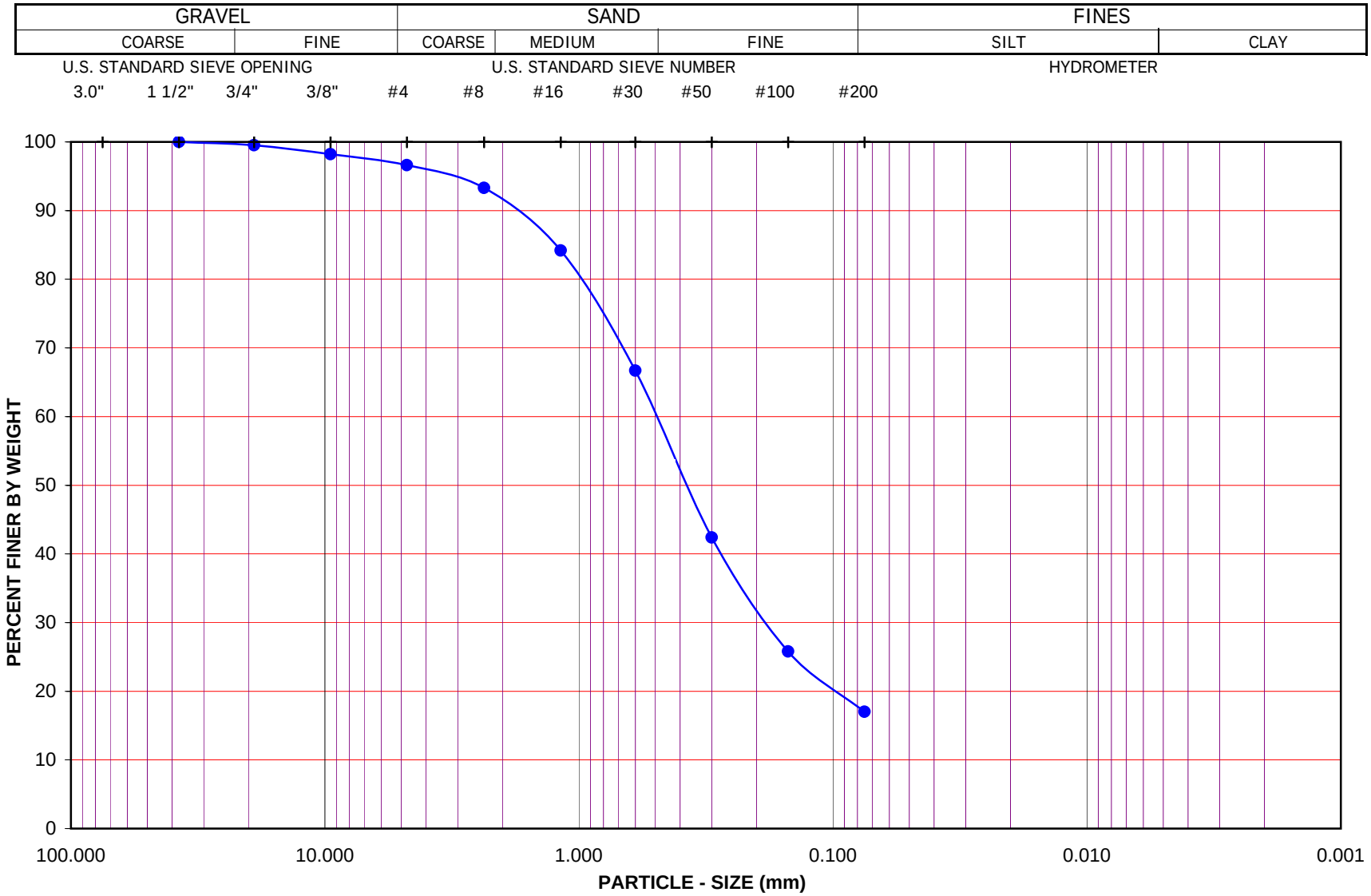
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: B-11

Sample No.: Bag-1

Depth (feet): 0-5

Soil Type : SM

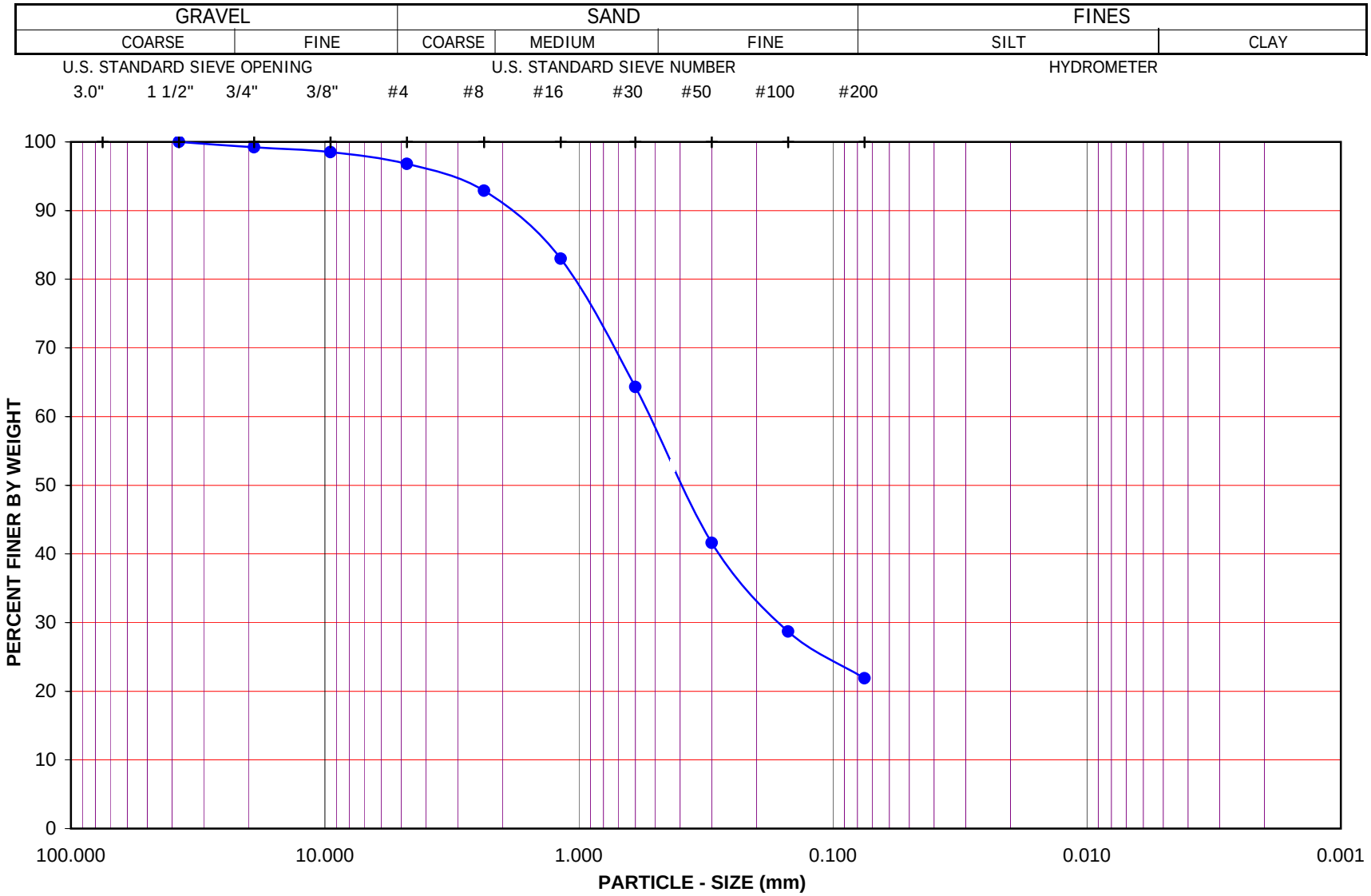
Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 3 : 80 : 17

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: B-12

Sample No.: Bag-1

Depth (feet): 0-5

Soil Type : SM

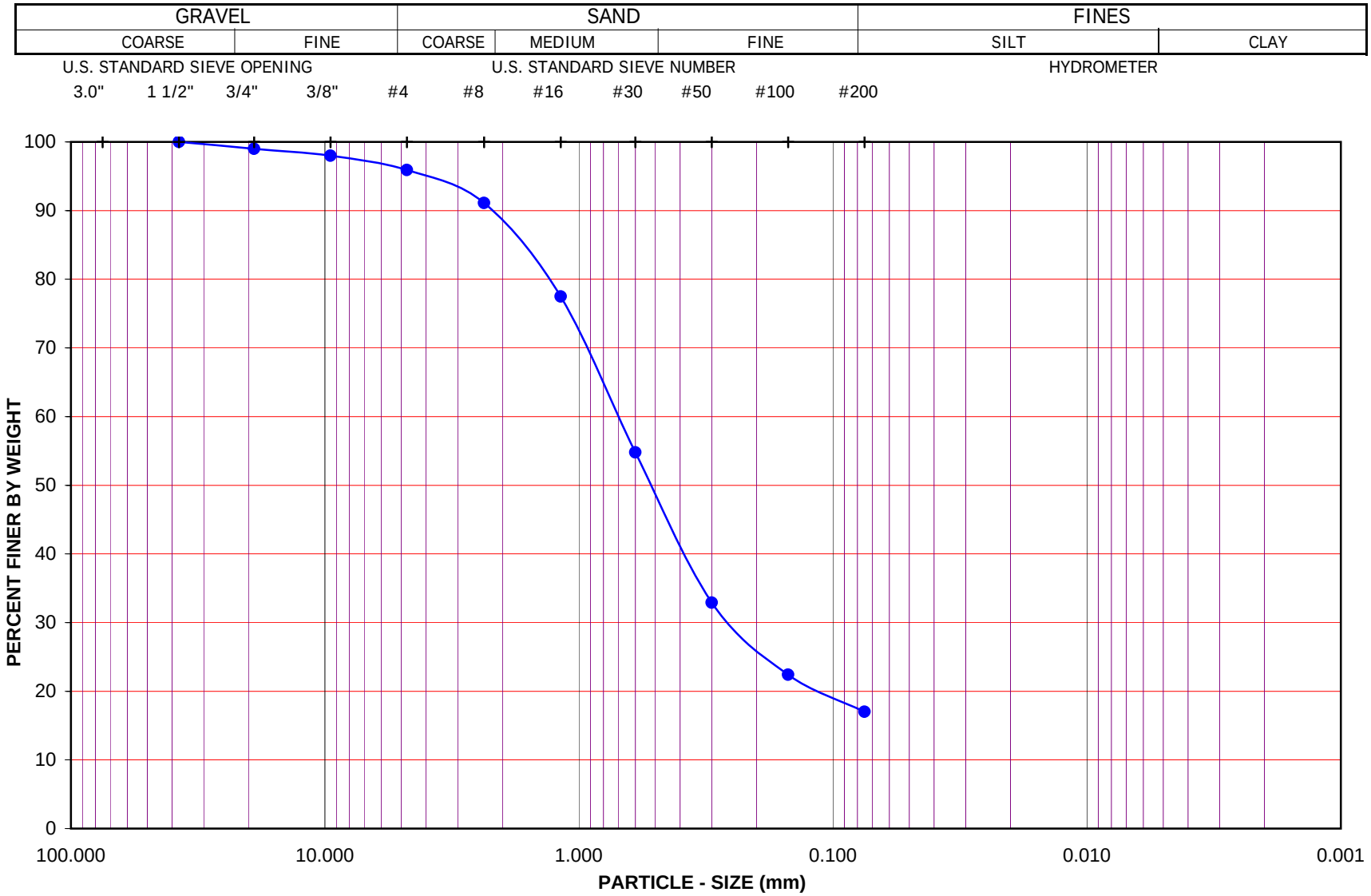
Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 3 : 75 : 22

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: B-13

Sample No.: Bag-1

Depth (feet): 0-5

Soil Type : SM

Soil Identification: Brown silty sand (SM)

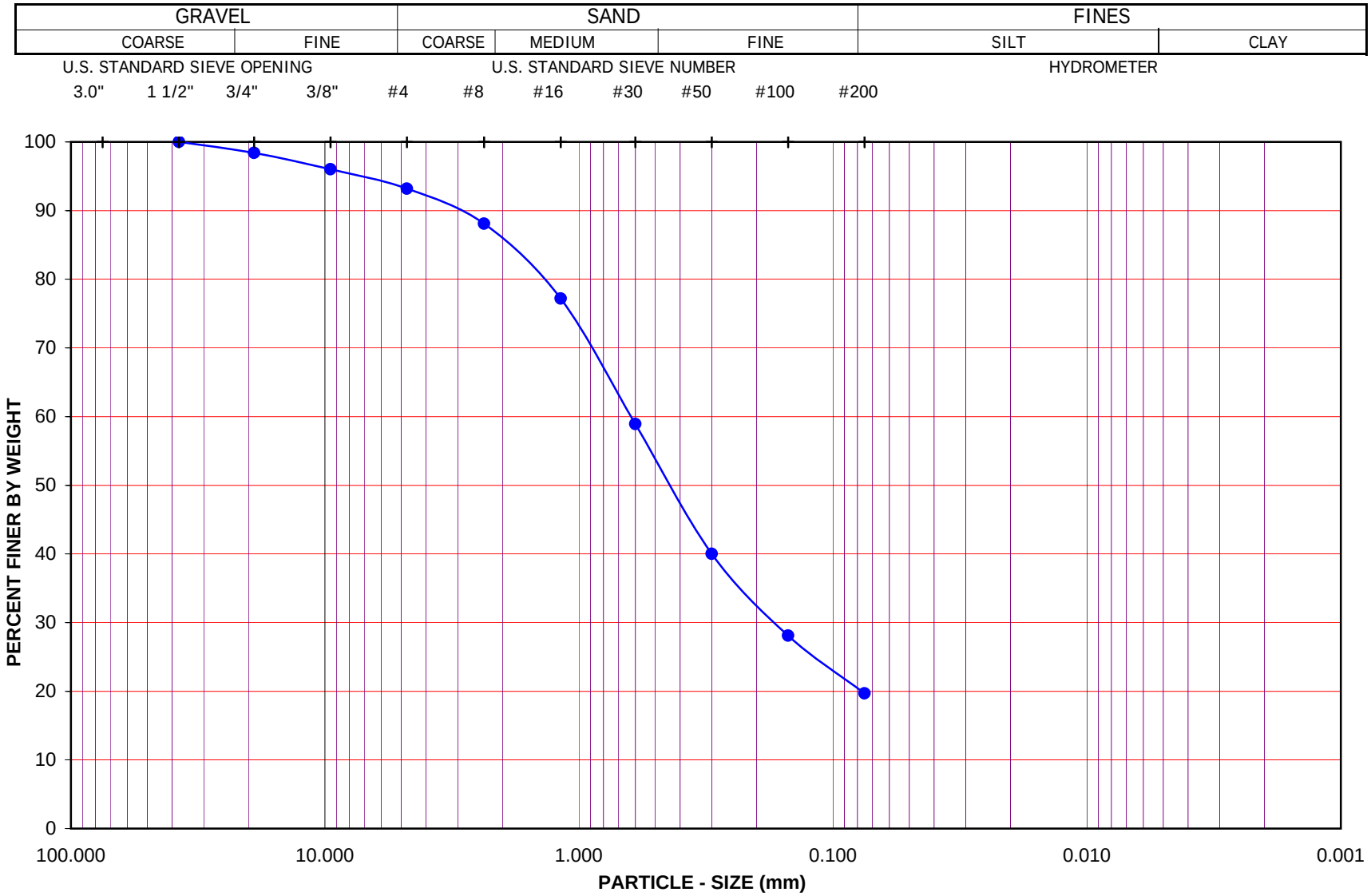
GR:SA:FI : (%) 4 : 79 : 17

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10

SA B-13 Bag-1.xls



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: B-15

Sample No.: Bag-1

Depth (feet): 0-5

Soil Type : SM

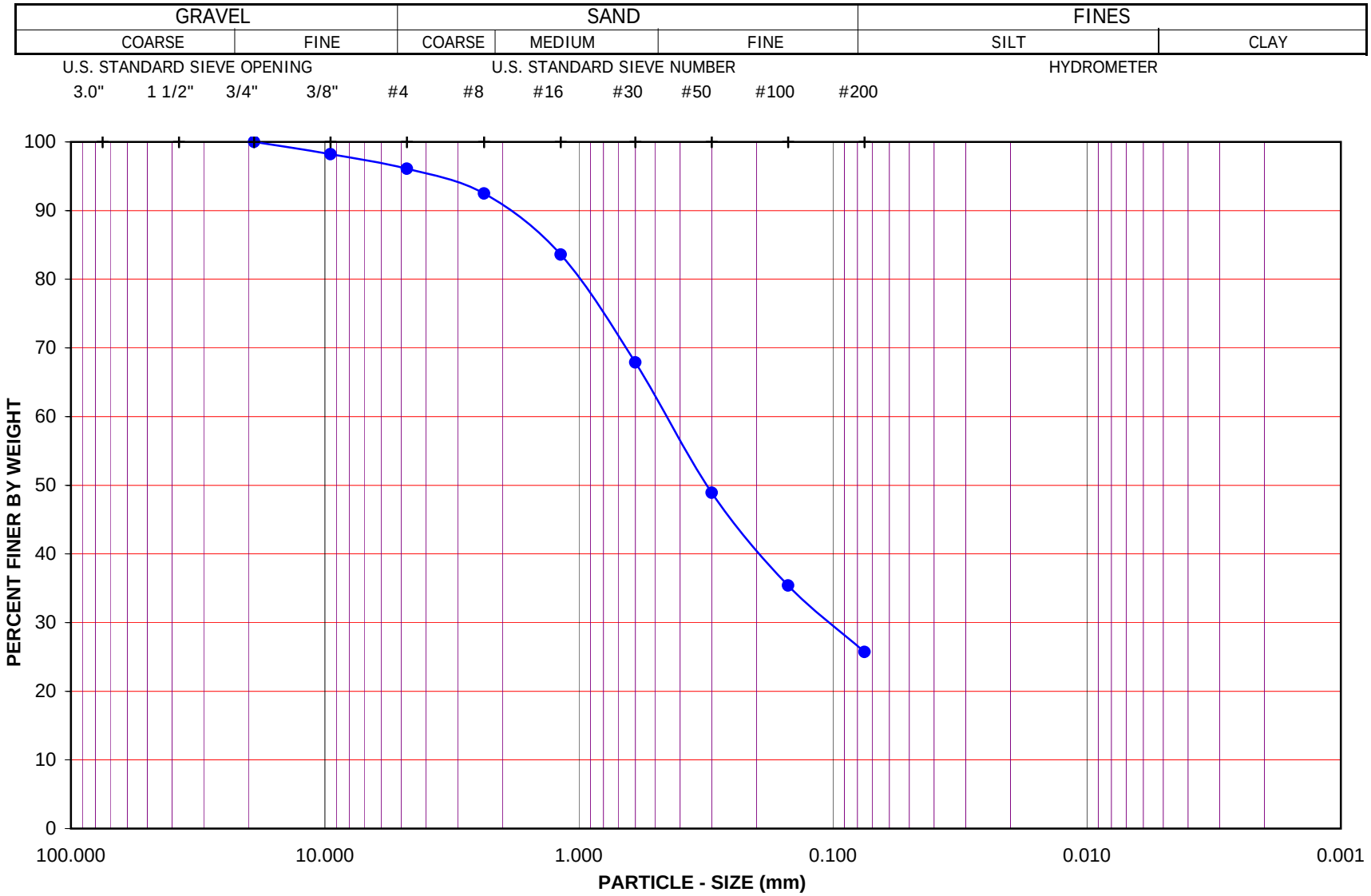
Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 7 : 73 : 20

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: B-16

Sample No.: Bag-1

Depth (feet): 0-5

Soil Type : SM

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 4 : 70 : 26

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10

SA B-16 Bag-1.xls

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: SR-57 Widening
Project No.: 602231-002
Exploration No.: B-18
Sample No.: Bag-1
Soil Identification: Light brown silty sand (SM)

Tested By: G. Berdy Date: 03/12/09
Checked By: J. Ward Date: 06/10/10
Depth (feet): 0-5

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	AB-7	537	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	2102.60	663.81	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	229.79	82.70	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	1872.81	581.11	Moisture Content (%)	0.00	0.00

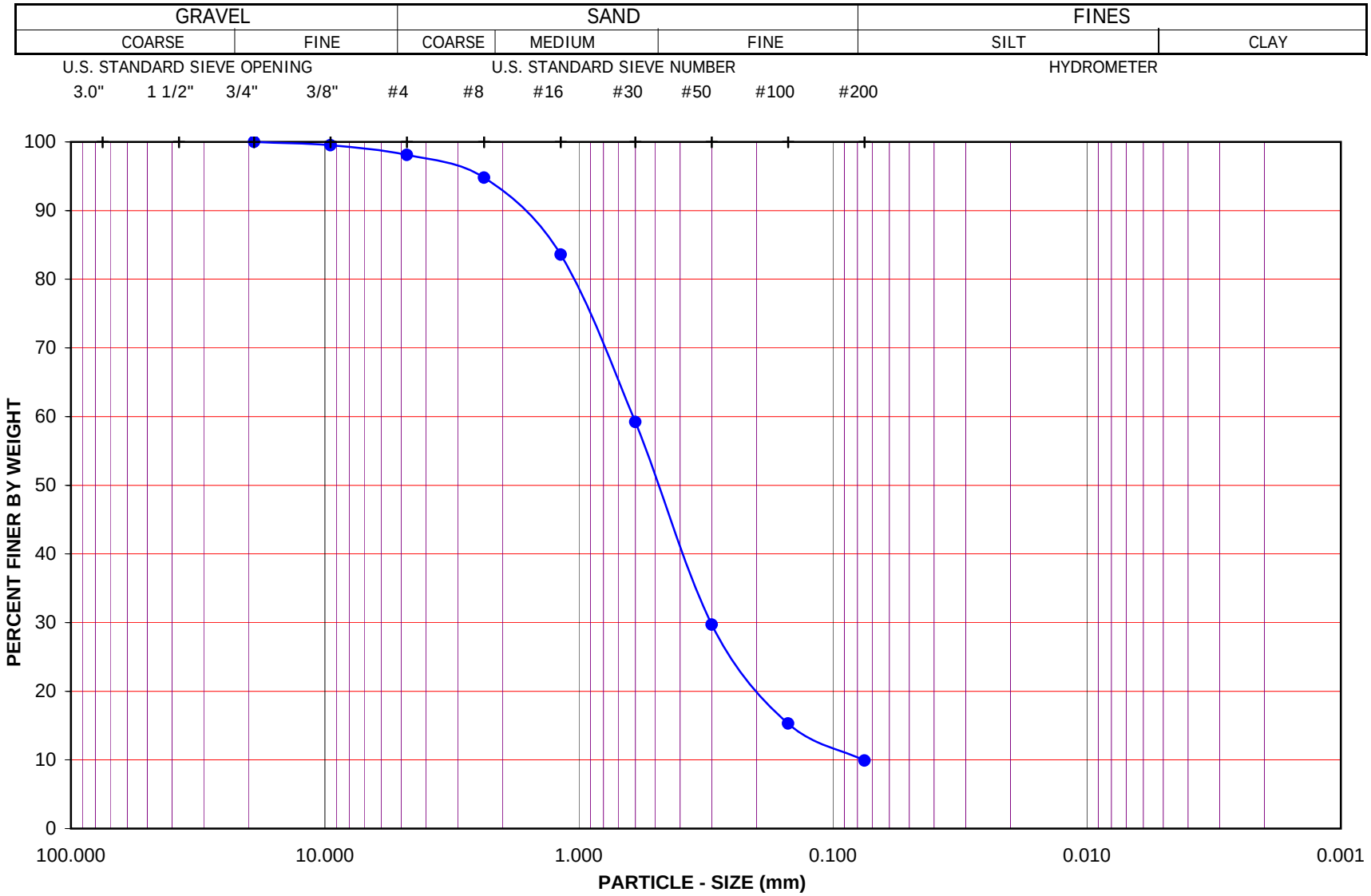
Passing #4 Material After Wet Sieve		
	Container No.	537
	Wt. of Dry Soil + Container (g)	518.39
	Wt. of Container (g)	82.70
	Dry Wt. of Soil Retained on # 200 Sieve (g)	435.69

U. S. Sieve Size		Cumulative Weight of Dry Soil Retained (g)		Percent Passing (%)
	(mm.)	Whole Sample	Sample Passing #4	
6"	152.400			
3"	75.000			
1 1/2	37.500			
3/4"	19.000	0.00		100.0
3/8"	9.500	10.94		99.4
#4	4.750	23.06		98.8
#8	2.360		12.67	96.6
#16	1.180		51.80	90.0
#30	0.600		130.18	76.7
#50	0.300		238.25	58.3
#100	0.150		341.88	40.7
#200	0.075		419.41	27.5
PAN				

GRAVEL: **1 %**
SAND: **71 %**
FINES: **28 %**
GROUP SYMBOL **SM**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 602231-002

Exploration No.: B-19

Sample No.: Bag-1

Depth (feet): 0-5

Soil Type : SP

Soil Identification: Light brown sand with silt (SP)

GR:SA:FI : (%) 2 : 88 : 10

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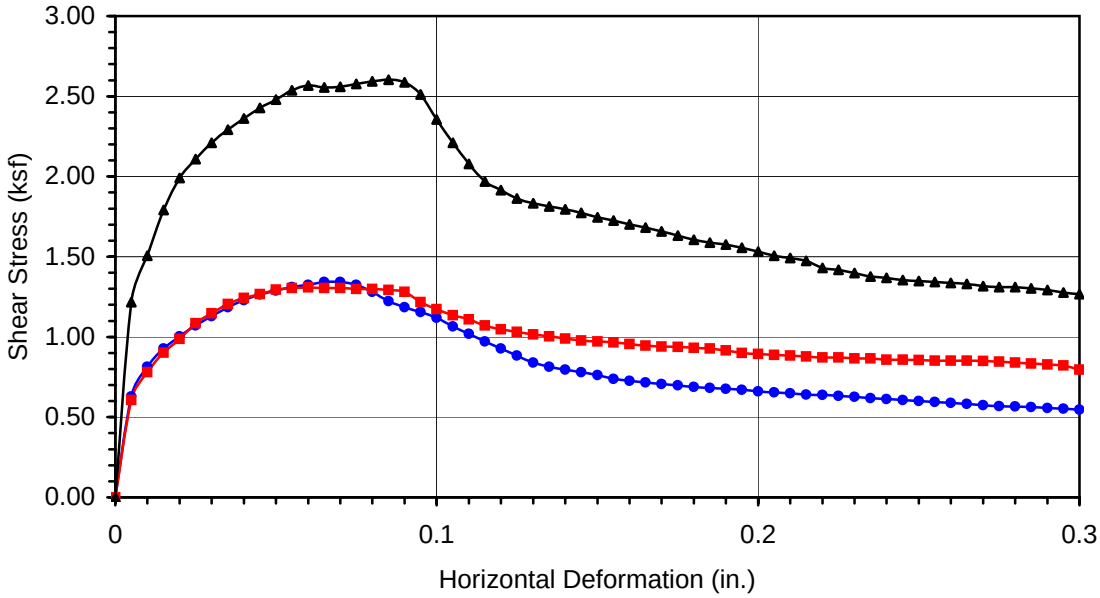
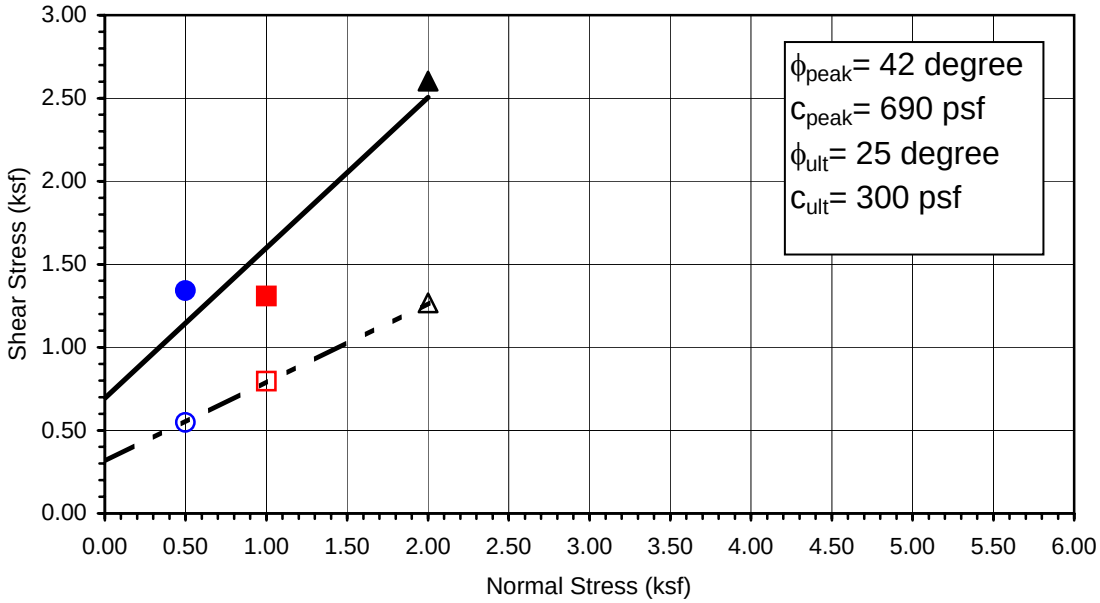
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-10

SA B-19 Bag-1.xls





Boring No.	**B-3**
Sample No.	**R-2**
Depth (ft)	**10**

Sample Type:

Drive

Soil Identification:
Gray lean silty clay (CL-ML)

Normal Stress (kip/ft²)	0.500	1.000	2.000
Peak Shear Stress (kip/ft²)	● 1.342	■ 1.308	▲ 2.603
Shear Stress @ End of Test (ksf)	○ 0.547	□ 0.795	△ 1.267
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	28.02	28.02	28.02
Dry Density (pcf)	96.3	97.3	97.5
Saturation (%)	100.8	103.2	103.7
Soil Height Before Shearing (in.)	1.0002	0.9895	0.9878
Final Moisture Content (%)	32.0	30.9	30.5

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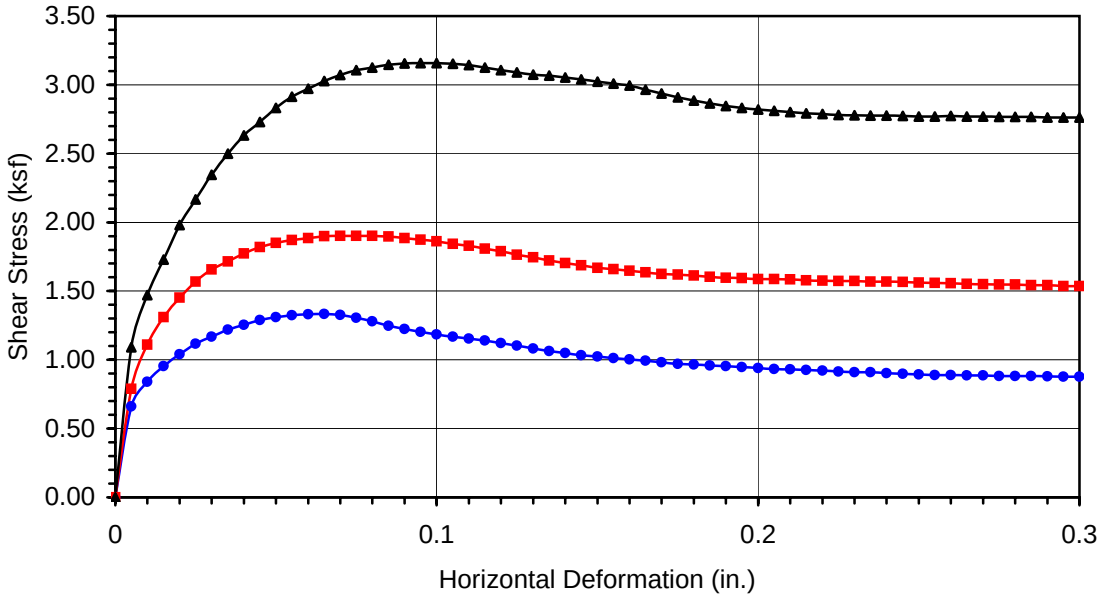
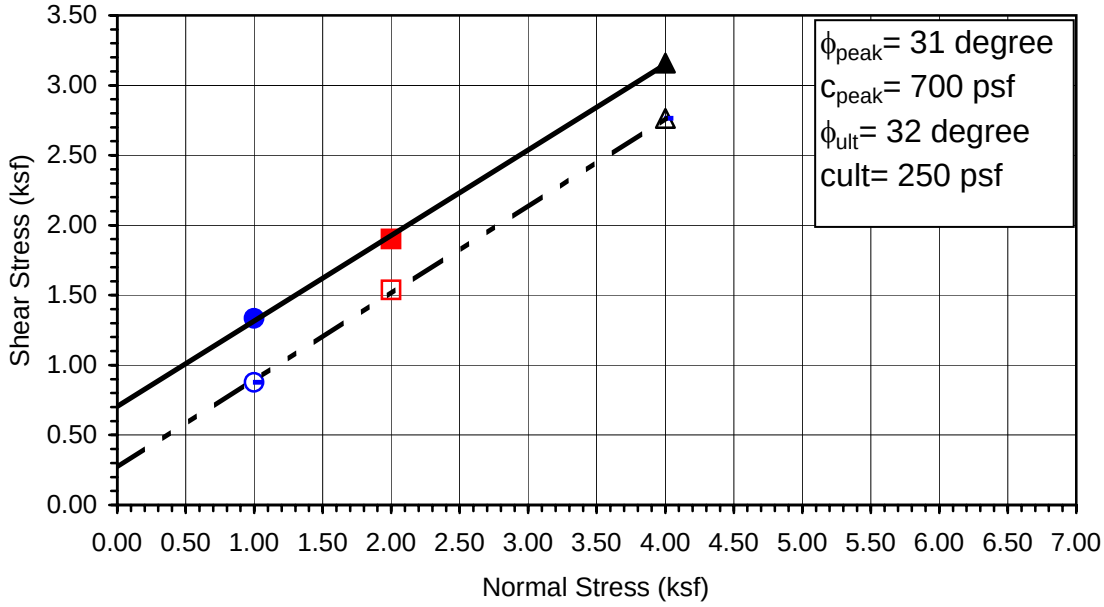
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09





Boring No.	**B-3**
Sample No.	**R-5**
Depth (ft)	**40**

Sample Type:

Drive

Soil Identification:
Reddish brown sandy silt (ML)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.333	■ 1.902	▲ 3.159
Shear Stress @ End of Test (ksf)	○ 0.877	□ 1.537	△ 2.763
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.87	16.87	16.87
Dry Density (pcf)	111.5	109.3	109.3
Saturation (%)	89.0	83.9	83.9
Soil Height Before Shearing (in.)	N/A	0.9876	0.9713
Final Moisture Content (%)	18.4	18.7	18.7

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DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602231-002

SR-57 Widening

03-09

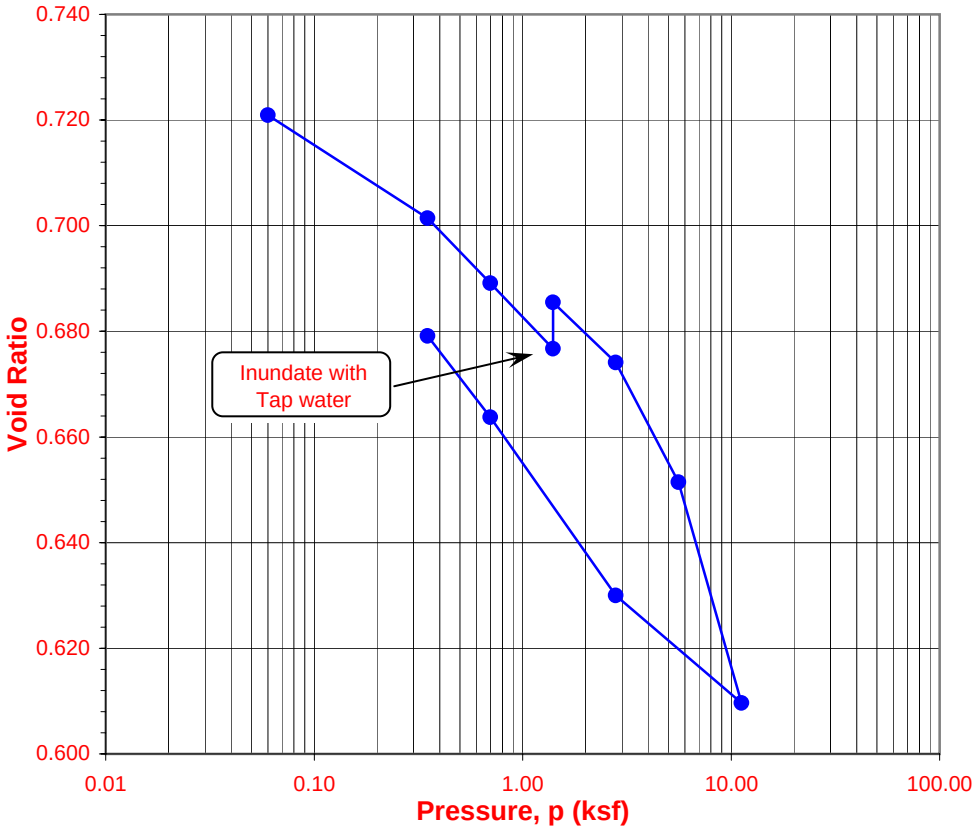
Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

(ASTM D 2435)

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	03/05/09
Project No.:	602231-002	Checked By:	J. Ward	Date:	06/10/10
Boring No.:	B-3	Depth (ft.):	5.0		
Sample No.:	R-1	Sample Type:	Drive		
Soil Identification:	Gray lean silty clay (CL-ML)				

Sample Diameter (in.):	2.416
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	191.38
Weight of Ring (g):	40.66
Height after consol. (in.):	0.9714
Before Test	
Wt. of Wet Sample+Cont. (g):	193.02
Wt. of Dry Sample+Cont. (g):	158.94
Weight of Container (g):	39.08
Initial Moisture Content (%)	28.4
Initial Dry Density (pcf)	97.5
Initial Saturation (%):	105
Initial Vertical Reading (in.)	0.1175
After Test	
Wt. of Wet Sample+Cont. (g):	229.85
Wt. of Dry Sample+Cont. (g):	196.38
Weight of Container (g):	38.77
Final Moisture Content (%)	28.62
Final Dry Density (pcf):	100.0
Final Saturation (%):	113
Final Vertical Reading (in.)	0.1461
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

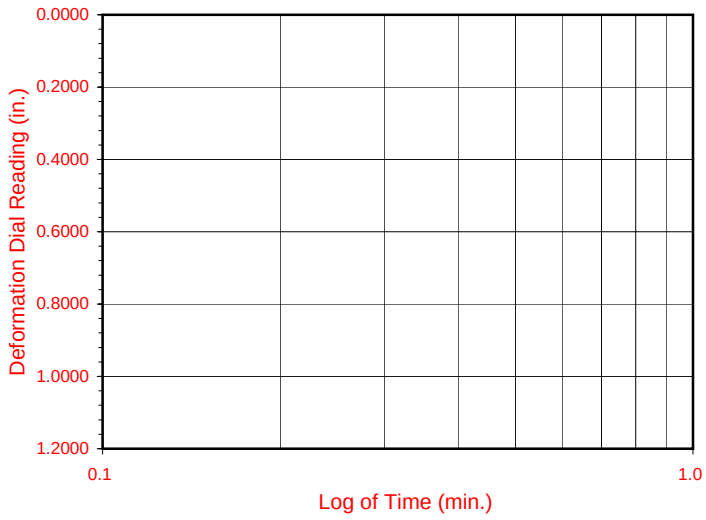


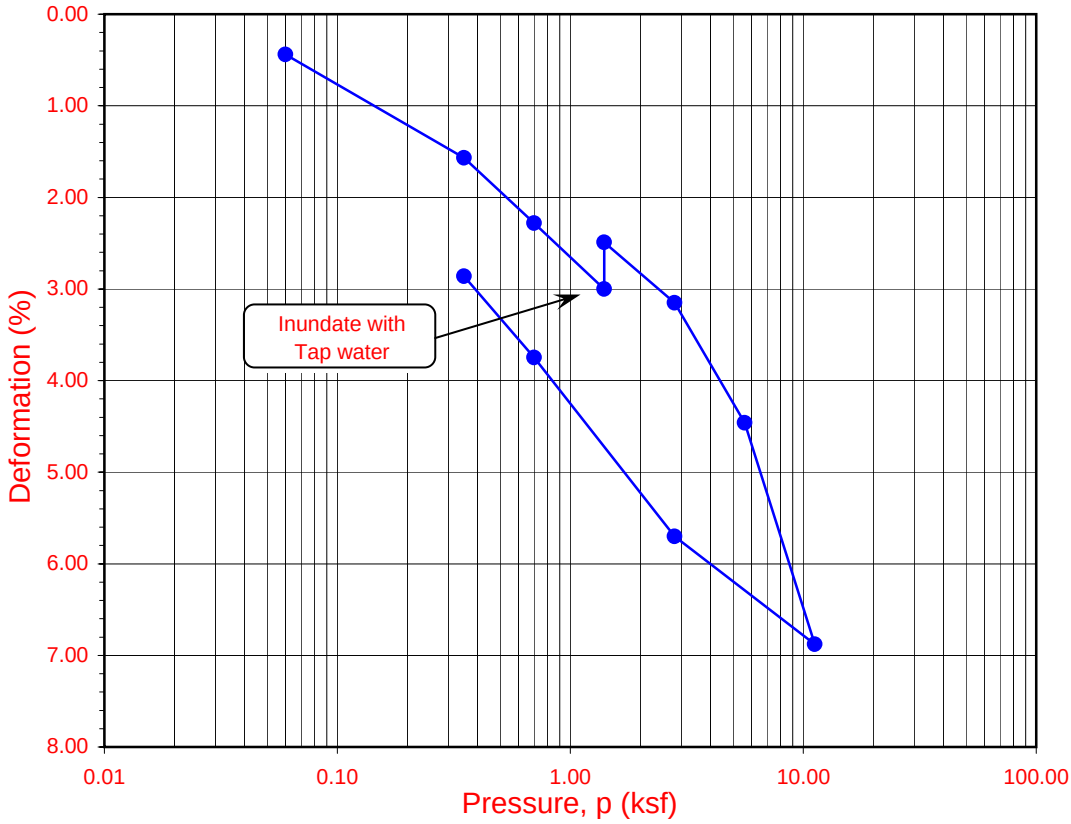
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.06	0.1219	0.9956	0.00	0.44	0.721	0.44
0.35	0.1332	0.9843	0.00	1.57	0.701	1.57
0.70	0.1403	0.9772	0.00	2.28	0.689	2.28
1.40	0.1475	0.9700	0.00	3.00	0.677	3.00
1.40	0.1424	0.9751	0.00	2.49	0.685	2.49
2.80	0.1490	0.9685	0.00	3.15	0.674	3.15
5.60	0.1621	0.9554	0.00	4.46	0.651	4.46
11.20	0.1863	0.9312	0.00	6.88	0.610	6.88
2.80	0.1745	0.9430	0.00	5.70	0.630	5.70
0.70	0.1550	0.9625	0.00	3.75	0.664	3.75
0.35	0.1461	0.9714	0.00	2.86	0.679	2.86

No Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)

No Time Readings





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
B-3	**R-1**	**5**	**28.4**	**28.6**	**97.5**	**100.0**	**0.729**	**0.679**	**105**	**113**

Soil Identification: Gray lean silty clay (CL-ML)

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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 602231-002

SR-57 Widening

06-10

Leighton

SOIL RESISTIVITY TEST

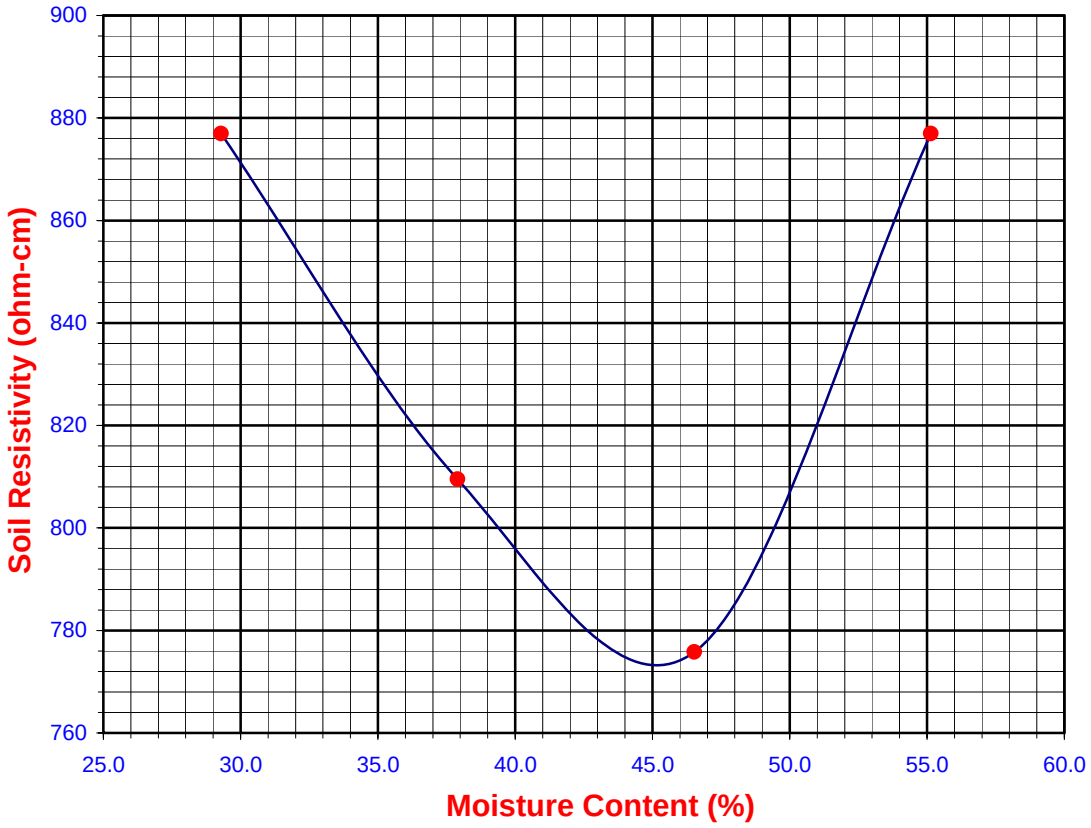
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/11/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	B-3	Depth (ft.) :	0.5-5		
Sample No. :	Bag-1				
Soil Identification:	Gray (ML)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	200	29.29	130	877
2	300	37.91	120	810
3	400	46.52	115	776
4	500	55.14	130	877
5				

Moisture Content (%) (MCi)	12.05
Wet Wt. of Soil + Cont. (g)	195.80
Dry Wt. of Soil + Cont. (g)	181.80
Wt. of Container (g)	65.60
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
774	**45.2**	**950**	**23**	**6.56**	**19.8**



Leighton

SOIL RESISTIVITY TEST

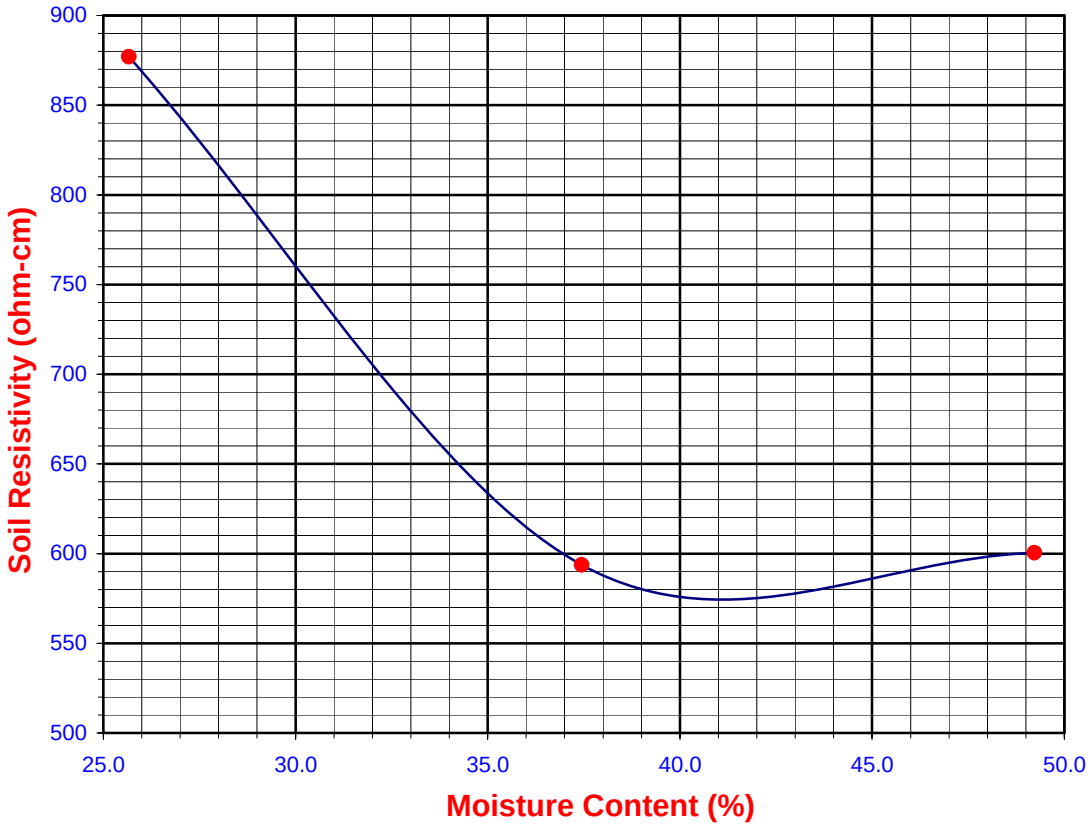
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/18/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	A-09-004	Depth (ft.) :	10-20		
Sample No. :	R-2, S-1, R-3 combined				
Soil Identification:	Gray (CL-ML) /(SC)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	300	25.66	130	877
2	450	37.44	88	594
3	600	49.23	89	600
4				
5				

Moisture Content (%) (MCi)	2.10
Wet Wt. of Soil + Cont. (g)	246.20
Dry Wt. of Soil + Cont. (g)	241.90
Wt. of Container (g)	37.30
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
574	**41.1**	**383**	**82**	**5.73**	**20.2**



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SOIL RESISTIVITY TEST

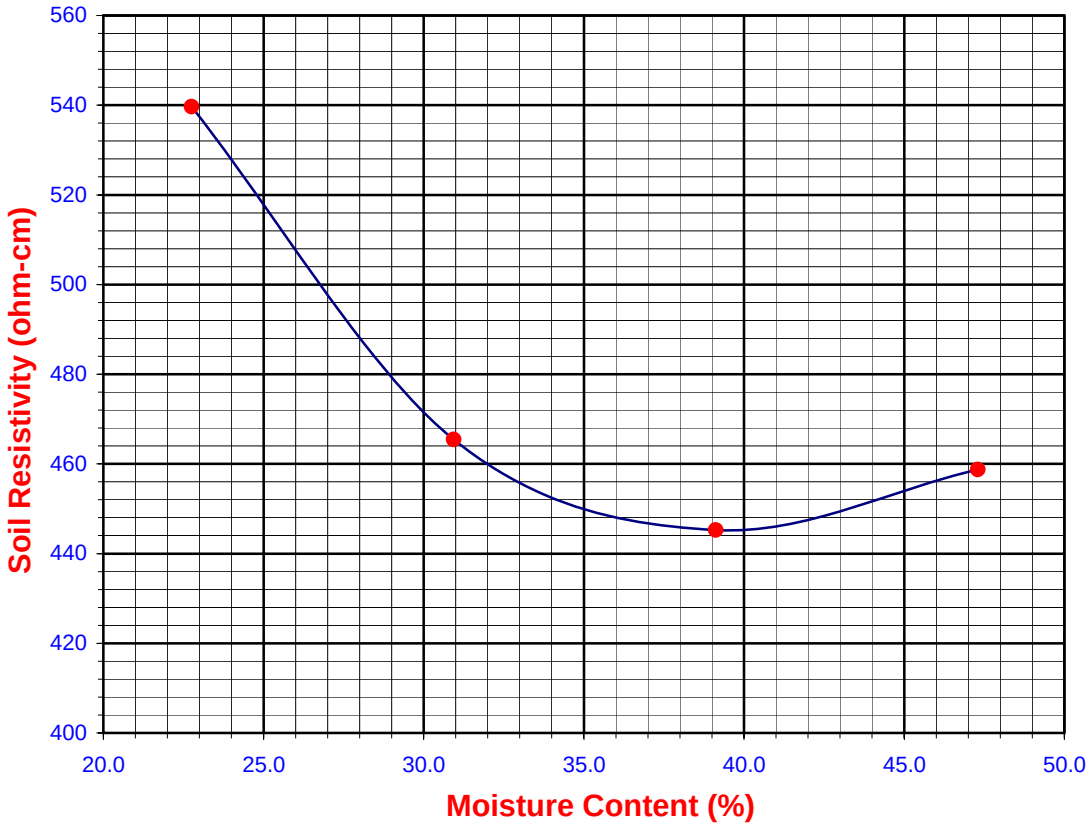
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/12/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	B-6	Depth (ft.) :	0-5		
Sample No. :	Bag-1				
Soil Identification:	Dark gray (SC)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	200	22.76	80	540
2	300	30.94	69	465
3	400	39.12	66	445
4	500	47.31	68	459
5				

Moisture Content (%) (MCi)	6.39
Wet Wt. of Soil + Cont. (g)	185.70
Dry Wt. of Soil + Cont. (g)	178.20
Wt. of Container (g)	60.79
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
446	**39.7**	**787**	**417**	**6.35**	**19.4**



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SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: SR-57 Widening

Project No. : 602231-002

Boring No.: B-8

Sample No. : Bag-1

Soil Identification: Dark gray (SC)

Tested By : V. Juliano Date: 03/12/09

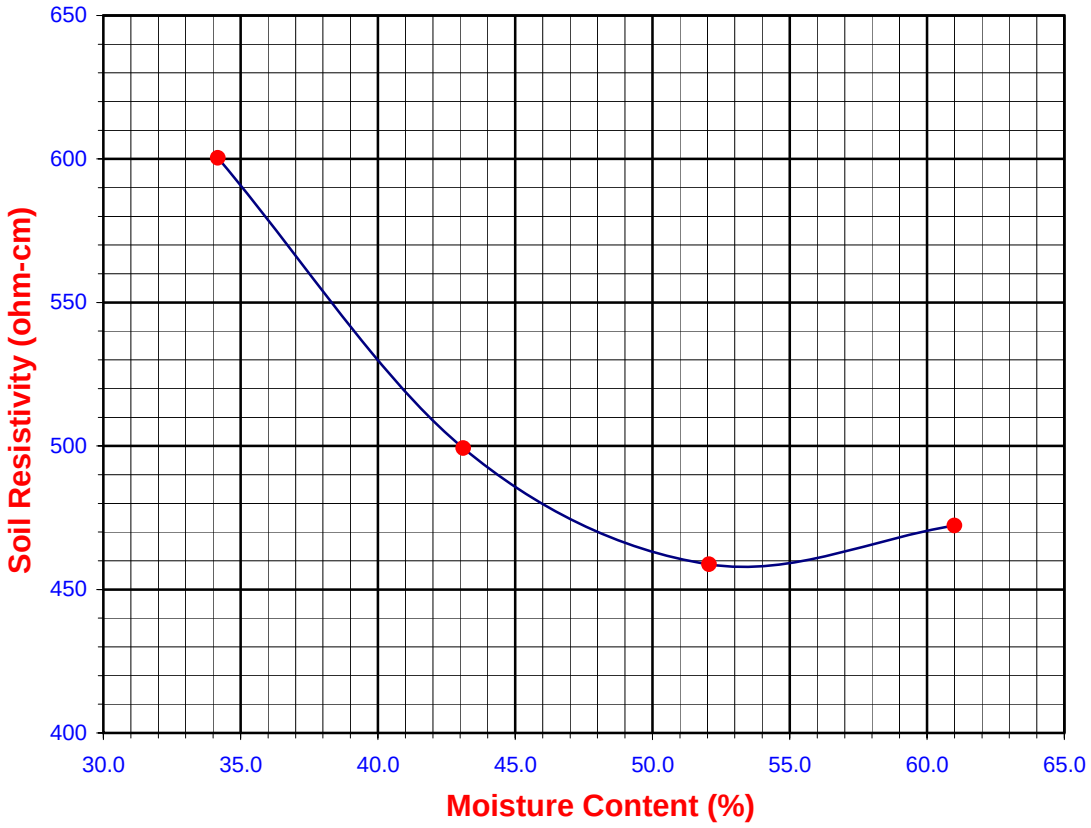
Data Input By: J. Ward Date: 03/24/09

Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	200	34.17	89	600
2	300	43.11	74	499
3	400	52.06	68	459
4	500	61.00	70	472
5				

Moisture Content (%) (MCi)	16.28
Wet Wt. of Soil + Cont. (g)	188.50
Dry Wt. of Soil + Cont. (g)	171.70
Wt. of Container (g)	68.50
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
458	**53.1**	**919**	**108**	**5.92**	**19.4**



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SOIL RESISTIVITY TEST

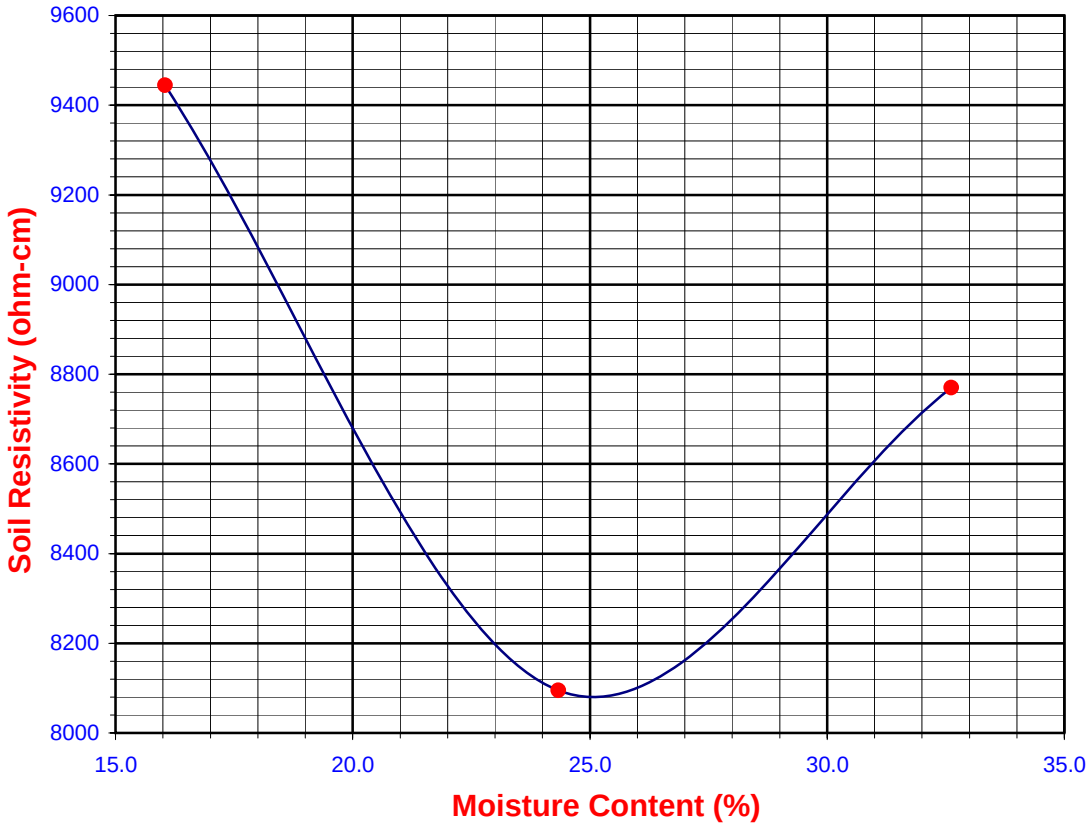
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/11/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	B-9	Depth (ft.) :	0-5		
Sample No. :	Bag-1				
Soil Identification:	Brown (SM)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	16.04	1400	9444
2	200	24.33	1200	8095
3	300	32.62	1300	8770
4				
5				

Moisture Content (%) (MCi)	7.76
Wet Wt. of Soil + Cont. (g)	159.40
Dry Wt. of Soil + Cont. (g)	150.67
Wt. of Container (g)	38.10
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
8080	**25.1**	**58**	**43**	**6.87**	**18.9**



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SOIL RESISTIVITY TEST

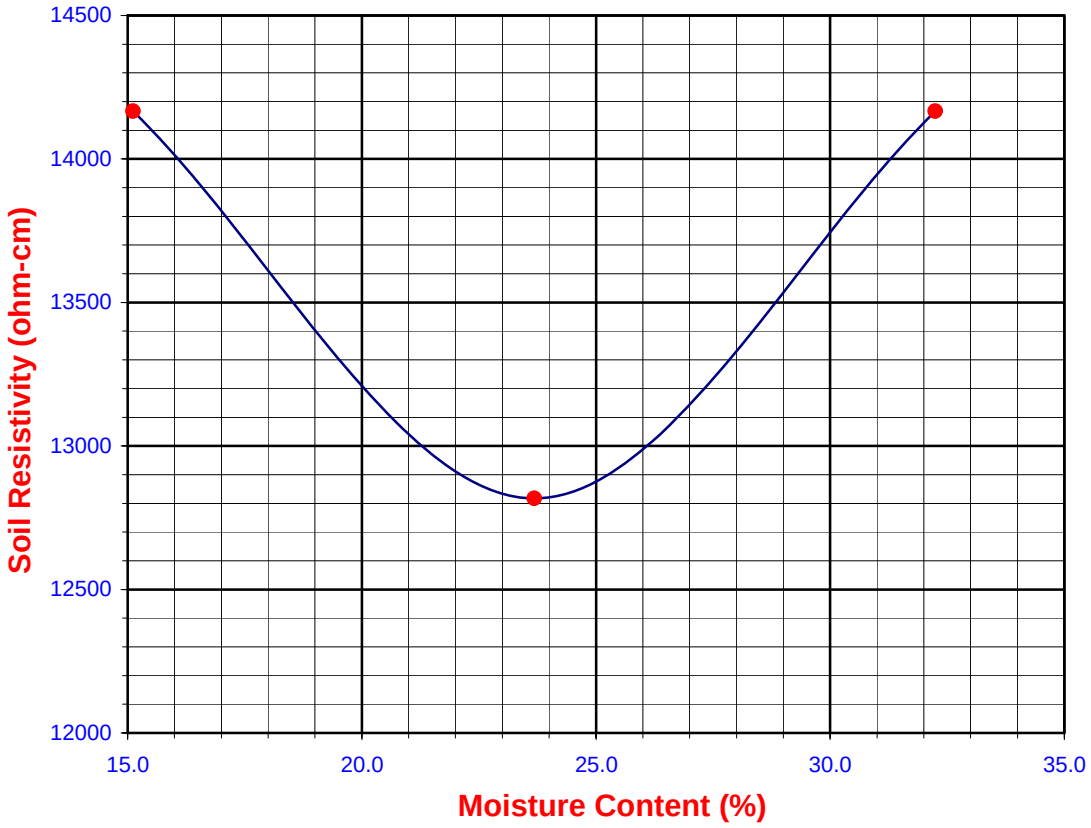
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/11/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	B-11	Depth (ft.) :	0-5		
Sample No. :	Bag-1				
Soil Identification:	Brown (SM)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	15.12	2100	14167
2	200	23.68	1900	12817
3	300	32.25	2100	14167
4				
5				

Moisture Content (%) (MCi)	6.55
Wet Wt. of Soil + Cont. (g)	128.10
Dry Wt. of Soil + Cont. (g)	123.74
Wt. of Container (g)	57.20
Container No.	
Initial Soil Wt. (g) (Wt)	1244.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
12817	**23.7**	**62**	**32**	**7.09**	**18.7**



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SOIL RESISTIVITY TEST

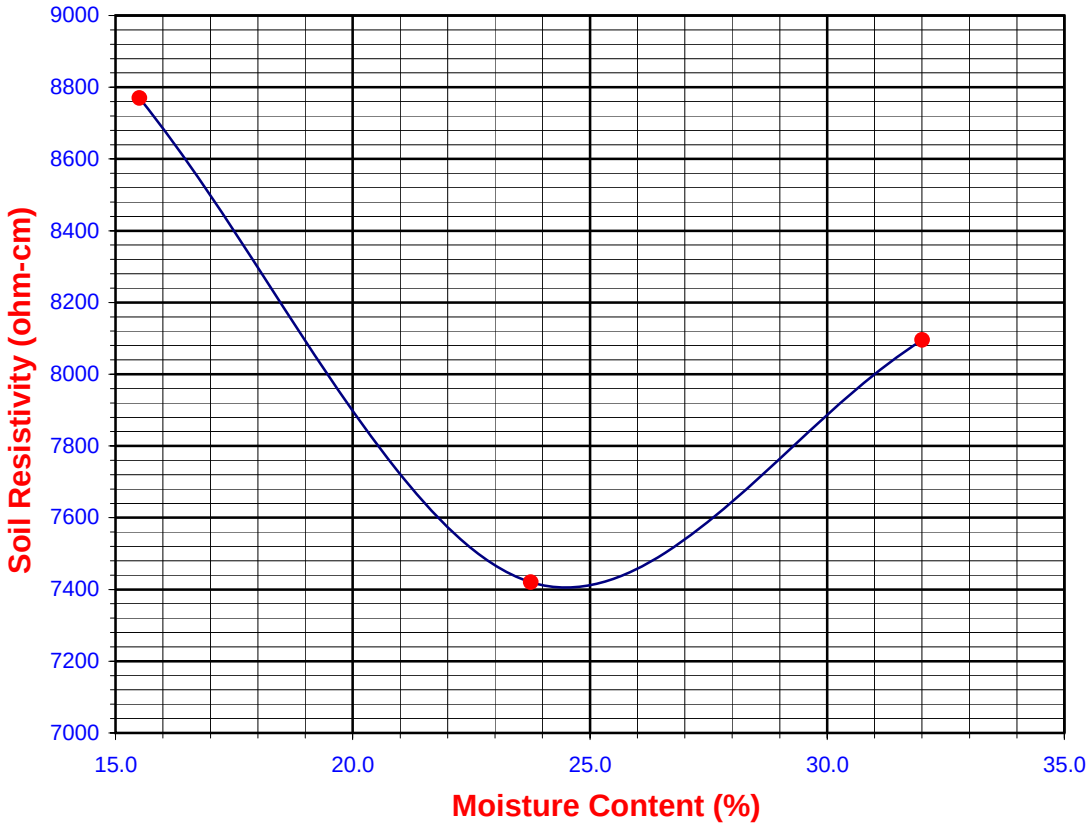
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/11/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	B-12	Depth (ft.) :	0-5		
Sample No. :	Bag-1				
Soil Identification:	Brown (SM)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	15.50	1300	8770
2	200	23.75	1100	7421
3	300	32.00	1200	8095
4				
5				

Moisture Content (%) (MCi)	7.25
Wet Wt. of Soil + Cont. (g)	182.50
Dry Wt. of Soil + Cont. (g)	174.06
Wt. of Container (g)	57.70
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
7400	**24.4**	**62**	**22**	**7.55**	**18.8**



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SOIL RESISTIVITY TEST

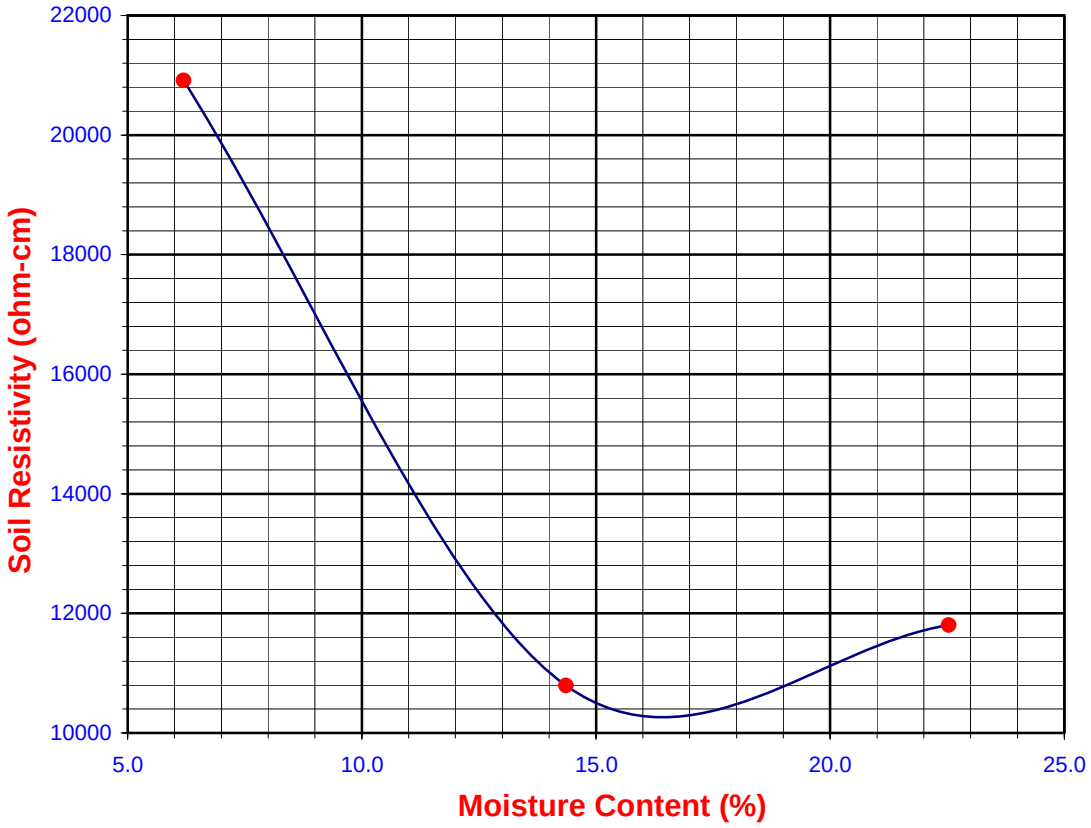
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/11/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	B-13	Depth (ft.) :	0-5		
Sample No. :	Bag-1				
Soil Identification:	Brown (SM)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	0	6.19	3100	20913
2	100	14.36	1600	10794
3	200	22.53	1750	11806
4				
5				

Moisture Content (%) (MCi)	6.19
Wet Wt. of Soil + Cont. (g)	168.00
Dry Wt. of Soil + Cont. (g)	161.45
Wt. of Container (g)	55.70
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
10200	**16.4**	**44**	**43**	**6.98**	**18.6**



Leighton

SOIL RESISTIVITY TEST

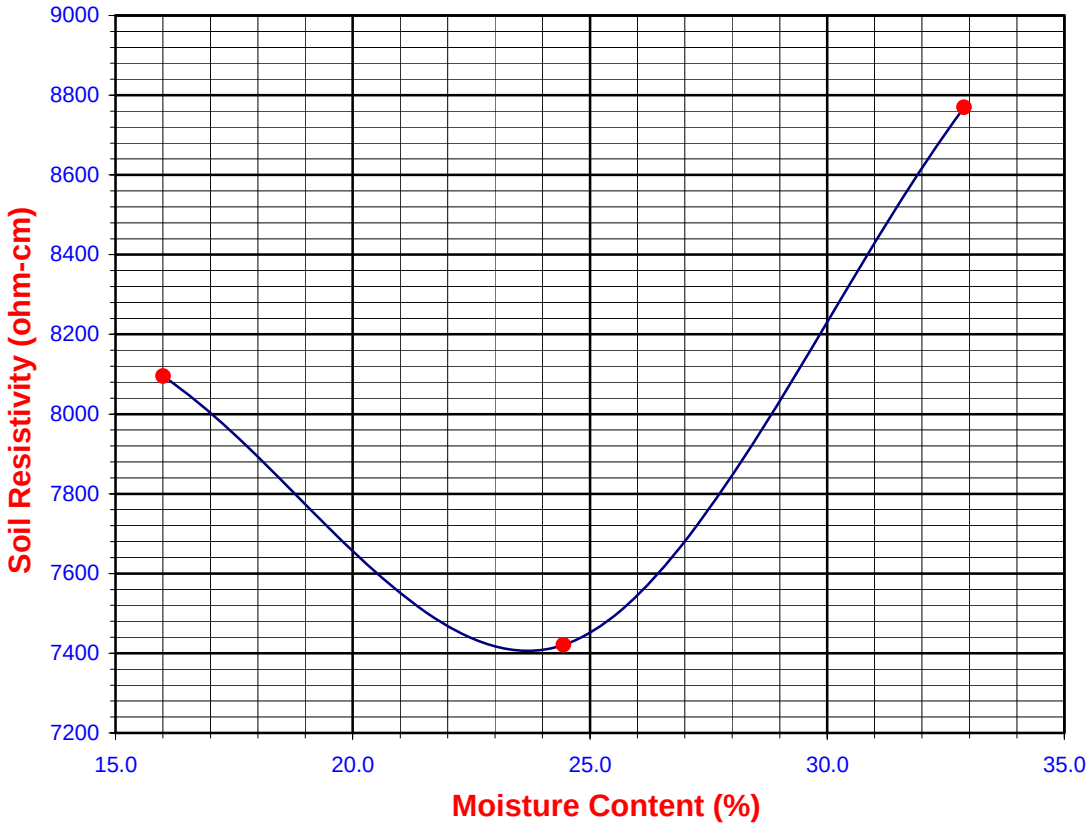
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/11/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	B-15	Depth (ft.) :	0-5		
Sample No. :	Bag-1				
Soil Identification:	Brown (SM)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	16.00	1200	8095
2	200	24.44	1100	7421
3	300	32.89	1300	8770
4				
5				

Moisture Content (%) (MCi)	7.56
Wet Wt. of Soil + Cont. (g)	169.70
Dry Wt. of Soil + Cont. (g)	163.15
Wt. of Container (g)	76.50
Container No.	
Initial Soil Wt. (g) (Wt)	1274.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
7400	**23.8**	**62**	**32**	**7.39**	**18.4**



Leighton

SOIL RESISTIVITY TEST

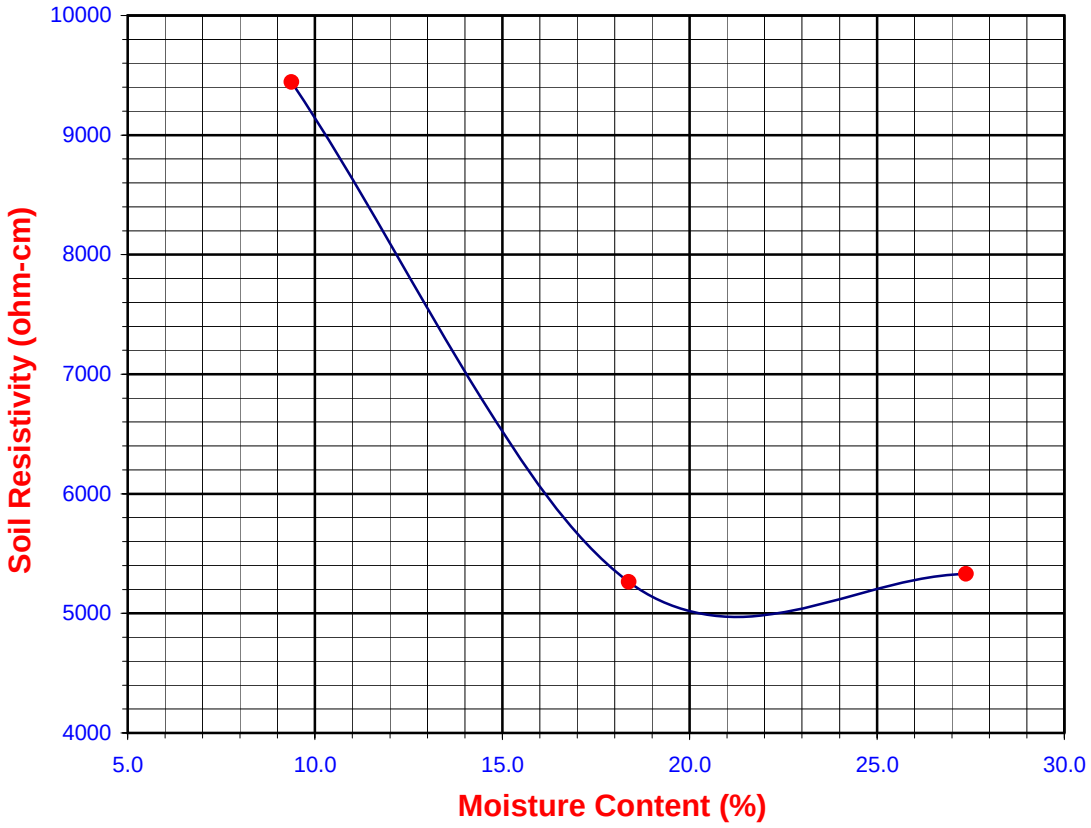
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/11/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	B-16	Depth (ft.) :	0-5		
Sample No. :	Bag-1				
Soil Identification:	Brown (SM)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	0	9.37	1400	9444
2	100	18.38	780	5262
3	200	27.38	790	5329
4				
5				

Moisture Content (%) (MCi)	9.37
Wet Wt. of Soil + Cont. (g)	160.60
Dry Wt. of Soil + Cont. (g)	152.57
Wt. of Container (g)	66.90
Container No.	
Initial Soil Wt. (g) (Wt)	1215.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
5000	**21.2**	**73**	**44**	**7.48**	**18.5**



Leighton

SOIL RESISTIVITY TEST

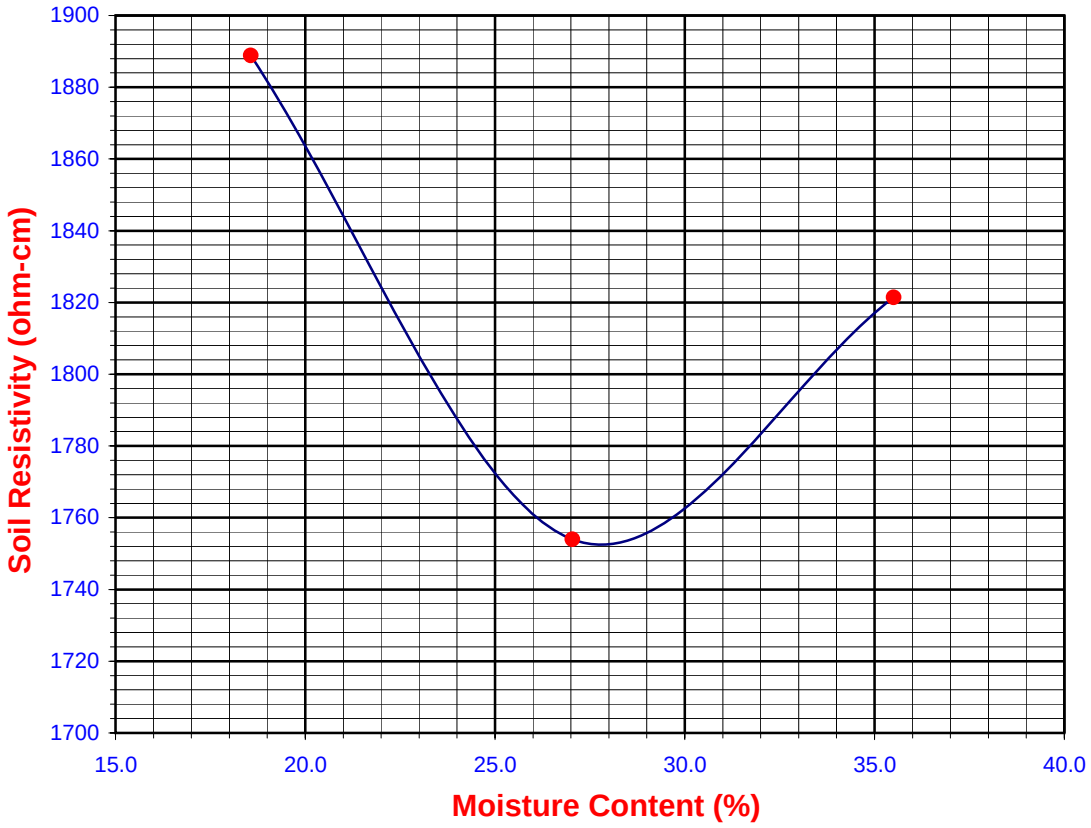
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	03/13/09
Project No. :	602231-002	Data Input By:	J. Ward	Date:	03/24/09
Boring No.:	B-18	Depth (ft.) :	0-5		
Sample No. :	Bag-1				
Soil Identification:	Light brown (SM)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	18.57	280	1889
2	200	27.04	260	1754
3	300	35.51	270	1821
4				
5				

Moisture Content (%) (MCi)	10.10
Wet Wt. of Soil + Cont. (g)	154.80
Dry Wt. of Soil + Cont. (g)	145.70
Wt. of Container (g)	55.60
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
1752	**27.8**	**96**	**111**	**7.18**	**19.5**



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SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: SR-57 Widening

Project No. : 602231-002

Boring No.: B-19

Sample No. : Bag-1

Soil Identification: Light brown (SP-SM)

Tested By : V. Juliano Date: 03/16/09

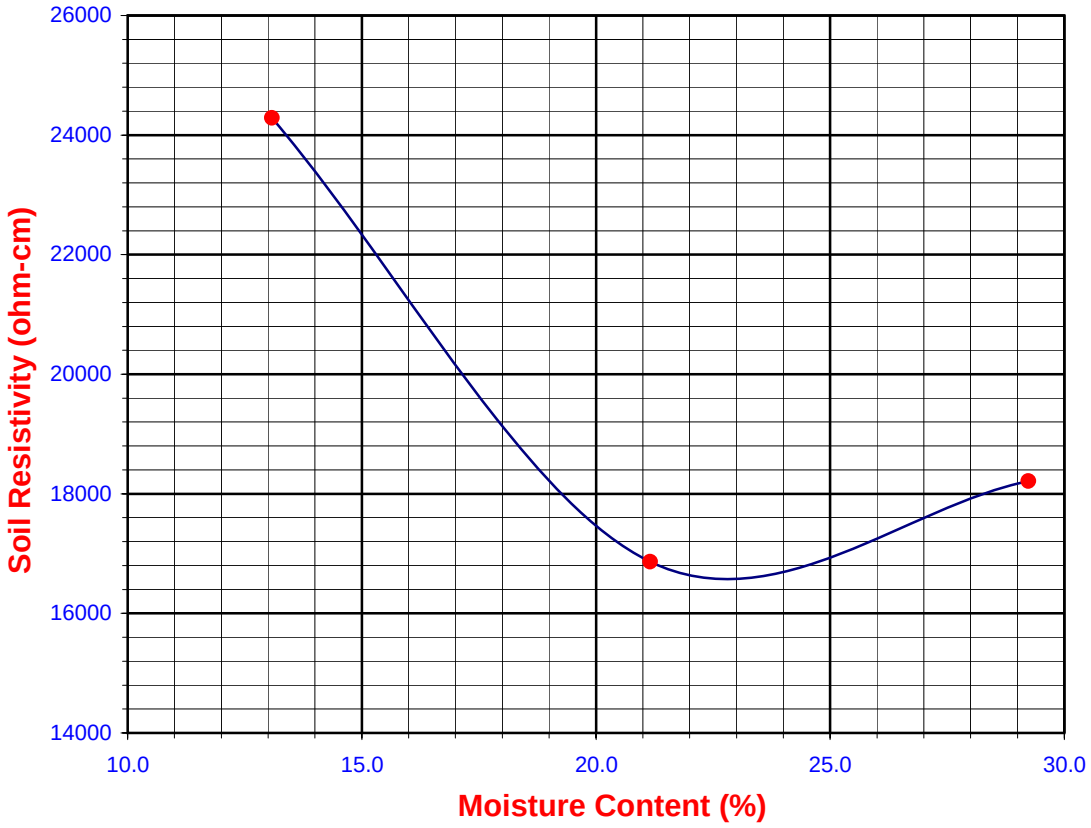
Data Input By: J. Ward Date: 03/24/09

Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	13.08	3600	24286
2	200	21.16	2500	16865
3	300	29.24	2700	18214
4				
5				

Moisture Content (%) (MCi)	5.00
Wet Wt. of Soil + Cont. (g)	187.00
Dry Wt. of Soil + Cont. (g)	181.00
Wt. of Container (g)	61.10
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
16600	**22.8**	**35**	**137**	**8.28**	**19.4**



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R-VALUE TEST RESULTS

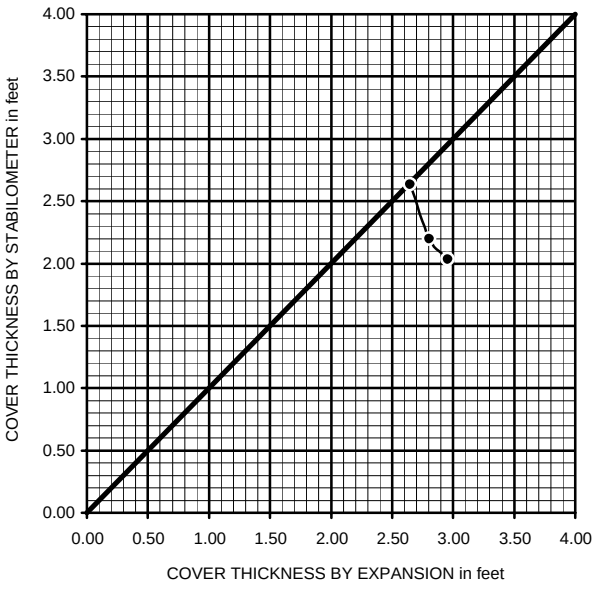
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-3 @ 0.5-5'
SAMPLE DESCRIPTION:	Gray sandy silt (ML)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

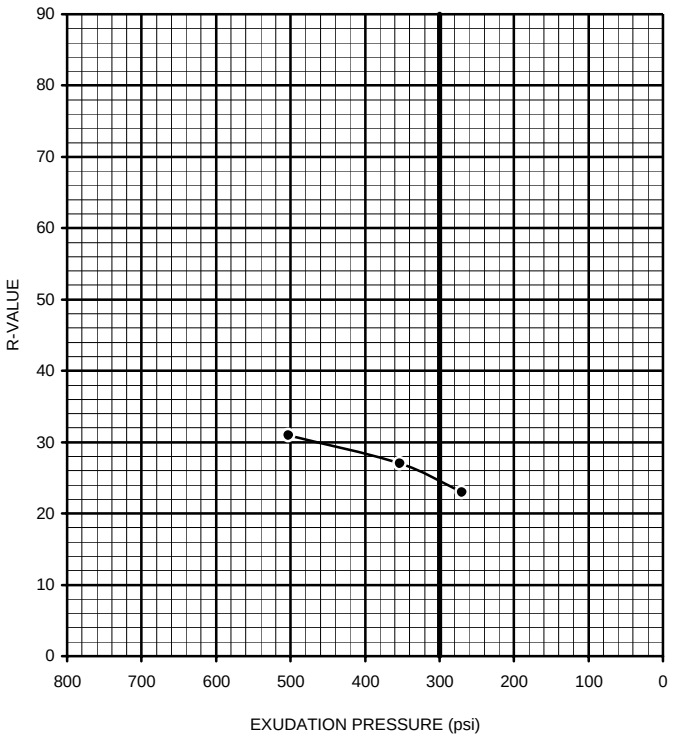
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	16.0	16.4	16.9
HEIGHT OF SAMPLE, Inches	2.44	2.60	2.59
DRY DENSITY, pcf	115.9	113.1	112.8
COMPACTOR PRESSURE, psi	100	75	50
EXUDATION PRESSURE, psi	502	353	270
EXPANSION, Inches x 10exp-4	79	66	61
STABILITY Ph 2,000 lbs (160 psi)	99	110	112
TURNS DISPLACEMENT	3.30	3.24	3.54
R-VALUE UNCORRECTED	32	26	23
R-VALUE CORRECTED	31	27	23

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	2.65	2.80	2.96
EXPANSION PRESSURE THICKNESS, ft.	2.63	2.20	2.03

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	32
R-VALUE BY EXUDATION:	25
EQUILIBRIUM R-VALUE:	25

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R-VALUE TEST RESULTS

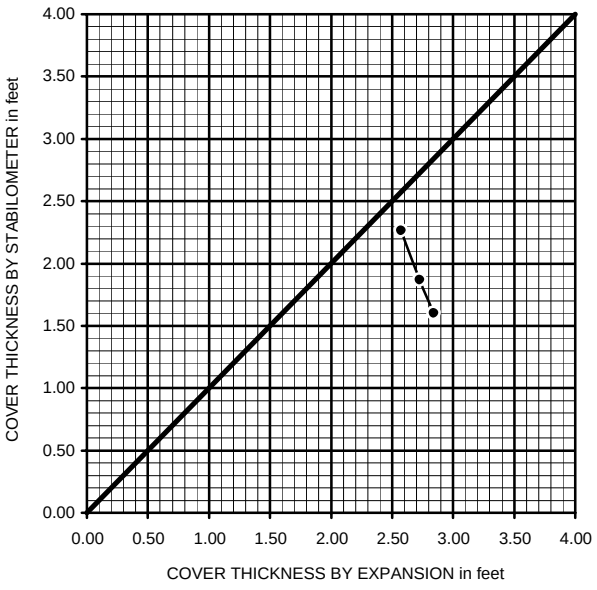
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	A-09-004 @ 1.5-5'
SAMPLE DESCRIPTION:	Gray clayey sand with gravel (SC)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

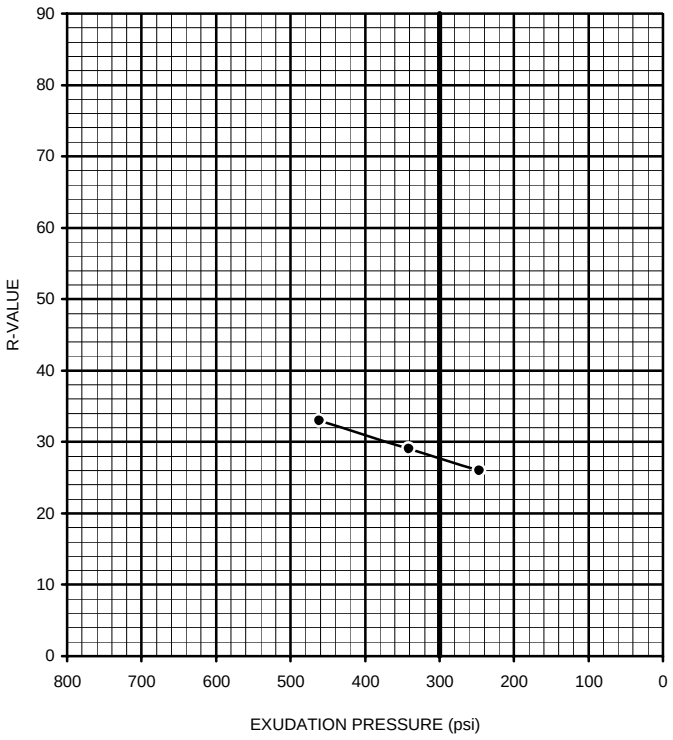
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	12.9	13.4	13.8
HEIGHT OF SAMPLE, Inches	2.51	2.51	2.57
DRY DENSITY, pcf	121.5	119.7	118.4
COMPACTOR PRESSURE, psi	100	75	50
EXUDATION PRESSURE, psi	461	341	247
EXPANSION, Inches x 10exp-4	68	56	48
STABILITY Ph 2,000 lbs (160 psi)	101	105	106
TURNS DISPLACEMENT	2.90	3.17	3.58
R-VALUE UNCORRECTED	33	29	26
R-VALUE CORRECTED	33	29	26

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	2.57	2.73	2.84
EXPANSION PRESSURE THICKNESS, ft.	2.27	1.87	1.60

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	36
R-VALUE BY EXUDATION:	28
EQUILIBRIUM R-VALUE:	28

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R-VALUE TEST RESULTS

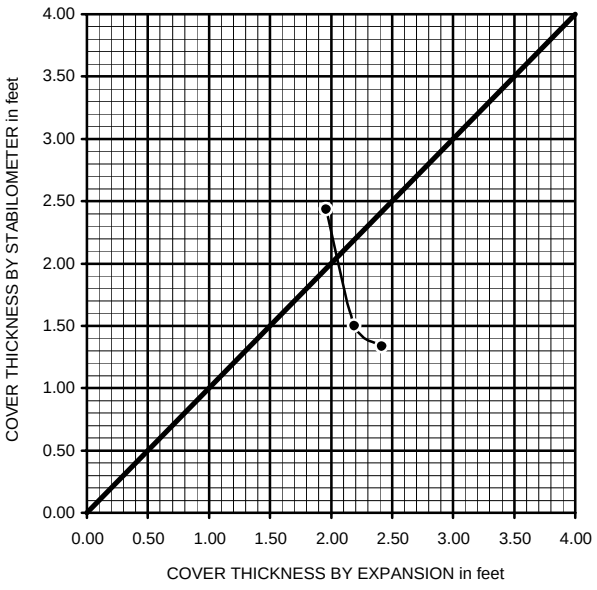
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-6 @ 0-5'
SAMPLE DESCRIPTION:	Dark gray clayey sand (SC)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

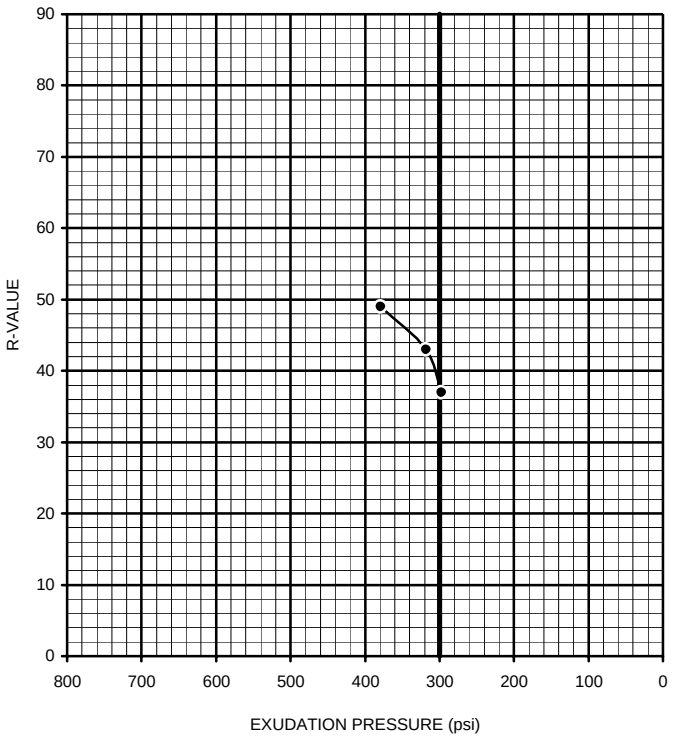
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	15.2	15.6	15.8
HEIGHT OF SAMPLE, Inches	2.58	2.55	2.57
DRY DENSITY, pcf	111.2	112.9	110.0
COMPACTOR PRESSURE, psi	175	125	110
EXUDATION PRESSURE, psi	379	318	297
EXPANSION, Inches x 10exp-4	73	45	40
STABILITY Ph 2,000 lbs (160 psi)	59	67	76
TURNS DISPLACEMENT	4.43	4.66	4.63
R-VALUE UNCORRECTED	49	43	37
R-VALUE CORRECTED	49	43	37

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	1.96	2.19	2.42
EXPANSION PRESSURE THICKNESS, ft.	2.43	1.50	1.33

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	47
R-VALUE BY EXUDATION:	38
EQUILIBRIUM R-VALUE:	38

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R-VALUE TEST RESULTS

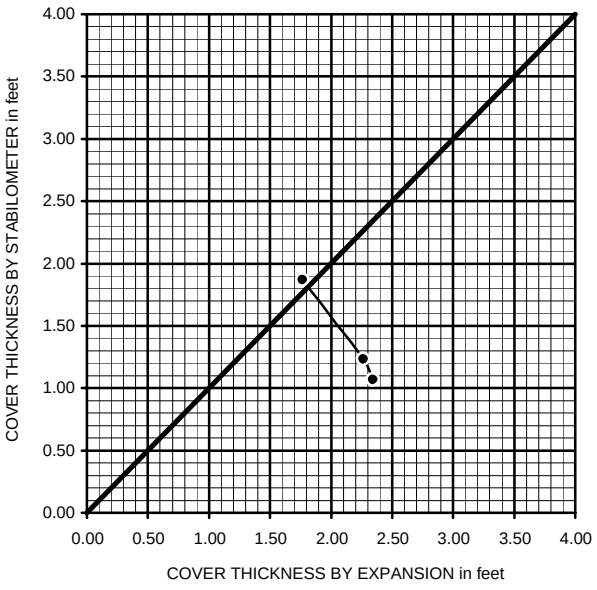
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-8 @ 0-5'
SAMPLE DESCRIPTION:	Dark gray clayey sand (SC)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

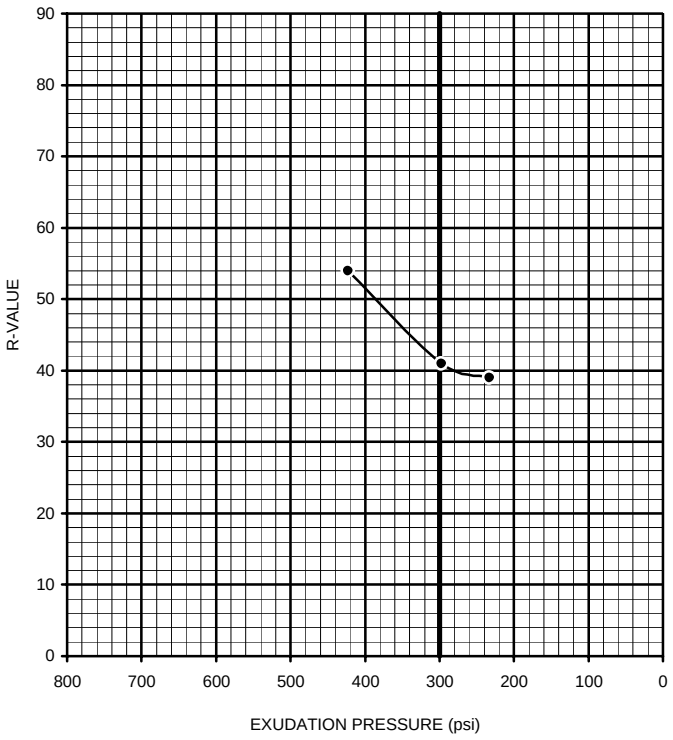
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	15.1	15.5	16.0
HEIGHT OF SAMPLE, Inches	2.55	2.57	2.50
DRY DENSITY, pcf	112.0	111.7	111.8
COMPACTOR PRESSURE, psi	165	115	75
EXUDATION PRESSURE, psi	423	298	233
EXPANSION, Inches x 10exp-4	56	37	32
STABILITY Ph 2,000 lbs (160 psi)	53	73	77
TURNS DISPLACEMENT	4.31	4.36	4.25
R-VALUE UNCORRECTED	54	41	39
R-VALUE CORRECTED	54	41	39

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	1.77	2.27	2.34
EXPANSION PRESSURE THICKNESS, ft.	1.87	1.23	1.07

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	53
R-VALUE BY EXUDATION:	41
EQUILIBRIUM R-VALUE:	41

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R-VALUE TEST RESULTS

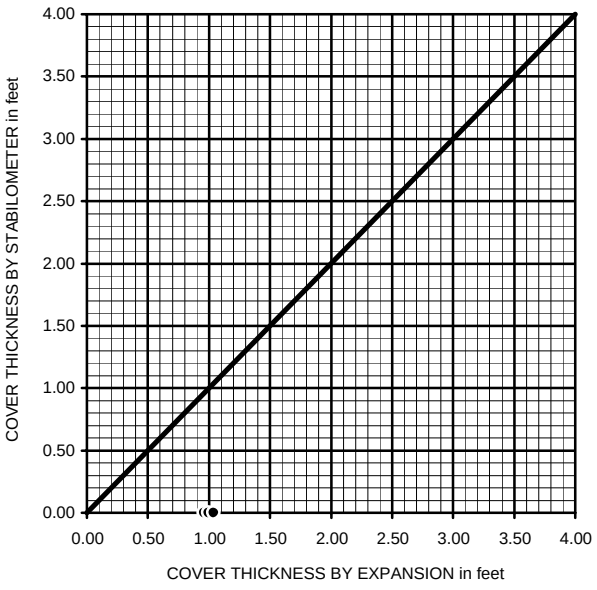
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-9 @ 0-5'
SAMPLE DESCRIPTION:	Brown silty sand (SM)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

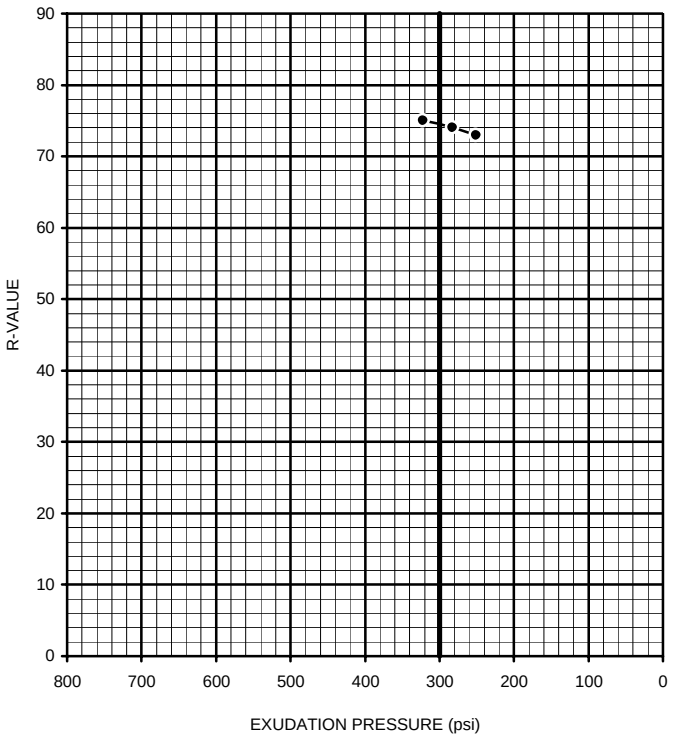
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	10.6	10.7	10.8
HEIGHT OF SAMPLE, Inches	2.46	2.48	2.51
DRY DENSITY, pcf	121.4	120.3	121.0
COMPACTOR PRESSURE, psi	300	290	280
EXUDATION PRESSURE, psi	322	283	251
EXPANSION, Inches x 10exp-4	0	0	0
STABILITY Ph 2,000 lbs (160 psi)	26	27	28
TURNS DISPLACEMENT	4.20	4.33	4.30
R-VALUE UNCORRECTED	75	74	73
R-VALUE CORRECTED	75	74	73

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	0.96	1.00	1.04
EXPANSION PRESSURE THICKNESS, ft.	0.00	0.00	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	n/a
R-VALUE BY EXUDATION:	74
EQUILIBRIUM R-VALUE:	74

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R-VALUE TEST RESULTS

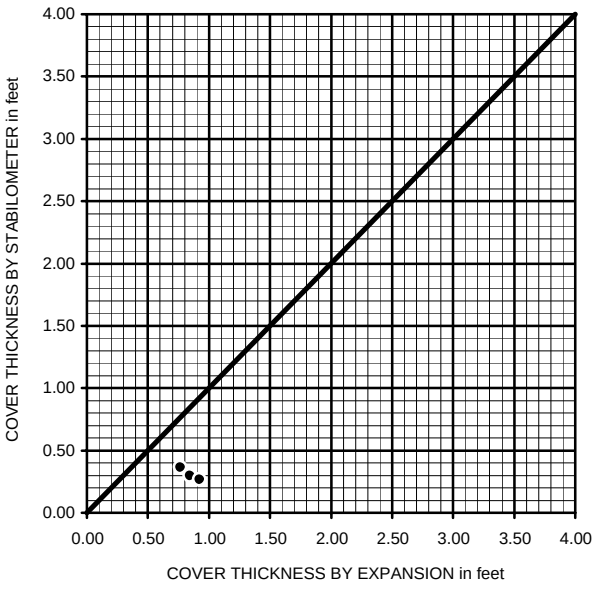
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-11 @ 0-5'
SAMPLE DESCRIPTION:	Brown silty sand (SM)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

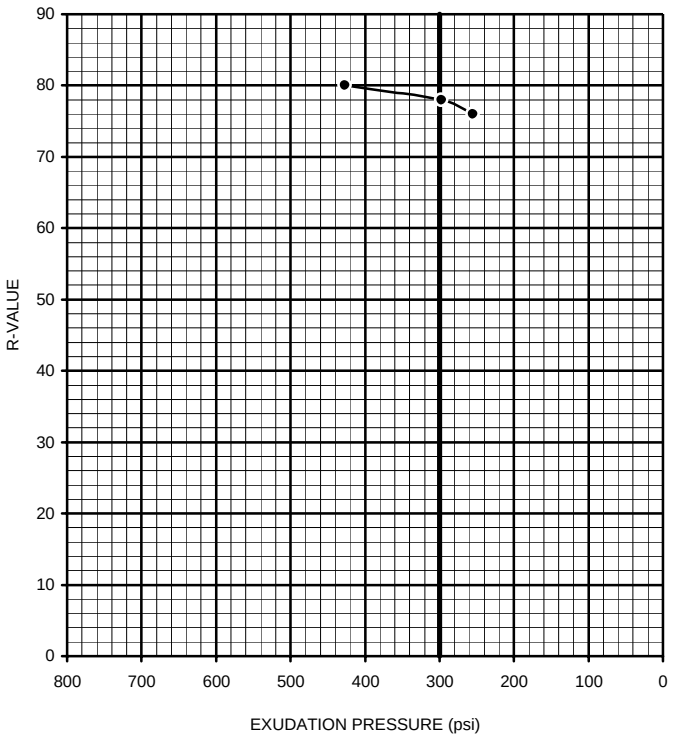
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	9.1	9.6	10.0
HEIGHT OF SAMPLE, Inches	2.50	2.43	2.46
DRY DENSITY, pcf	123.0	121.6	123.1
COMPACTOR PRESSURE, psi	350	325	300
EXUDATION PRESSURE, psi	427	297	255
EXPANSION, Inches x 10exp-4	11	9	8
STABILITY Ph 2,000 lbs (160 psi)	22	24	26
TURNS DISPLACEMENT	3.99	4.04	4.00
R-VALUE UNCORRECTED	80	78	76
R-VALUE CORRECTED	80	78	76

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	0.77	0.84	0.92
EXPANSION PRESSURE THICKNESS, ft.	0.37	0.30	0.27

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	84
R-VALUE BY EXUDATION:	78
EQUILIBRIUM R-VALUE:	78

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R-VALUE TEST RESULTS

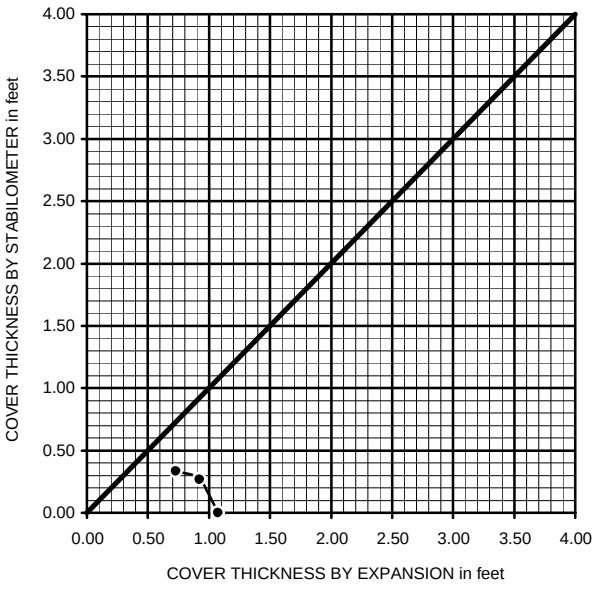
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-12 @ 0-5'
SAMPLE DESCRIPTION:	Brown silty sand (SM)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

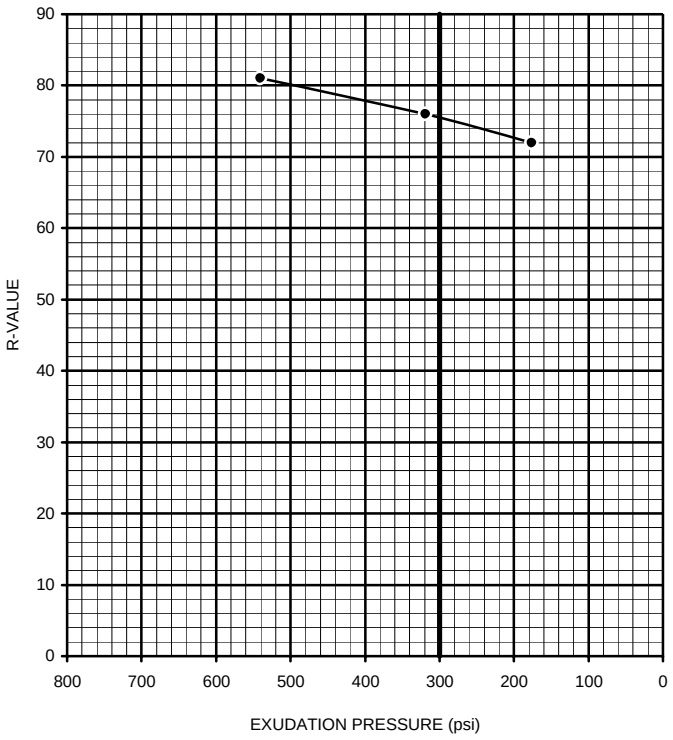
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	8.6	9.0	9.5
HEIGHT OF SAMPLE, Inches	2.59	2.49	2.45
DRY DENSITY, pcf	121.7	125.9	125.7
COMPACTOR PRESSURE, psi	350	325	300
EXUDATION PRESSURE, psi	540	319	176
EXPANSION, Inches x 10exp-4	10	8	0
STABILITY Ph 2,000 lbs (160 psi)	21	26	30
TURNS DISPLACEMENT	3.86	3.97	4.13
R-VALUE UNCORRECTED	81	76	72
R-VALUE CORRECTED	81	76	72

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	0.73	0.92	1.08
EXPANSION PRESSURE THICKNESS, ft.	0.33	0.27	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	88
R-VALUE BY EXUDATION:	76
EQUILIBRIUM R-VALUE:	76

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R-VALUE TEST RESULTS

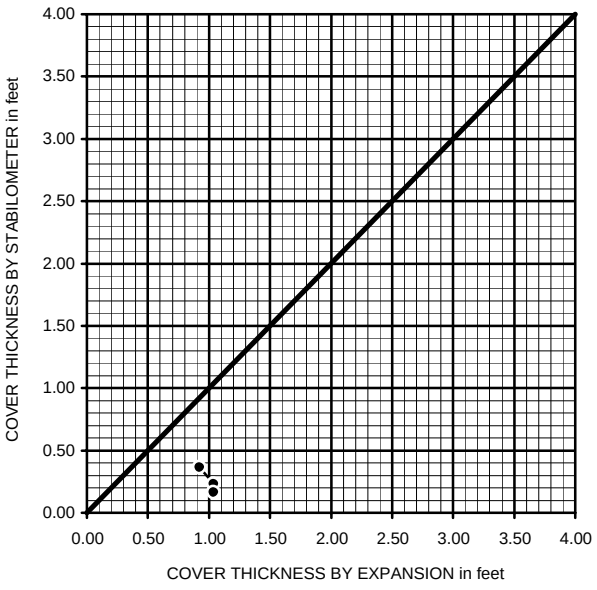
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-13 @ 0-5'
SAMPLE DESCRIPTION:	Brown silty sand (SM)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

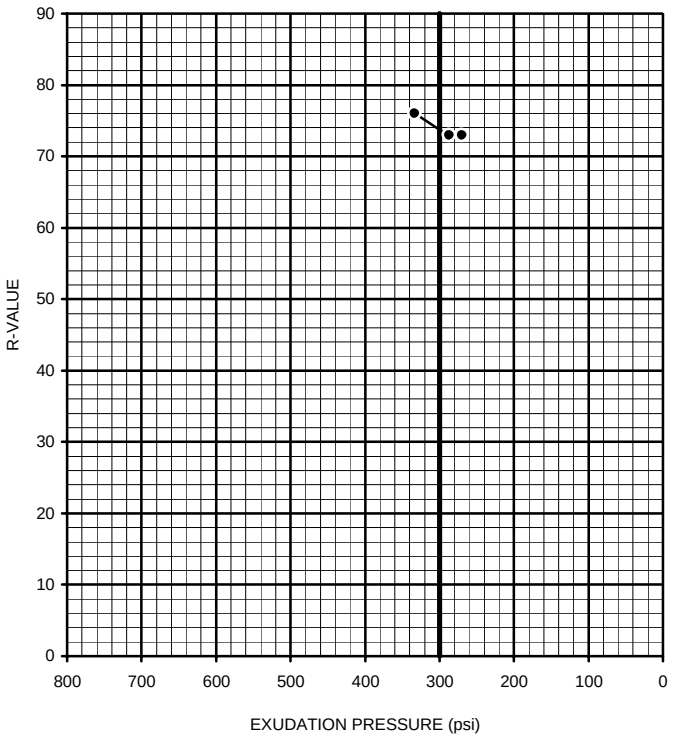
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	9.1	9.2	9.3
HEIGHT OF SAMPLE, Inches	2.45	2.45	2.48
DRY DENSITY, pcf	127.1	125.5	124.9
COMPACTOR PRESSURE, psi	300	285	270
EXUDATION PRESSURE, psi	333	287	270
EXPANSION, Inches x 10exp-4	11	7	5
STABILITY Ph 2,000 lbs (160 psi)	26	29	29
TURNS DISPLACEMENT	3.96	4.11	4.24
R-VALUE UNCORRECTED	76	73	73
R-VALUE CORRECTED	76	73	73

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	0.92	1.04	1.04
EXPANSION PRESSURE THICKNESS, ft.	0.37	0.23	0.17

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	83
R-VALUE BY EXUDATION:	74
EQUILIBRIUM R-VALUE:	74

Leighton

R-VALUE TEST RESULTS

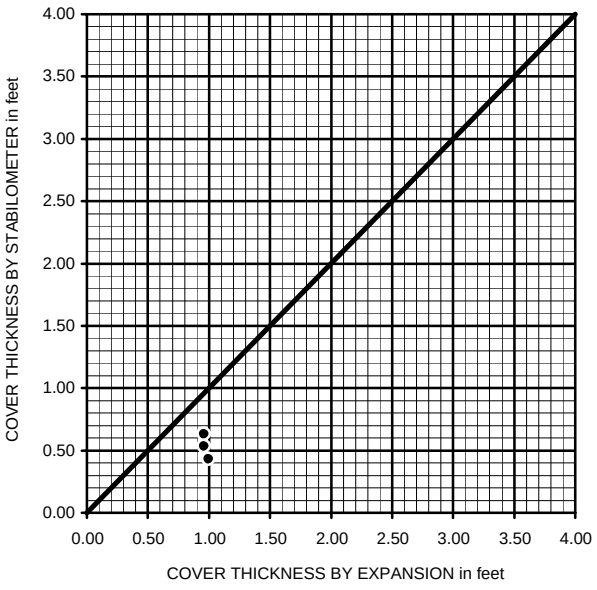
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-15 @ 0-5'
SAMPLE DESCRIPTION:	Brown silty sand (SM)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

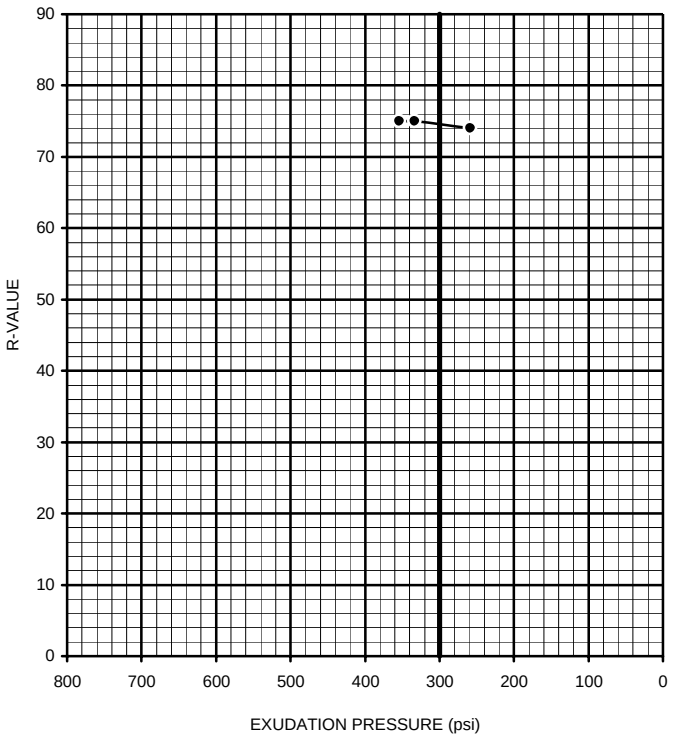
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	9.8	9.9	10.3
HEIGHT OF SAMPLE, Inches	2.55	2.50	2.53
DRY DENSITY, pcf	121.6	122.0	122.9
COMPACTOR PRESSURE, psi	300	280	270
EXUDATION PRESSURE, psi	354	333	259
EXPANSION, Inches x 10exp-4	19	16	13
STABILITY Ph 2,000 lbs (160 psi)	26	26	28
TURNS DISPLACEMENT	4.23	4.29	4.21
R-VALUE UNCORRECTED	75	75	74
R-VALUE CORRECTED	75	75	74

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	0.96	0.96	1.00
EXPANSION PRESSURE THICKNESS, ft.	0.63	0.53	0.43

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	75
R-VALUE BY EXUDATION:	74
EQUILIBRIUM R-VALUE:	74

Leighton

R-VALUE TEST RESULTS

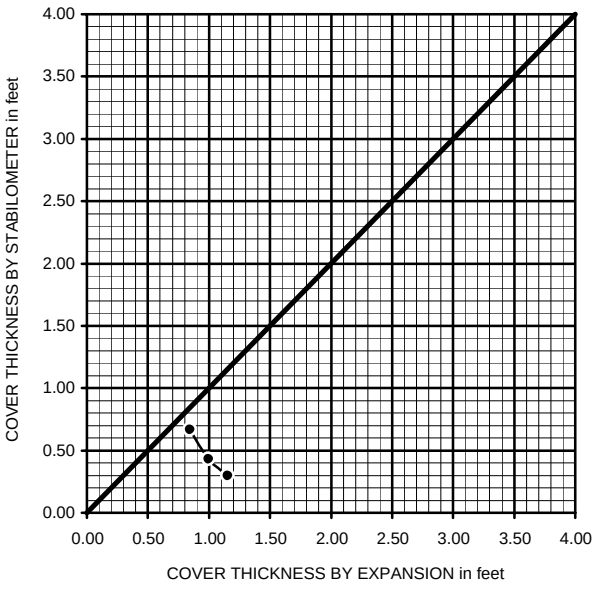
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-16 @ 0-5'
SAMPLE DESCRIPTION:	Brown silty sand (SM)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

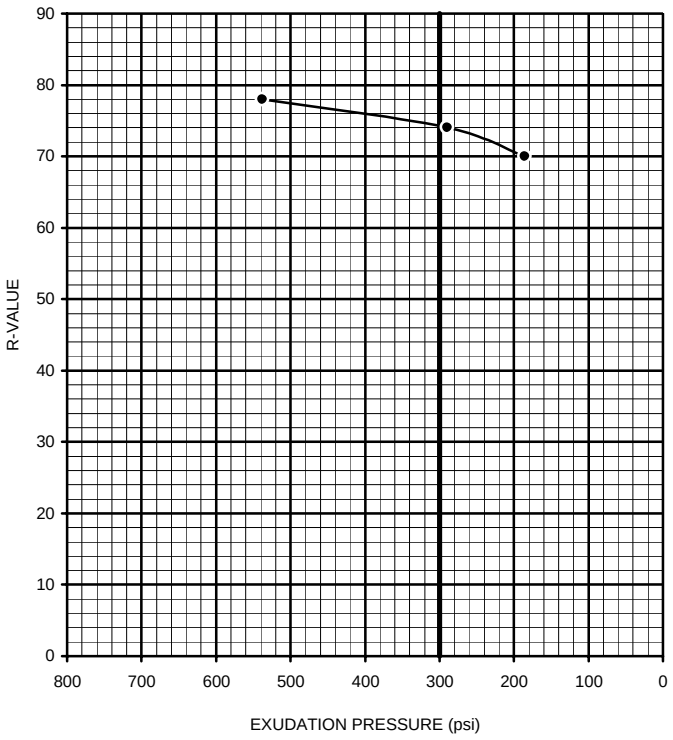
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	9.5	9.9	10.2
HEIGHT OF SAMPLE, Inches	2.48	2.40	2.54
DRY DENSITY, pcf	122.2	123.8	122.4
COMPACTOR PRESSURE, psi	350	300	250
EXUDATION PRESSURE, psi	538	290	185
EXPANSION, Inches x 10exp-4	20	13	9
STABILITY Ph 2,000 lbs (160 psi)	24	27	33
TURNS DISPLACEMENT	4.05	4.15	4.09
R-VALUE UNCORRECTED	78	75	70
R-VALUE CORRECTED	78	74	70

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	0.84	1.00	1.15
EXPANSION PRESSURE THICKNESS, ft.	0.67	0.43	0.30

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	80
R-VALUE BY EXUDATION:	74
EQUILIBRIUM R-VALUE:	74

Leighton

R-VALUE TEST RESULTS

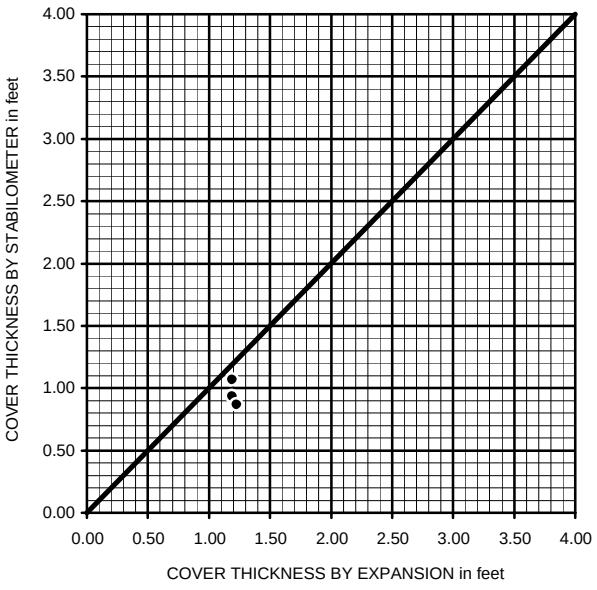
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-18 @ 0-5'
SAMPLE DESCRIPTION:	Light brown silty sand (SM)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

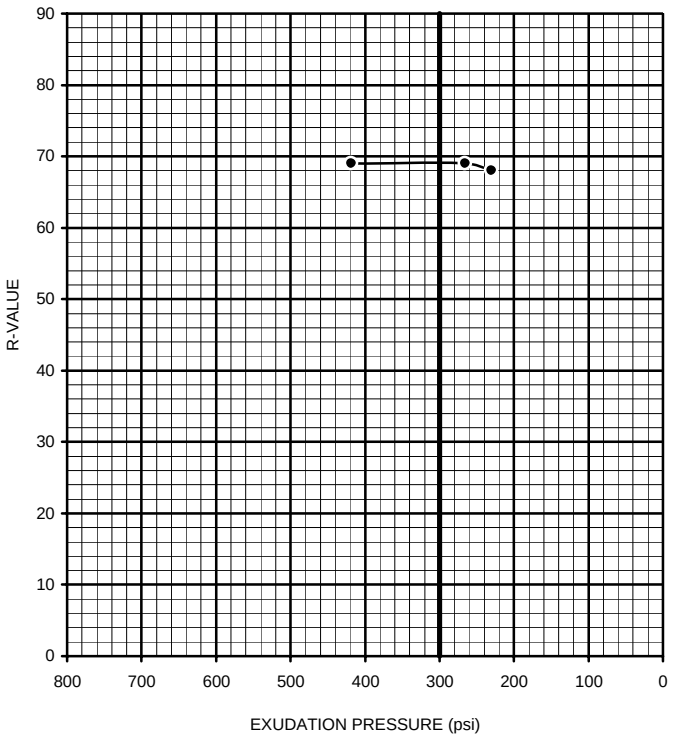
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	11.8	12.0	12.2
HEIGHT OF SAMPLE, Inches	2.62	2.52	2.64
DRY DENSITY, pcf	113.6	113.8	112.9
COMPACTOR PRESSURE, psi	300	270	250
EXUDATION PRESSURE, psi	418	266	230
EXPANSION, Inches x 10exp-4	32	28	26
STABILITY Ph 2,000 lbs (160 psi)	31	31	32
TURNS DISPLACEMENT	4.67	4.66	4.72
R-VALUE UNCORRECTED	69	69	68
R-VALUE CORRECTED	69	69	68

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	1.19	1.19	1.23
EXPANSION PRESSURE THICKNESS, ft.	1.07	0.93	0.87

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	69
R-VALUE BY EXUDATION:	69
EQUILIBRIUM R-VALUE:	69

Leighton

R-VALUE TEST RESULTS

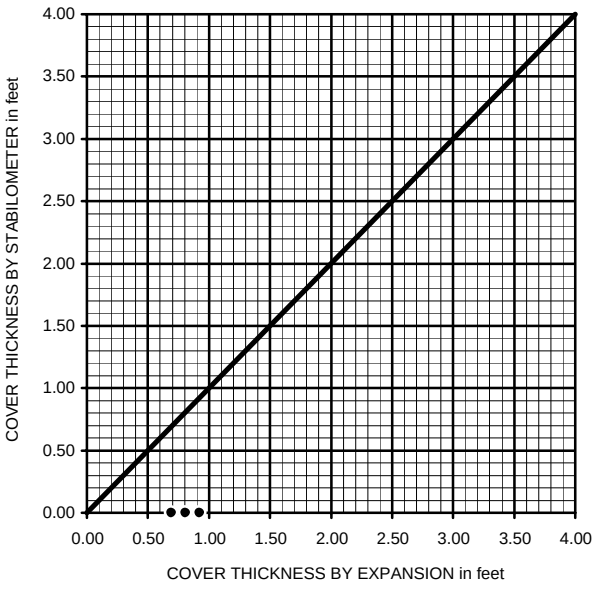
DOT CA 301

PROJECT NAME:	SR-57	PROJECT NUMBER:	602231-002
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	B-19 @ 0-5'
SAMPLE DESCRIPTION:	Light brown sand with silt (SP-SM)	TECHNICIAN:	SCF
		DATE COMPLETED	3/19/2009

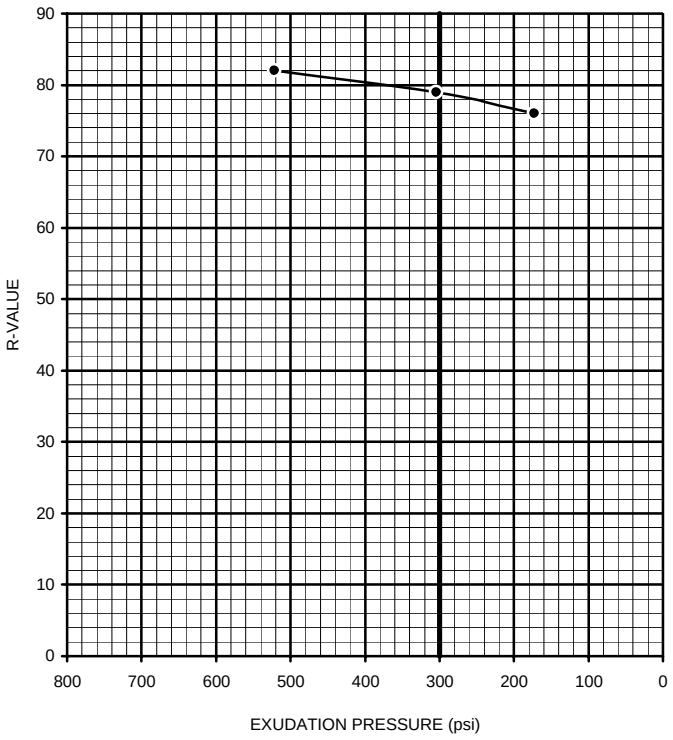
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	9.3	9.7	10.1
HEIGHT OF SAMPLE, Inches	2.47	2.54	2.54
DRY DENSITY, pcf	123.6	123.3	123.4
COMPACTOR PRESSURE, psi	350	300	250
EXUDATION PRESSURE, psi	522	305	172
EXPANSION, Inches x 10exp-4	0	0	0
STABILITY Ph 2,000 lbs (160 psi)	19	22	25
TURNS DISPLACEMENT	4.04	4.13	4.24
R-VALUE UNCORRECTED	82	79	76
R-VALUE CORRECTED	82	79	76

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	12.0	12.0	12.0
STABILOMETER THICKNESS, ft.	0.69	0.81	0.92
EXPANSION PRESSURE THICKNESS, ft.	0.00	0.00	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	n/a
R-VALUE BY EXUDATION:	79
EQUILIBRIUM R-VALUE:	79

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	03/18/09
Project No. :	602231-002	Checked By:	J. Ward	Date:	06/10/10
Boring No.:	B-3	Depth (ft.)	0.5-5		
Sample No. :	Bag-1				
Soil Identification:	Gray sandy silt (ML)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0355
Wt. Comp. Soil + Mold	(g)	605.50	432.60
Wt. of Mold	(g)	204.60	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	798.10	637.20
Dry Wt. of Soil + Cont.	(g)	725.50	569.00
Wt. of Container	(g)	0.00	204.60
Moisture Content	(%)	10.01	18.72
Wet Density	(pcf)	120.9	126.0
Dry Density	(pcf)	109.9	106.2
Void Ratio		0.534	0.588
Total Porosity		0.348	0.370
Pore Volume	(cc)	72.0	79.4
Degree of Saturation (%) [S_{meas}]		**50.6**	85.9

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
03/18/09	14:34	1.0	0	0.0665
03/18/09	14:44	1.0	10	0.0655
Add Distilled Water to the Specimen				
03/18/09	15:10	1.0	26	0.0940
03/19/09	7:13	1.0	989	0.1020
03/19/09	10:18	1.0	1174	0.1020

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**37**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	03/18/09
Project No. :	602231-002	Checked By:	J. Ward	Date:	06/10/10
Boring No.:	A-09-004	Depth (ft.)	1.5-5		
Sample No. :	Bag-1				
Soil Identification:	Gray clayey sand with gravel (SC)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0475
Wt. Comp. Soil + Mold	(g)	595.10	443.20
Wt. of Mold	(g)	190.30	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	806.10	633.50
Dry Wt. of Soil + Cont.	(g)	735.50	559.60
Wt. of Container	(g)	0.00	190.30
Moisture Content	(%)	9.60	20.01
Wet Density	(pcf)	122.1	127.6
Dry Density	(pcf)	111.4	106.3
Void Ratio		0.513	0.585
Total Porosity		0.339	0.369
Pore Volume	(cc)	70.2	80.0
Degree of Saturation (%) [S_{meas}]		**50.5**	92.3

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
03/18/09	13:43	1.0	0	0.2160
03/18/09	13:53	1.0	10	0.2160
Add Distilled Water to the Specimen				
03/18/09	14:00	1.0	7	0.2275
03/19/09	7:15	1.0	1042	0.2635
03/19/09	10:15	1.0	1222	0.2635

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**48**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	03/18/09
Project No. :	602231-002	Checked By:	J. Ward	Date:	06/10/10
Boring No.:	B-6	Depth (ft.)	0-5		
Sample No. :	Bag-1				
Soil Identification:	Dark gray clayey sand (SC)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0490
Wt. Comp. Soil + Mold	(g)	546.90	427.90
Wt. of Mold	(g)	163.80	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	759.90	591.70
Dry Wt. of Soil + Cont.	(g)	678.50	505.90
Wt. of Container	(g)	0.00	163.80
Moisture Content	(%)	12.00	25.08
Wet Density	(pcf)	115.6	123.0
Dry Density	(pcf)	103.2	98.4
Void Ratio		0.634	0.714
Total Porosity		0.388	0.416
Pore Volume	(cc)	80.3	90.4
Degree of Saturation (%) [S_{meas}]		**51.1**	94.9

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
03/18/09	15:11	1.0	0	0.1535
03/18/09	15:21	1.0	10	0.1525
Add Distilled Water to the Specimen				
03/18/09	15:30	1.0	9	0.1755
03/19/09	7:10	1.0	949	0.2025
03/19/09	10:24	1.0	1143	0.2025

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**50**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	03/19/09
Project No. :	602231-002	Checked By:	J. Ward	Date:	06/10/10
Boring No.:	B-8	Depth (ft.)	0-5		
Sample No. :	Bag-1				
Soil Identification:	Dark gray clayey sand (SC)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0515
Wt. Comp. Soil + Mold	(g)	567.00	423.40
Wt. of Mold	(g)	184.80	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	759.90	608.20
Dry Wt. of Soil + Cont.	(g)	678.50	526.10
Wt. of Container	(g)	0.00	184.80
Moisture Content	(%)	12.00	24.06
Wet Density	(pcf)	115.3	121.5
Dry Density	(pcf)	102.9	97.9
Void Ratio		0.638	0.722
Total Porosity		0.389	0.419
Pore Volume	(cc)	80.6	91.2
Degree of Saturation (%) [S_{meas}]		**50.8**	90.0

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
03/19/09	13:56	1.0	0	0.1435
03/19/09	14:06	1.0	10	0.1430
Add Distilled Water to the Specimen				
03/19/09	14:17	1.0	11	0.1625
03/20/09	7:10	1.0	1024	0.1950
03/20/09	8:12	1.0	1086	0.1950

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**52**

APPENDIX C

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 275+20 and 70 feet Right

TEST SAMPLE NO.....B-3 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 6.6 , WATER pH = 0.0 , SOIL pH = 6.6
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 774 , WATER = 0 , SOIL = 774
CHLORIDES, PPM... 23 , SULFATES, PPM... 950

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	10	18	25	35	60
16 0.064	14	22	29	39	64
14 0.079	17	25	32	42	67
12 0.109	23	31	38	48	73
10 0.138	30	38	45	55	80
08 0.168	36	44	51	61	86

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
MAXIMUM W/C RATIO OF 0.45

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 289+90 and 70 feet right

TEST SAMPLE NO.....B-4 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 6.6 , WATER pH = 0.0 , SOIL pH = 6.6
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 804 , WATER = 0 , SOIL = 804
CHLORIDES, PPM... 41 , SULFATES, PPM... 271

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	11	19	26	36	61
16 0.064	15	23	30	40	65
14 0.079	18	26	33	43	68
12 0.109	25	33	40	50	75
10 0.138	32	40	47	57	82
08 0.168	39	47	54	64	89

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
MAXIMUM W/C RATIO OF 0.45

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

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DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
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CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 289+90 and 70 feet right

TEST SAMPLE NO.....B-4 Bag-2

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 5.7 , WATER pH = 0.0 , SOIL pH = 5.7
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 574 , WATER = 0 , SOIL = 574
CHLORIDES, PPM... 82 , SULFATES, PPM... 383

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	4	12	19	29	54
16 0.064	5	13	20	30	55
14 0.079	7	15	22	32	57
12 0.109	9	17	24	34	59
10 0.138	12	20	27	37	62
08 0.168	15	23	30	40	65

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
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A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
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A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 305+35 and 75 feet right

TEST SAMPLE NO.....B-6 B-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 6.3 , WATER pH = 0.0 , SOIL pH = 6.3
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 446 , WATER = 0 , SOIL = 446
CHLORIDES, PPM... 417 , SULFATES, PPM... 787

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ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	6	14	21	31	56
16 0.064	7	15	22	32	57
14 0.079	9	17	24	34	59
12 0.109	13	21	28	38	63
10 0.138	17	25	32	42	67
08 0.168	20	28	35	45	70

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
MAXIMUM W/C RATIO OF 0.45

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 319+50 and 90 feet right

TEST SAMPLE NO.....B-8 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 5.9 , WATER pH = 0.0 , SOIL pH = 5.9
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 458 , WATER = 0 , SOIL = 458
CHLORIDES, PPM... 108 , SULFATES, PPM... 919

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	3	11	18	28	53
16 0.064	5	13	20	30	55
14 0.079	6	14	21	31	56
12 0.109	8	16	23	33	58
10 0.138	11	19	26	36	61
08 0.168	13	21	28	38	63

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
MAXIMUM W/C RATIO OF 0.45

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 329+50 and 127 feet right

TEST SAMPLE NO.....B-9 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 6.9 , WATER pH = 0.0 , SOIL pH = 6.9

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 8080 , WATER = 0 , SOIL = 8080

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	27	35	42	52	77
16 0.064	36	44	51	61	86
14 0.079	44	52	59	69	94
12 0.109	61	69	76	86	111
10 0.138	78	86	93	103	128
08 0.168	95	103	110	120	145

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
MAXIMUM W/C RATIO OF 0.45

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 346+00 and 112 feet right

TEST SAMPLE NO.....B-11 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.1 , WATER pH = 0.0 , SOIL pH = 7.1

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 12817 , WATER = 0 , SOIL = 12817

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	34	42	49	59	84
16 0.064	44	52	59	69	94
14 0.079	54	62	69	79	104
12 0.109	75	83	90	100	125
10 0.138	95	103	110	120	145
08 0.168	116	124	131	141	166

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 352+70 and 117 feet right

TEST SAMPLE NO.....B-12 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.6 , WATER pH = 0.0 , SOIL pH = 7.6

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 7400 , WATER = 0 , SOIL = 7400

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	56	64	71	81	106
16 0.064	73	81	88	98	123
14 0.079	90	98	105	115	140
12 0.109	124	132	139	149	174
10 0.138	158	166	173	183	208
08 0.168	192	200	207	217	242

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 361+40 and 114 feet right

TEST SAMPLE NO.....B-13 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.0 , WATER pH = 0.0 , SOIL pH = 7.0

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 10200 , WATER = 0 , SOIL = 10200

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage	& in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	0.052	30	38	45	55	80
16	0.064	40	48	55	65	90
14	0.079	49	57	64	74	99
12	0.109	67	75	82	92	117
10	0.138	86	94	101	111	136
08	0.168	104	112	119	129	154

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
MAXIMUM W/C RATIO OF 0.45

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 372+50 and 98 feet right

TEST SAMPLE NO.....B-15 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.4 , WATER pH = 0.0 , SOIL pH = 7.4

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 7400 , WATER = 0 , SOIL = 7400

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	56	64	71	81	106
16 0.064	73	81	88	98	123
14 0.079	90	98	105	115	140
12 0.109	124	132	139	149	174
10 0.138	158	166	173	183	208
08 0.168	192	200	207	217	242

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 377+05 and 140 feet right

TEST SAMPLE NO.....B-16 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.5 , WATER pH = 0.0 , SOIL pH = 7.5

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 5000 , WATER = 0 , SOIL = 5000

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	48	56	63	73	98
16 0.064	62	70	77	87	112
14 0.079	77	85	92	102	127
12 0.109	106	114	121	131	156
10 0.138	135	143	150	160	185
08 0.168	164	172	179	189	214

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 391+50 and 83 feet right

TEST SAMPLE NO.....B-18 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09
********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********
CSP SITE pH = 7.2 , WATER pH = 0.0 , SOIL pH = 7.2
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1752 , WATER = 0 , SOIL = 1752
****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	24	32	39	49	74
16 0.064	32	40	47	57	82
14 0.079	39	47	54	64	89
12 0.109	54	62	69	79	104
10 0.138	69	77	84	94	119
08 0.168	84	92	99	109	134

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...12-Ora-57-12.25/15.17

PROJECT ACCOUNT NO.602231-002

SAMPLE LOCATION....STA 396+60 and 142 feet right

TEST SAMPLE NO.....B-19 Bag-1

OPERATOR...........TK

TEST DATE..........3/24/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 8.3 , WATER pH = 0.0 , SOIL pH = 8.3

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 16600 , WATER = 0 , SOIL = 16600

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	78	86	93	103	128
16 0.064	102	110	117	127	152
14 0.079	126	134	141	151	176
12 0.109	173	181	188	198	223
10 0.138	221	229	236	246	271
08 0.168	268	276	283	293	318

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

CALFP Ver. 1.1

Unit System = E

Title: SR-57 Northbound Widening Shoulder TI-9.5
Traffic Index (TI) = 09.5
R.Value of Subgrade (Native Soil) = 40
Required GE = 0001.82 ft

Base Type = AB-Class 2

Base Gravel Factor = 0001.10
Base R.Value = 0078.00
0.0032*TI*(100-R.VALUE) = 0000.67 ft
Base MAX. depth = 0002.00 ft
Base MIN. depth = 0000.35 ft

Depth (ft)	GF	GE (ft)	Depth (ft)	GF	GE (ft)
00.10	01.84	00.18	00.15	01.84	00.28
00.20	01.84	00.37	00.25	01.84	00.46
00.30	01.84	00.55	00.35	01.84	00.64
00.40	01.84	00.74	00.45	01.84	00.83
00.50	01.84	00.92	00.55	01.86	01.02
00.60	01.92	01.15	00.65	01.97	01.28
00.70	02.02	01.41	00.75	02.06	01.55
00.80	02.11	01.69	00.85	02.15	01.83
00.90	02.19	01.97	00.95	02.23	02.12
01.00	02.27	02.27	01.05	02.31	02.43
01.10	02.34	02.57	01.15	02.38	02.74
01.20	02.41	02.89	01.25	02.45	03.06
01.30	02.48	03.22	01.35	02.51	03.39

HMA Safety Factor (GE) = 0000.20 ft
HMA Ultimate Depth = 0001.30 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (from Base) = 0000.20 ft

HMA MIN. Depth (selected) = 0000.20 ft

Note: Positive Residual GE indicates over-design.
Note: Negative Safety Factor in Base

HMA ft	TPB ft	T-Base ft	B-Base ft	Subbase ft	Res-GE ft	Cost $/y^2	HMA-GF
00.50	00.00	00.80	00.00	00.00	-00.02	0000.00	01.84
00.55	00.00	00.75	00.00	00.00	00.02	0000.00	01.86
00.60	00.00	00.60	00.00	00.00	-00.01	0000.00	01.92
00.65	00.00	00.50	00.00	00.00	00.01	0000.00	01.97
00.70	00.00	00.35	00.00	00.00	-00.02	0000.00	02.02
00.75	00.00	00.35	00.00	00.00	00.11	0000.00	02.06
00.80	00.00	00.35	00.00	00.00	00.25	0000.00	02.11
00.85	00.00	00.35	00.00	00.00	00.39	0000.00	02.15
00.90	00.00	00.35	00.00	00.00	00.53	0000.00	02.19

***** FINISH *****

CALFP Ver. 1.1

Unit System = E

Title: SR-57 Northbound Widening Shoulder TI-10
Traffic Index (TI) = 10.0
R.Value of Subgrade (Native Soil) = 40
Required GE = 0001.92 ft

Base Type = AB-Class 2

Base Gravel Factor = 0001.10
Base R.Value = 0078.00
0.0032*TI*(100-R.VALUE) = 0000.70 ft
Base MAX. depth = 0002.00 ft
Base MIN. depth = 0000.35 ft

Depth (ft)	GF	GE (ft)	Depth (ft)	GF	GE (ft)
00.10	01.79	00.18	00.15	01.79	00.27
00.20	01.79	00.36	00.25	01.79	00.45
00.30	01.79	00.54	00.35	01.79	00.63
00.40	01.79	00.72	00.45	01.79	00.81
00.50	01.79	00.90	00.55	01.81	01.00
00.60	01.87	01.12	00.65	01.92	01.25
00.70	01.97	01.38	00.75	02.01	01.51
00.80	02.05	01.64	00.85	02.10	01.79
00.90	02.14	01.93	00.95	02.18	02.07
01.00	02.21	02.21	01.05	02.25	02.36
01.10	02.29	02.52	01.15	02.32	02.67
01.20	02.35	02.82	01.25	02.38	02.98
01.30	02.42	03.15	01.35	02.45	03.31

HMA Safety Factor (GE) = 0000.20 ft
HMA Ultimate Depth = 0001.35 ft
(HMA MAX. Depth shown in Table)

HMA MIN. Depth (from Base) = 0000.20 ft

HMA MIN. Depth (selected) = 0000.20 ft

Note: Positive Residual GE indicates over-design.
Note: Negative Safety Factor in Base

HMA ft	TPB ft	T-Base ft	B-Base ft	Subbase ft	Res-GE ft	Cost $/y^2	HMA-GF
00.50	00.00	00.95	00.00	00.00	00.02	0000.00	01.79
00.55	00.00	00.85	00.00	00.00	00.01	0000.00	01.81
00.60	00.00	00.75	00.00	00.00	00.03	0000.00	01.87
00.65	00.00	00.60	00.00	00.00	-00.01	0000.00	01.92
00.70	00.00	00.50	00.00	00.00	00.01	0000.00	01.97
00.75	00.00	00.35	00.00	00.00	-00.03	0000.00	02.01
00.80	00.00	00.35	00.00	00.00	00.11	0000.00	02.05
00.85	00.00	00.35	00.00	00.00	00.25	0000.00	02.10
00.90	00.00	00.35	00.00	00.00	00.39	0000.00	02.14
00.95	00.00	00.35	00.00	00.00	00.54	0000.00	02.18

***** FINISH *****

CALFP Ver. 1.1

Unit System = E

Title: SR-57 Northbound Widening Ramp TI=12
Traffic Index (TI) = 12.0
R.Value of Subgrade (Native Soil) = 40
Required GE = 0002.30 ft

Base Type = AB-Class 2

Base Gravel Factor = 0001.10
Base R.Value = 0078.00
0.0032*TI*(100-R.VALUE) = 0000.84 ft
Base MAX. depth = 0002.00 ft
Base MIN. depth = 0000.35 ft

Depth (ft)	GF	GE (ft)	Depth (ft)	GF	GE (ft)
00.10	01.64	00.16	00.15	01.64	00.25
00.20	01.64	00.33	00.25	01.64	00.41
00.30	01.64	00.49	00.35	01.64	00.57
00.40	01.64	00.66	00.45	01.64	00.74
00.50	01.64	00.82	00.55	01.66	00.91
00.60	01.70	01.02	00.65	01.75	01.14
00.70	01.79	01.25	00.75	01.84	01.38
00.80	01.88	01.50	00.85	01.91	01.62
00.90	01.95	01.76	00.95	01.99	01.89
01.00	02.02	02.02	01.05	02.05	02.15
01.10	02.09	02.30	01.15	02.12	02.44
01.20	02.15	02.58	01.25	02.18	02.73
01.30	02.21	02.87	01.35	02.23	03.01
01.40	02.26	03.16	01.45	02.29	03.32
01.50	02.31	03.47	01.55	02.34	03.63
01.60	02.36	03.78	01.65	02.39	03.94

HMA Safety Factor (GE) = 0000.20 ft
HMA Ultimate Depth = 0001.65 ft

(HMA MAX. Depth shown in Table)

HMA MIN. Depth (from Base) = 0000.20 ft

HMA MIN. Depth (selected) = 0000.20 ft

Note: Positive Residual GE indicates over-design.
Note: Negative Safety Factor in Base

HMA ft	TPB ft	T-Base ft	B-Base ft	Subbase ft	Res-GE ft	Cost $/y^2	HMA-GF
00.60	00.00	01.15	00.00	00.00	-00.02	0000.00	01.70
00.65	00.00	01.05	00.00	00.00	-00.01	0000.00	01.75
00.70	00.00	00.95	00.00	00.00	-00.01	0000.00	01.79
00.75	00.00	00.85	00.00	00.00	00.01	0000.00	01.84
00.80	00.00	00.75	00.00	00.00	00.02	0000.00	01.88
00.85	00.00	00.60	00.00	00.00	-00.02	0000.00	01.91
00.90	00.00	00.50	00.00	00.00	00.00	0000.00	01.95
00.95	00.00	00.40	00.00	00.00	00.03	0000.00	01.99
01.00	00.00	00.35	00.00	00.00	00.10	0000.00	02.02
01.05	00.00	00.35	00.00	00.00	00.23	0000.00	02.05
01.10	00.00	00.35	00.00	00.00	00.38	0000.00	02.09
01.15	00.00	00.35	00.00	00.00	00.52	0000.00	02.12

***** FINISH *****

APPENDIX D

State of California

Business, Transportation and

Memorandum

To: Kamran Mahzar, Chief
Design Branch F

Date: May 7, 2009

File: 12-ORA-57
PM 12.2-15.2
EA-0F0400

From: **DEPARTMENT OF TRANSPORTATION**
District 12
Materials and Research Branch

Cat: 441.01

Subject: Review of Preliminary Pavement Structural Section Report and Project Plans for SR 57 NB Widening, City of Anaheim in Orange County, California.

The District Materials & Research (M&R) Branch has reviewed your April 21, 2009 submittal of Preliminary Pavement Structural Section Report and the project pals for the subject project.

As indicated in the PR, it is proposed to improve existing and projected traffic during peak-hour condition on NB SR-57 in the city of Anaheim between 0.31 mile south of Katella Ave (PM 12.2) and 0.31 mile north of Lincoln Ave (PM 15.2). Three "build" alternatives and "no build" alternative are under consideration, ranging in cost from $23.8 million to $38.2 million:

Alternative 1 would provide an auxiliary lane from Katella Ave. NB SR-57 loop on ramp to NB SR-57 Ball Road off-ramp and from Ball Road NB SR-57 loop on-ramp to NB Lincoln Ave. off-ramp. Alternative 2 would provide a general purpose (GP) lane instead of an auxiliary lane, within the defined project limits and would maintain a non-standard median shoulder. Alternative 3 is the same alternative 2, but would provide a standard median shoulder and a HOV lane. Our comments:

Plans

1. Pavement structural sections on plan sheets X-1, X-2, and X-3 shall be updated as soon as the preliminary pavement structural section design report is finalized.

Materials Report (Preliminary Pavement Structural Section Design Report)

Per our review of the preliminary pavement structural section design report prepared by Leighton Consulting, Inc., dated April 17, 2009, please provide the following information/documentation and make necessary changes to sections outlined below:

1. Section 2.1, Table 1- Boring Locations and Laboratory Test Results, please provide detailed laboratory test results for R-Value, Percent Fines, Expansion Index and Sand Equivalent for our review. Also, please provide detailed the results of laboratory testing for Atterberg and Plastic Limit tests for clayey soils (B3 through B8).

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2. Section 3.1.2, Remedial Removal, please identify the type of imported fill material (i.e., Class 2 AS) within the upper 4 feet of the subsurface soil for areas required over-excavation and replacement with imported fill.

3. Section 3. 1. 3., Fill material, please change the Expansion Index (EI) criteria for the material within the upper 4 feet of finished grade from 51 to 50.

4. Section 3. 2. 1, Traffic Indices, please provide documentation or calculation for the TI-values recommended for the general purpose lane (TI =15.5).

5. Section 3. 2. 2, Flexible Pavements, please strike out the statement "Caltrans provided a preliminary design R-value of 40 prior to completion of our laboratory testing. As such, the preliminary pavement sections presented in the report are based on an R-value of 40". Caltrans did not provide any preliminary R-values. We suggested an R-value of 40 for design of pavement on imported fill (Class 3 Aggregate Subbase). Flexible pavement should be designed based on a maximum R-value of 40 even if the actual laboratory R-value exceeds 40.

6. Section 3. 2. 2, Flexible Pavements, Tables 2 and 3 (Design Flexible Pavement Sections), no aggregate subbase (AS) option is provided for design of ramps and shoulders placed in areas that require over-excavation to a depth of 4 feet below the finished grade.

7. Section 3. 2. 3, Rigid Pavements, Tables 4 and 5 (Design Rigid pavement Sections), no aggregate subbase (AS) option is provided for design of general purpose lane, ramps and shoulders placed in areas that require over-excavation to a depth of 4 feet below the finished grade.

For further assistance, please contact Mike Azmoudeh at (949) 756-4940.

Prepared by:

Mike Azmoudeh
Materials & Research Branch
Division of Project Delivery

Concurred by:

Behdad Bateghi, Ph.D, PE, GE, PMP
Chief, Materials & Research Branch
Division of Project Delivery
RCE # 47051

Cc: Frank Lin
Sidney Dadras
File

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SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MAY 7, 2009
BY CALTRANS DISTRICT 12 MATERIALS AND RESEARCH BRANCH

Review of Preliminary Pavement Structural Section Report and Project Plans for SR 57 NB Widening, City of Anaheim in Orange County, California, dated April 17, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	2.1	Mike Azmoudeh	Section 2.1, Table 1- Boring Locations and Laboratory Test Results, please provide detailed laboratory test results for R-Value, Percent Fines, Expansion Index and Sand Equivalent for our review. Also, please provide detailed the results of laboratory testing for Atterberg and Plastic Limit tests for clayey soils (B3 through B8).	Our report dated April 17, 2009, is not intended as a Materials Report. We will include the results of laboratory test in the Materials Report. We did not perform Atterberg Limit tests for borings B-3 through B-8.
2	3.12	Mike Azmoudeh	Section 3.1.2, Remedial Removal, please identify the type of imported fill material (i.e., Class 2 AS) within the upper 4 feet of the subsurface soil for areas required over-excavation and replacement with imported fill.	The imported fill material should be Aggregate Subbase Class 3 and we will identify the type of imported fill material in our Materials Report.
3	3.1.3	Mike Azmoudeh	Section 3.1.3, Fill material, please change the Expansion Index (EI) criteria for the material within the upper 4 feet of finished grade from 51 to 50.	We will incorporate this into our Materials Report.
4	3.2.1	Mike Azmoudeh	Section 3.2.1, Traffic Indices, please provide documentation or calculation for the TI-values recommended for the general purpose lane (TI =15.5).	We will include the TI documentation in our Materials Report.
5	3.2.2	Mike Azmoudeh	Section 3. 2. 2, Flexible Pavements, please strike out the statement “Caltrans provided a preliminary design R-value of 40 prior to completion of our laboratory testing. As such, the preliminary pavement sections presented in the report are based on an R-value of 40”. Caltrans did not provide any preliminary R-values. We suggested an R-value of 40 for design of pavement on imported fill (Class 3 Aggregate Subbase). Flexible pavement should be designed based on a maximum R-value of 40 even if the actual laboratory R-value exceeds 40.	We will incorporate this comment into our Materials Report.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MAY 7, 2009
BY CALTRANS DISTRICT 12 MATERIALS AND RESEARCH BRANCH

Review of Preliminary Pavement Structural Section Report and Project Plans for SR 57 NB Widening, City of Anaheim in Orange County, California, dated April 17, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
6	3.2.2	Mike Azmoudeh	Section 3. 2. 2, Flexible Pavements, Tables 2 and 3 (Design Flexible Pavement Sections), no aggregate subbase (AS) option is provided for design of ramps and shoulders placed in areas that require over-excavation to a depth of 4 feet below the finished grade.	We will include in our Materials Report aggregate subbase (AS) option for flexible pavement in areas requiring 4-foot overexcavation.
7	3.2.3	Mike Azmoudeh	Section 3. 2. 3, Rigid Pavements, Tables 4 and 5 (Design Rigid pavement Sections), no aggregate subbase (AS) option is provided for design of general purpose lane, ramps and shoulders placed in areas that require over-excavation to a depth of 4 feet below the finished grade.	We will include in our Materials Report aggregate subbase (AS) option for rigid pavement in areas requiring 4-foot overexcavation.

State of California

Business, Transportation and

Memorandum

To: Kamran Mahzar, Chief
Design Branch F

Date: November 16, 2009

File: 12-ORA-57
PM 12.2-15.2
EA-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
District 12
Materials and Research Branch

Cat: 441.01

Subject: **Review of Preliminary Pavement Structural Section Report and Project Plans For SR 57 NB Widening, City of Anaheim in Orange County, California.**

The District Materials & Research (M&R) Branch has reviewed your October 12, 2009 submittal of Draft Materials Report, Life Cycle Cost Analysis (LCCA) and the project plans for the subject project.

As indicated in the PR, it is proposed to widen NB SR-57 in the city of Anaheim between 0.31 mile south of Katella Ave (PM 12.2) and 0.31 mile north of Lincoln Ave (PM 15.2). The purpose of the proposed project is to improve mobility, reduce congestion, improve mainline merge and diverge movement. Our comments:

Plans

1. Pavement structural sections on plan sheet X-1; structural section #1, change 05' of LCB to 0.5' of LCB.

2. A separate structural section shall be provided on plan sheet X-1 for areas (South of Ball Road) that require over excavation to a depth of 4 feet below the finished grade.

3. Table 612.2 of HDM requires that the first two feet of the shoulder cross-section shall match the adjacent travel way (the same TI as the travel way) for shoulders wider than 5 ft. If the shoulder width is less than 5 ft, the cross section of the entire shoulder shall match the travel way. Please make sure that the above design requirement is incorporated into the design of pavement. Any variation from the above will require mandatory design exception.

Draft Materials Report

Per our review of the draft materials report prepared by Leighton Consulting, Inc., dated October 9, 2009, we have presented our comments in the following:

1. Section 4.2. 3, Recommended Minimum Pavement Sections, per our through review of the laboratory test results, we recommend changing the subgrade soil type from soil type

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I to type II soil with an R-value of less than 40 for the design of rigid jointed plain concrete pavement (JPCP). Apparently, the JPCP section shown on plan sheet X-1 assumes soil Type II.

2. Section 4. 2. 1 Traffic Indices, as indicated in our comments dated May 17, 2009, please provide documentation or calculation for the TI-values recommended for the general purpose lane (TI =15.5).

3. Section 4. 2. 3, Rigid Pavements, Table 6 (Design Rigid pavement Sections), no aggregate subbase (AS) option is provided for design of general purpose lane placed in areas that require over-excavation to a depth of 4 feet below the finished grade.

Life Cycle Cost Analysis (LCCA)

We are in the process of reviewing LCCA for SR 57 NB widening project prepared by HDR. We submit our comments as soon as we complete our review and receive feedback from HQ.

For further assistance, please contact Mike Azmoudeh at (949) 756-4940.

Prepared by:

Mike Azmoudeh
Materials & Research Branch
Division of Project Delivery

Concurred by:

Behdad Baseghi, Ph.D, PE, GE, PMP
Chief, Materials & Research Branch
Division of Project Delivery
RCE # 47051

Cc: Frank Lin
Sidney Dadras
File

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SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED NOVEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of Preliminary Pavement Structural Section Report and Project Plans for SR 57 NB Widening, Anaheim, CA, dated October 12, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Plans	Mike Azmoudeh	Pavement structural sections on plan sheet X-1; structural section #1, change 05' of LCB to 0.5' of LCB. A separate structural section shall be provided on plan sheet X-I for areas (South of Ball Road) that require over excavation to a depth of 4 feet below the finished grade. Table 612.2 of HDM requires that the first two feet of the shoulder cross-section shall match the adjacent travel way (the same TI as the travel way) for shoulders wider than 5 ft. If the shoulder width is less than 5 ft, the cross section of the entire shoulder shall match the travel way. Please make sure that the above design requirement is incorporated into the design of pavement. Any variation from the above will require mandatory design exception.	We understand that HDR will revise the plans accordingly.
2	Draft Materials Report	Mike Azmoudeh	Section 4.2. 3, Recommended Minimum Pavement Sections, per our through review of the laboratory test results, we recommend changing the subgrade soil type from soil type I to type II soil with an R-value of less than 40 for the design of rigid jointed plain concrete pavement (JPCP). Apparently, the JPCP section shown on plan sheet X-1 assumes soil Type II. Section 4.2.1, Traffic Indices, as indicated in our comments dated May 17, 2009, please provide documentation or calculation for the TI-values recommended for the general purpose lane (TI =15.5). Section 4.2.3, Rigid Pavements, Table 6 (Design Rigid pavement Sections), no aggregate subbase (AS) option is provided for design of general purpose lane placed in	Subgrade soils south of Ball Road were considered as Type II soils. However, as discussed in our phone conversations, subgrade soils north of the Ball Road will be considered as Type I since the laboratory test results indicated that the subgrade soils meet the requirements of Class 3 aggregate subbase. We understand that HDR will provide the TI calculation. We will revise our report to incorporate this.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED NOVEMBER 16, 2009
BY CALTRANS DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1 MS #18

Review of Preliminary Pavement Structural Section Report and Project Plans for SR 57 NB Widening, Anaheim, CA, dated October 12, 2009.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			areas that require over-excavation to a depth of 4 feet below the finished grade.	
3	Life Cycle Cost Analysis (LCCA)	Mike Azmoudeh	We are in the process of reviewing LCCA for SR 57 NB widening project prepared by HDR. We submit our comments as soon as we complete our review and receive feedback from HQ.	N/A

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M e m o r a n d u m

To: Kamran Mahzar, Chief
Design Branch F

Date: March 16, 2010

File: 12-ORA-57
PM 12.2-15.2
EA-0F0401

From: **DEPARTMENT OF TRANSPORTATION**
District 12
Materials and Research Branch

Cat: 441.01

Subject: **Review of Materials Report and Project Plans For SR 57 NB Widening, City of Anaheim in Orange County, California**.

The District Materials & Research (M&R) Branch has reviewed your February 17, 2010 submittal of Materials Report and the project plans for the subject project.

As indicated in the PR, it is proposed to widen NB SR-57 in the city of Anaheim between 0.31 mile south of Katella Ave (PM 12.2) and 0.31 mile north of Lincoln Ave (PM 15.2). The purpose of the proposed project is to improve mobility, reduce congestion, improve mainline merge and diverge movement. Our comments:

Plans

1. Pavement structural sections on plan sheet X-1; structural section #1 and #5 shall be designed based on type II subgrade soil with no lateral support as follows:

   1.05' JPCP/0.35' LCB/0.7'AS (Class 2)

   Please refer to topic 623-4 of HDM, Standard Plans, May 2008 (P2 and P18) and Table 623.1 for determination of pavement with or without lateral support. Additionally, Materials Report prepared by Leighton Consulting does not provided adequate laboratory testing (PI) to support subgrade soil type I. R-value is not the only criteria for classifying subgrade soil. Most R-values provided by Leighton Consultants do not correlate with other soil parameters such as percent fines and expansion index. Therefore, the District Materials & Research (M&R) Branch recommends subgrade soil type II for design of JPCP for the entire widening of NB SR-57 (south and north of Ball Road).

2. A separate structural section shall be provided on plan sheet X-1 for areas (South of Ball Road) to clarify over excavation to a depth of 4 feet below the finished grade.

Materials Report

Per our review of the materials report prepared by Leighton Consulting, Inc., revised on February 15, 2010, we have presented our comments in the following:

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1. As indicated in our November 16, 2009 comments, Section 4.2. 3, Recommended Minimum Pavement Sections, per our through review of the laboratory test results, we recommend changing the subgrade soil type from soil type I to type II soil with an R-value of less than 40 for the design of rigid jointed plain concrete pavement (JPCP). Additional laboratory testing will be required to support type I subgrade soil. R-value is not the only criteria for classifying subgrade soil. Most R-values provided by Leighton Consultants do not correlated with other soil parameters such as percent fines and expansion index. Therefore, the District Materials & Research (M&R) Branch recommends subgrade soil type II for design of JPCP for the entire widening of NB SR-57 (south and north of Ball Road). Additional laboratory testing for PI and R-value will be required to better classify the subgrade soil.

2. Section 4. 2. 1 Traffic Indices, as indicated in our comments dated May 17, 2009, please provide documentation or calculation for the TI-values recommended for the general purpose lane (TI =15.5).

3. Section 4. 2. 3, Recommended Minimum Pavement Section, Notes under Tables 5a and 6a, please change the Note from "the upper 4 feet of subsurface soil below the finished grade for this segment should be overexcavated and replaced with imported material with R-value greater than 40 (e.g., Class 3 aggregate subbase)" to **Unsuitable material below the upper 4 feet of finished grade shall be overexcavated and replaced with imported material with R-value greater than 40 (Class 2 aggregate subbase**).

4. Section 4. 2. 3, Recommended Minimum Pavement Section, Tables 6a and 6b (Design of Rigid Pavement Sections), please change the structural section for without lateral support to:

1.05' JPCP/0.35' LCB/0.7'AS (Class 2)

For further assistance, please contact Mike Azmoudeh at (949) 756-4940.

Prepared by:

Mike Azmoudeh
Materials & Research Branch
Division of Project Delivery

Concurred by:

Behdad Baseghi, Ph.D, PE, GE, PMP
Chief, Materials & Research Branch
Division of Project Delivery
RCE # 47051

Cc: Frank Lin
Sidney Dadras
File

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SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MARCH 16, 2010
BY CALTRANS DISTRICT 12 MATERIALS AND RESEARCH BRANCH

Review of the Draft Material Report, SR 57 NB Widening, dated February 15, 2010.				
NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
1	Plans	Mike Azmoudeh	Pavement structural sections on plan sheet X-1; structural section #1 and #5 shall be designed based on type II subgrade soil with no lateral support as follows: **1.05' JPCP / 0.35' LCB / 0.7'AS (Class 2)** Please refer to topic 623-4 of HDM, Standard Plans, May 2008 (P2 and P18) and Table 623.1 for determination of pavement with or without lateral support. Additionally, Materials Report prepared by Leighton Consulting does not provided adequate laboratory testing (PI) to support subgrade soil type I. R-value is not the only criteria for classifying subgrade soil. Most R-values provided by Leighton Consultants do not correlate with other soil parameters such as percent fines and expansion index. Therefore, the District Materials & Research (M&R) Branch recommends subgrade soil type II for design of JPCP for the entire widening of NB SR-57 (south and north of Ball Road). A separate structural section shall be provided on plan sheet X-1 for areas (South of Ball Road) to clarify over excavation to a depth of 4 feet below the finished grade.	HDR will revise the plan accordingly. Leighton will revise the soil type as requested but Leighton does not agree that adequate laboratory testing has not been performed. For each R-value test north of Ball Road, percent fines and Sand Equivalent tests were performed. No PI and Expansion Index testing was conducted on these samples since it is not a standard practice to perform such tests on materials classified as sand. HDR will incorporate this.
2	Draft Materials Report	Mike Azmoudeh	As indicated in our November 16, 2009 comments, Section 4.2.3, Recommended Minimum Pavement Sections, per our thorough review of the laboratory test results, we recommend changing the subgrade soil type from soil type I to type II soil with an R-value of less than 40 for the design of rigid jointed plain concrete pavement (JPCP). Additional laboratory testing will be required to support type I subgrade soil. R-value is not the only criteria for classifying subgrade soil. Most R-values provided by	Leighton will revise the subgrade soil type to Type II. However, Leighton does not agree that adequate laboratory testing has not been performed. For each R-value test north of Ball Road, percent fines and Sand Equivalent tests were performed. No PI and Expansion Index testing was conducted on these samples since it is not a standard practice to perform such tests on materials classified as sand.

SR-57 NORTHBOUND WIDENING
RESPONSE TO REVIEW COMMENTS DATED MARCH 16, 2010
BY CALTRANS DISTRICT 12 MATERIALS AND RESEARCH BRANCH

Review of the Draft Material Report, SR 57 NB Widening, dated February 15, 2010.

NO.	REPORT SECTION	CALTRANS REVIEWER	COMMENTS	RESPONSE
			Leighton Consultants do not correlated with other soil parameters such as percent fines and expansion index. Therefore, the District Materials & Research (M&R) Branch recommends subgrade soil type II for design of JPCP for the entire widening of NB SR-57 (south and north of Ball Road). Additional laboratory testing for PI and R-value will be required to better classify the subgrade soil.	
			Section 4. 2. 1 Traffic Indices, as indicated in our comments dated May 17, 2009, please provide documentation or calculation for the TI-values recommended for the general purpose lane (TI =15.5).	Traffic Index calculation will be provided by HDR.
			Section 4. 2. 3, Recommended Minimum Pavement Section, Notes under Tables 5a and 6a, please change the Note from "the upper 4 feet of subsurface soil below the finished grade for this segment should be overexcavated and replaced with imported material with R-value greater than 40 (e.g., Class 3 aggregate subbase)" to **Unsuitable material below the upper 4 feet of finished grade shall be overexcavated and replaced with imported material with R-value greater than 40 (Class 2 aggregate subbase**).	Leighton will add the statement in Section 6.3 Remedial Grading where it belongs. Leighton will keep the existing statement under the tables for clarity.
			Section 4. 2. 3, Recommended Minimum Pavement Section, Tables 6a and 6b (Design of Rigid Pavement Sections), please change the structural section for without lateral support to: **1.05' JPCP / 0.35' LCB / 0.7'AS (Class 2)**	Leighton will revise the report to incorporate the indicated rigid pavement section. Please note that this pavement section has a reduced LCB thickness of 0.35 feet in lieu of the 0.5 feet recommended in HDM.

Procedure – Out of Service Pipe Removal

Preparation

1. Contractor shall obtain all required permits, i.e. city, railroad, One Call, etc.
2. Kinder Morgan Pipeline Maintenance Manager shall be contacted at least 30 days prior to the planned removal operation. Obtain Maintenance Manager recommendation on the need for vacuum trucks at the site.
3. If required, Contractor shall arrange for required vacuum trucks to be on site.
4. Contractor shall excavate the area that needs to be removed. Contractor shall provide any cribbing required to prevent sagging. Maximum unsupported span is 20-feet.
5. Contractor's Competent Person (provided by Contractor) shall verify that the excavation is safe to enter through the use of sloping and or shoring.

Tapping and Cutting

6. On the day of the planned removal, Kinder Morgan Maintenance personnel will contact the Pipeline Maintenance Manager for approval to cut the line.
7. Kinder Morgan Corrosion Dept. will be contacted to determine if cathodic wires are needed (not common).
8. With a vacuum truck standing by (if required) Kinder Morgan Maintenance personnel will tap the line through a 2" valve to use as a control point and to assure that there is no product remaining in line. If slurry or ash filler was placed in the pipe when it was taken out of service, verify through the tap that the filler material is solidified.
9. Once line is tapped and verified empty, fire watch is in place, and a gas detector has verified no concentration of explosive vapors, entry to the work place may be allowed.
10. Place drip pans under the ends that are to be cut to catch any residual product that may drip. To mitigate the potential for buildup of static electric charge, drip pans must be electrically bonded to the pipeline. Material collected in the drip pans can be vacuumed up after the pipe has been removed.
11. Assure the pipe is fully supported. Attach lifting equipment centered on the length to be removed.
12. Cold cut one end of the pipe at a time to prevent binding and jamming the cutter. After both ends have been cut completely all the way around the pipe, remove the cutters.

Segment Removal

13. To mitigate the risk of static electricity buildup, attach jumper cables across the cut to maintain electrical continuity as the pipe is removed.
14. Usually the sling will need to be rotated so that the pipe can be rolled out between the cut ends. The rotating of the sling may need to be repeated a few times depending upon how much tension there is in the segment being remove. All personnel shall stand in a safe location during this operation as the segment may shift unexpectedly.
15. Once the line is free and ready to be lifted out of the ditch, a tag line shall be attached to assist in controlling the segment. Tape both ends of the removed pipe segment closed with a Visqueen cover to prevent any fluid from escaping and touching the ground during handling of the segment.
16. The removed piece of pipe is the Contractor's responsibility and shall be disposed of properly.

Capping Open Pipeline Ends

17. If there is no fluid dripping from the remaining ends of the pipe, weld a piece of steel plate on the two ends according to the following steps.

18. With a gas detector, verify that the end to be welded is within the acceptable Kinder Morgan LEL range - Oxygen must be below 19.5% and vapor concentration must be below 10% of LEL.
19. Introduce dry ice to the open pipeline end and recheck until readings are within the acceptable range. If dry ice is used, weld a 1” coupling to the top of the plate (12:00 position) ahead of time to allow venting of CO2 during the welding process.
20. When gas detector readings are within the acceptable range, weld the plate on the open pipe end. No x-ray or dye penetrant testing is required. A minimum of two (2) welding passes is required.
21. The coupling can be plugged with a 1” plug after the welding has been completed.
22. Repeat steps 17 through 20 for the other end.

Completion

23. Apply proper coating to the plates and pipe ends to complete the work. Refer to L-O&M 203, Coating Pipelines, for guidance in selecting a coating
24. Kinder Morgan Maintenance personnel will take pictures and complete a Pipeline Inspection and Repair Report so that Kinder Morgan Record Drawings can be updated.

KINDER MORGAN
ENERGY PARTNERS, L.P.
SFPP, L.P.

SFPP, L.P.
Operating Partnership

March 25, 2011

Ms. Franci Coleman
State of California
Department of Transportation
District 12 Office of Right-of-Way
Suite 380
3337 Michelson Drive,
Irvine CA 92612-8894

Re: LS 125 & LS 121 OCTA SR-57 NB Widening Project

Dear Ms. Coleman:

This is in reply to your letter dated January 11, 2011, concerning the referenced project in the town of Anaheim in Orange County, California.

A review of the project plans indicates that the 16-inch LS 125 (16" Norwalk to Orange) and 10-inch LS 121 (10" Abandoned) refined petroleum product pipelines are located approximately as shown.

Further to your request, please consider the following information. The 16-inch pipeline, LS 125 was installed in 1985. I am attaching copy of Document #94-0619011 dated October 19, 1994, entitled Memorandum of Grant of Easement that establishes Kinder Morgan's prior easement with UPRR at this location. The 10-inch pipeline has been abandoned and ownership has reverted to the Union Pacific Railroad at locations where it is located within their right-of-way.

A review of the project plans furnished by the California Department of Transportation indicates that the 16-inch pipeline is located approximately as shown and can be protected in place. In the interest of public safety and for pipeline protection please note the following requirements:

1. Notify the KINDER MORGAN Right-of-Way Specialist, Mr. Al Giese, of our Carson Terminal (310) 930-3145 at least twenty (20) calendar days prior to commencement of work near the pipeline.

2. Expose the 16-inch pipeline by hand excavation at areas adjacent to pile locations to determine the exact pipeline location prior to any excavation utilizing power equipment. Excavation shall be defined by 49 CFR 195.442(a). Backfill around the pipeline must be sand (or rock free dirt) and must be hand-compacted.

3. Maintain a minimum 10 feet separation between the KINDER MORGAN 16-inch pipeline in areas where parallel facilities (sewer, storm drain, water, gas, electrical, etc.) are proposed.

1100 Town & Country Road Orange, California 92868 714/560-4400 714/560-4601 Fax

4. No heavy equipment may work over the pipeline without prior review and approval by a pipeline representative of the specific construction equipment to be utilized. Accordingly, OCTA's contractor should submit a list of all proposed equipment as soon as practical after contract award.

5. KINDER MORGAN will maintain a pipeline inspector on site during work near the pipeline. In this regard, a "Caltrans Pipeline Inspection Agreement" covering the cost of inspection will be forwarded for handling with the appropriate authority. Inspection cost can be estimated based on $650/day/person plus 19.4% for G&A overhead times the number of days that is estimated that work will be performed near the pipeline. Execution of the agreement and deposit in the amount of the estimated inspection cost must be received before any work can be progressed within the KINDER MORGAN easement.

I trust the foregoing is clear but please contact me at (714) 560-4822 with any questions regarding this matter.

Sincerely,

S. P. Davis
Sr. Project Manager

Enclosures

cc: Martin Vice w/o enclosures
Al Giese w/o enclosures

FOUNDATION REPORT FOR
PROPOSED PROTECTION WALL
FOR DOUGLASS OVERHEAD (BRIDGE NO. 55-0337),
NORTHBOUND STATE ROUTE 57,
ORANGE COUNTY, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 57
PROJECT POST MILES: 12.2/15.2, EA # 0F0401

Prepared For:

HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Project No. 602231-002

February 15, 2010
(Revised May 20, 2010)

February 15, 2010
(Revised May 20, 2010)

Project No. 602231-002

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Attention: Mr. Scott Bacsikin

Subject: Foundation Report for Proposed Protection Wall for Douglass Overhead (Bridge No. 55-0337), Northbound State Route 57, Orange County, California

In response to your request, Leighton Consulting, Inc. has performed a geotechnical exploration for the proposed protection wall for Douglass Overhead (Bridge No. 55-0337) at northbound State Route 57 (SR-57) in Orange County, California. The protection wall is part of the proposed widening of Douglass Overhead and northbound SR-57 from approximately 0.3 mile south of Katella Avenue to approximately 0.3 miles north of Lincoln Avenue. This project is sponsored by OCTA and Leighton Consulting has been retained as the geotechnical consultant by HDR Engineering, Inc. The purpose of our study was to evaluate the subsurface conditions at the project site and to provide geotechnical recommendations for design and construction of the foundation of the proposed protection wall.

Based on the available borings, the site is underlain by approximately 5 feet of man-made fill consisting mainly of light brown, poorly graded sand. The fill is further underlain by alluvium consisting predominantly of medium dense to dense, poorly graded sand with varying contents of silt to a depth of approximately 45 feet below Douglass Road grade. The soils below 40 feet to the maximum depth explored (81½ feet) generally consist of silty sand, sandy silt and silty clay. Groundwater was encountered during our field exploration at a depth of 40½ feet below the street level (elevation of 130.5 feet).

This report summarizes the results of our geotechnical exploration and presents geotechnical recommendations for design and construction of the proposed structure. The *Foundation Plan* of the proposed protection wall is included at the end of the text of the attached report. A draft version of this report was issued on February 15, 2010, for review by Caltrans. This report has been revised to incorporate review comments from Caltrans. Caltrans review comments and our response are included in Appendix C of this report.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/gv

Distribution: (6) Addressee

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1.0 INTRODUCTION

1.1 Project Overview

The California Department of Transportation (Caltrans), District 12, in cooperation with the Orange County Transportation Authority (OCTA), proposes to widen northbound State Route 57 (SR-57) between approximately 0.3 miles south of Katella Avenue (Post Mile 12.2) and approximately 0.3 miles north of Lincoln Avenue (Post Mile 15.2). This project segment of SR-57 is approximately 3 miles long, passing through the City of Anaheim in Orange County, California. The purpose of the proposed project is to improve both existing and future mobility, reduce congestion and improve mainline merge and diverge movements.

This segment of SR-57 is relatively flat with elevations ranging from 186 feet at Katella Avenue to 200 feet at Lincoln Avenue. Elevations used throughout this report are referenced to mean sea level (msl). The southern portion of this segment is higher than the surrounding areas while the northern portion is lower. SR-57 was constructed in 1974 and currently has four general purpose lanes and a high-occupancy vehicle (HOV) lane in each direction. Six grade separations exist within this segment; namely at Katella Avenue, Douglass Road, Ball Road, Wagner Avenue, South Street and Lincoln Avenue. The project consists of widening of approximately 3 miles of northbound SR-57 by approximately 35 feet to provide standard lane widths, an additional general purpose lane (fifth lane) and a standard 10-foot wide inside shoulder.

1.2 Project Description

As part of the northbound SR-57 widening project, the existing bridge at Douglass Road will be widened. An existing railroad track is located approximately 15 feet north of Bent 2 of the bridge. A protection wall is proposed between Bent 2 and the railroad track to protect the bent from potential impact due to derailed trains. The approximate location of the project site is shown in Figure 1, *Site Location Map*.

Based on the as-built plan (Caltrans, 1974), the existing Douglass Overhead (Bridge No. 55-0337) was constructed in 1974 and is supported on two abutments and one bent. The as-built elevations of the bridge range from 205.2 to 204.8 feet from south to north. Datum for all elevations referenced in this report is mean sea level (msl). The as-built plan was based on the old datum (NGVD29) and approximately 1.84 feet should be added to the as-built elevations to convert them to the current elevations (Datum

NAVD88). The elevation of Douglass Road is approximately 171 feet. The existing bridge, approximately 235 feet long and currently 158 feet wide, will be widened easterly by approximately 20 feet. The protection wall will be located along the north of Bent 2 and will be supported on a Cast-In-Drilled-Hole (CIDH) pile foundation system. The *Foundation Plan* of the proposed protection wall prepared by HDR is included at the end of the text of this report.

1.3 Purpose and Scope

The purpose of this report is to review existing geotechnical data and perform subsurface exploration, laboratory testing and geotechnical analysis to provide geotechnical design recommendations for the proposed project.

Our scope of work for this project included the following tasks:

- *Literature Review*: We reviewed various documents pertinent to the project site including the as-built Log of Test Borings (LOTBs) prepared by Caltrans for the existing Bridge No. 55-0337. The as-built LOTBs are presented in Sheet 4 of 4 of the attached LOTBs. A list of references used in preparation of this report is presented in Section 6.0.

- *Site Reconnaissance:* We performed a site reconnaissance to visually evaluate the accessibility of the site for drilling equipment and locate and mark the proposed boring locations.

- *Subsurface Exploration*: We performed a subsurface exploration that included drilling, logging and sampling of one 8-inch diameter hollow-stem auger boring to a depth of 81½ feet below existing grade of Douglass Road. We also advanced one Cone Penetration Test (CPT) to a depth of 80 feet below the existing grade of Douglass Road. Logs of the boring and CPT are included in Sheet 1 of 4 of the attached LOTBs.

- *Laboratory Testing*: Laboratory testing was performed on selected soil samples collected from our field exploration to evaluate the engineering properties of the soils. The laboratory test results are included in Appendix A.

- *Seismic Analysis*: Based upon the encountered subsurface conditions and regional seismicity of the area, we performed ground motion analysis for the project site for use in structural analysis and design.

- *Geotechnical Design and Analysis*: Geotechnical analysis was performed on the collected data to develop recommendations for design and construction. Results of the analysis are included in Appendix B.

- *Report Preparation*: Relevant geotechnical data were compiled in this report along with our findings and recommendations for the proposed project.

2.0 GEOTECHNICAL FIELD AND LABORATORY INVESTIGATIONS

2.1 Subsurface Exploration

Our field exploration consisted of advancing a 8-inch diameter hollow-stem boring and a CPT to a maximum depth of 81½ feet below the existing grade of Douglass Road. The boring and CPT were located near the proposed bent location and the approximate locations are shown in the LOTBs.

Standard Penetration Test (SPT) was performed within the hollow-stem borings using a 140-pound automatic hammer falling freely for 30 inches. The samplers were driven for a total penetration of 18 inches and the blow counts were recorded for the last 12 inches of penetration. Relatively undisturbed samples were collected from the boring using the Modified California Ring sampler. The field sampling procedures were conducted in accordance with ASTM Standard Specifications D 1586 and D 3550 for SPT and split-barrel sampling of soil. In addition to driven samples, representative bulk soil samples were also collected from the boring.

The test boring was logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. All samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the boring was backfilled with soil cutting mixed with cement, tamped and capped with cold mix asphalt. The CPT was performed in accordance with ASTM D 5778. Geotechnical logs of the boring and CPT are included in the LOTBs.

2.2 Geotechnical Laboratory Testing

Laboratory tests were performed on representative soil samples to determine the geotechnical engineering properties of subsurface materials. The following laboratory tests were performed:

- In-situ moisture content and density;
- Atterberg Limits;
- Grain-size distribution;
- Percent passing No. 200 sieve;

- Direct shear; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests, except corrosivity tests, were performed in general accordance with ASTM procedures. The corrosivity tests were performed in accordance with Caltrans procedures. Results of the laboratory tests are presented in Appendix A.

3.0 GEOTECHNICAL FINDINGS

3.1 Geologic Setting

The subject site is located in the Tustin Plain within the southeastern margin of the Los Angeles Basin, a large structural depression within the Peninsular Ranges geomorphic province of California. In general, the Tustin Plain consists of approximately 1,400 feet of unconsolidated to semi-consolidated Quaternary-age alluvial sediments. Underlying the Quaternary alluvial deposits are Tertiary-age bedrock units consisting of sandstone, siltstone, shale and conglomerate on the order of 31,000 feet in thickness.

The site lies near the lower reaches of the Santa Ana River. The surface distribution of Holocene sediments, as recorded in early editions of regional soil survey maps (Eckmann et al., 1916), suggests that the Santa Ana River has recently wandered back and forth across the Orange County coastal plain from Alamitos Bay to Newport Bay. Historical accounts and documents further support the process of widespread sheet flooding being the dominant depositional process associated with the Santa Ana River prior to the construction of Prado Dam in 1941 (California Department of Water Resources, 1957). Currently, the Santa Ana River is located approximately 1,000 feet from the Douglass Overhead. Geology map of the area is presented in Figure 2.

3.2 Subsurface Earth Materials

The subsurface soils encountered in our boring and CPT consist of approximately 5 feet of man-made fill underlain by alluvial deposits. The fill is likely associated with the construction of Douglass Road and consists of light brown, poorly graded sand. The alluvium consists mainly of medium dense to dense, poorly graded sand with varying contents of silt to a depth of 40 feet. The soils below 40 feet to 60 feet generally consist of stiff sandy silt and medium dense silty sand. The soils below 60 feet to the maximum depth explored (81½ feet) consist of medium stiff to stiff silty clay and sandy silt and very dense silty sand.

We have performed direct shear tests on representative samples collected from our borings. The cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils were found to range from 35 to 60 psf and 28 to 33 degrees, respectively. The test results are presented in Appendix A. Based on these test results, SPT blowcounts, and soil types, the shear strength parameters and unit weights selected for design are presented in Table 1.

Table 1 – Generalized Soil Profile and Design Parameters

Depth below Existing Grade (feet)	Elevation (feet)	Generalized Soil Type	Total Unit Weight (pcf)	Friction Angle[(1)] (degrees)	Undrained Cohesion, Cu[(1)] (psf)
0 to 5	171 to 168	**Fill**: Sand	110	33	
5 to 40	168 to 131	**Alluvium**: Sand	110	33	-
40 to 50	131 to 121	Sandy Silt	110	-	1,500
50 to 60	121 to 111	Silty Sand	110	32	
60 to 82	111 to 89	Silty Clay/ Sandy Silt	110	-	1,500

[(1)]Ultimate shear strength parameters based on SPT blow counts (NAFVAC, 1986) and laboratory test results.

3.3 Groundwater

Groundwater was encountered during our field exploration at depths 40½ feet below the existing grade (elevation of 130.5 feet) in our Boring A-09-005. Groundwater was also encountered in Borings B-1 and B-3 by Caltrans in 1962 at depths ranging from 33 to 34.5 feet below the existing grade (elevation of 134.2 to 135.7 feet). The historically high groundwater table is on the order of 30 feet below grade (CDMG, 1997), corresponding to elevation of 141 feet. The groundwater data from the borings are summarized in Table 2. Fluctuations of the groundwater level, localized zones of perched water, and an increase in soil moisture should be anticipated during and following the rainy seasons or periods of locally intense rainfall or storm water runoff.

Table 2 – Groundwater Tables

Boring No.	SR-57 Station-ing	Offset	Time of Drilling	Total Depth (feet)	Bottom Elevation of Boring[1] (feet)	Groundwater Table	
						Depth below Existing Grade (feet)	Elevations[1] (feet)
A-09-005 [2]	291+60	100' RT	2009	81.5	89.5	40.5	130.5
B-1 [3]	291+70	25' LT	1962	82.0	86.7	34.5	134.2
B-3 [3]	291+97	26' RT	1962	75.0	93.7	33.0	135.7

[1]Elevations used by Caltrans were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).
[2]Borings by Leighton Consulting
[3]Borings by Caltrans

3.4 Engineering Properties of Subsurface Materials

Engineering properties of the subsurface materials were modeled based on results of geotechnical field and laboratory tests performed during our exploration. Results of these laboratory tests that are applicable to the proposed project are presented in Appendix A. These test results are briefly discussed below:

3.4.1 Shear Strength

Based on direct shear test results, the cohesion intercept (c) and friction angle (ϕ) representing the effective ultimate shear strength of the onsite soils ranges from 35 to 60 psf and 28 to 33 degrees, respectively. The shear strength parameters used for design are presented in Table 1.

3.4.2 Corrosion Potential

Representative samples of the subsurface soils were subjected to analytical testing to evaluate the potential for corrosion to concrete and ferrous metals. The test results are included in Appendix A and indicate the tested soils exhibited chloride concentration of 40 parts per million (ppm), sulfate concentration of 33 to 67 ppm, minimum resistivity of 13,500 ohm-cm, and pH level of 7.4 to 7.7. Caltrans specifications define a corrosive soil as a material in which any of the conditions exist: a chloride content greater than 500 ppm; soluble sulfate content greater than 2,000 ppm; or a pH of 5.5 or less. Based on the guidelines established by Caltrans, the subsurface soils at the site are not considered corrosive.

3.4.3 Expansion Potential

Based on our boring, the near-surface soils consist of poorly graded sand and, by nature of sandy soils, the near-surface soils are considered to possess low expansion potential.

3.5 Faulting and Seismicity

Our review of available in-house literature indicates that there are no known active or potentially active faults that have been mapped at the site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in southern California. According to the California Geological Survey fault database, the closest active faults that could affect the site are the San Joaquin Hills Blind Thrust, Puente Hills Blind Thrust, and Whittier faults located approximately 12.3 kilometers (km), 13.8 km and 13.9 km, respectively, from the site. Other known regional active faults that could affect the site include the Newport-Inglewood (L.A. Basin), Elsinore (Glen Ivy), and Newport-Inglewood (Offshore) faults. The locations of these faults with respect to the site are shown in Figure 3.

We have performed seismic analysis for the site following Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). Distance of faults to the site was estimated using Caltrans ARS online program and peak ground acceleration for each fault was estimated using Caltrans excel worksheet. The estimated peak ground accelerations caused by various faults near the site are summarized in the following table.

Table 3 – Peak Bedrock Accelerations

Fault	Maximum Magnitude	Distance (km)	Peak Bedrock Acceleration
Peralta Hills	6.2	3.7	0.39g
Compton-Los Alamitos Blind Thrust	6.8	11.8	0.38g
Puente Hills Blind Thrust	7.3	12.3	0.34g
Elsinore fault zone (Whittier Section)	7.6	13.1	0.29g
Elsinore fault zone (Chino Section)	7.6	17.8	0.33g

As shown in the table above, the Peralta Hills fault is the nearest fault to the site at a distance of approximately 3.7 km. A maximum earthquake magnitude of 6.2 has been estimated for this fault, resulting in a peak horizontal ground acceleration of 0.39g at the site. This fault, however, is not included in the latest California Geological Survey fault database.

We have also performed probabilistic seismic analysis using Caltrans ARS online program and USGS deaggregation hazard online program. The peak ground acceleration was calculated to be 0.48g with a deaggregated moment magnitude (Mw) of 6.6. We have used this ground acceleration and earthquake magnitude in our liquefaction analysis.

3.6 Seismic Hazards

3.6.1 Fault Rupture

Based on available literature and reports, no known active faults are known to traverse the project site, and the site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. As such, the principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along one of several major active or potentially active faults in the region as discussed in Section 3.5.

3.6.2 Liquefaction

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils. Effects of liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading.

The site is located within an area designated as potentially liquefiable on the *California Seismic Hazard Zone Map* (CDMG, 1998). We have performed liquefaction analysis of the soil profiles encountered at Boring A-09-005 and the profile obtained from the interpretation of the field data collected from CPT-09-006. Based on our boring and CPT, the subsurface soils below the historically high groundwater table of 30 feet below the existing grade consist predominantly of loose to dense sand and silt and medium stiff to stiff clay to the maximum depth explored.

The liquefaction analysis was performed using procedures outlined by Youd et al. (2001) and in accordance with the guidelines in the *Special Publication 117*. The historically high groundwater level of 30 feet below the existing grade of Douglass Road and a peak ground acceleration of 0.48g with a moment magnitude (Mw) of 6.6 were used in the analysis.

The effect of liquefaction is expected to be settlement due to the post-liquefaction consolidation of the soils that experience liquefaction in response to the seismic event. We have used the procedure described by Tokimatsu and Seed (1987) to calculate the liquefaction-induced settlement. The results of our analysis, summarized in Table 4, indicate the presence of sandy soil layers between 30 and 48 feet below the existing grade (elevations 123 and 141 feet) and 50 and 55 feet (elevations of 116 and 121 feet) that are potentially susceptible to liquefaction.

With historically high groundwater, the settlement of these strata was estimated to be less than ¾ inch. Due to the relatively thin layers, liquefaction is not expected to have an adverse impact on the proposed structure.

Table 4 – Results of Liquefaction Analysis

Boring/ CPT No.	Depth of Liquefiable Layer (feet)	Elevation of Liquefiable Layer (feet)	Liquefaction-Induced Settlement (inches)
A-09-005	50 to 55	116 to 121	0.7
CPT-09-006	30 to 48	123 to 137	0.2
	51 to 54	117 to 120	0.0

3.6.3 Seismically Induced Settlement

Seismically induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). This settlement occurs primarily within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event. The seismically induced settlement was estimated to be on the order of ½ to 1 inch. The magnitude of the estimated settlement is considered relatively minor, especially considering that the potentially liquefiable layers are relatively deep and thin.

3.6.4 Seisches and Tsunami

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are waves generated in large bodies of water by fault displacement or major ground movement. Based on the absence of enclosed bodies of water near the site and the inland location of the site, seiches and tsunami risks at the site are considered negligible.

4.0 GEOTECHNICAL AND FOUNDATION DESIGN RECOMMENDATIONS

Based upon our evaluation of the soils and geologic information, we conclude that the proposed project is feasible from a geotechnical standpoint, provided that the recommendations presented in this report are properly incorporated in the design and construction of the project. The recommendations in this report are considered minimum and may be superseded by more stringent requirements of the structural engineer and/or the governing agencies. Leighton should be notified, in a timely manner, of changes in the project plans that might impact recommendations in this report.

4.1 Response Spectra

Caltrans design ARS curve was developed following Caltrans *Seismic Design Criteria* (2006b with updated Appendix B) and *Geotechnical Services Design Manual* (Caltrans, 2009). The ARS curve was first generated using Caltrans ARS online program and then checked against Caltrans deterministic and probabilistic excel worksheets. For the probabilistic approach, the difference between the ARS curve by the online program and the excel worksheet was found to be less than 10 percent. The next step was to input the spectral accelerations from USGS deaggregation hazard online program into the probabilistic excel worksheet to account for basin effects and near-source factors. The difference between the probabilistic ARS curve by Caltrans online program and the one by USGS online program adjusted for basin effects and near-source factors was greater than 10 percent. Therefore, per Caltrans guidelines, the latter ARS curve is recommended as the design curve. The ARS curves and the digitized values for the site are provided in Figure 4.

4.2 As-Built Foundation Data

Based on the as-built plan for Douglass Overhead (Caltrans, 1974), we have summarized the as-built foundation type and characteristics of Bent 2 in Table 5. The nominal resistance shown in the table was calculated using the computer program *APILE* (Reese et al., 2004) considering the skin friction only. The computer printouts are included in Appendix B. Elevations in Table 5 were based on the old datum (NGVD29) that was approximately 1.84 feet lower than the current datum (NAVD88).

Table 5 – As-Built Foundation Data of Bent 2 (Caltrans, 1974)

Structure[1]	Pile Size and Type	Pile Cutoff Elevation (feet)	Pile Tip Elevation (feet)	Nominal Resistance[2] (kips)	Allowable Capacity[3] (kips)
Bent 2[4]	10-inch Square Precast Concrete Pile	162.0	140.2	180	90

[1]Elevations of Douglass Road grade are approximately 171 feet.
[2]A minimum factor of safety of 2.0 should be applied to calculate the allowable capacity.
[3]Design load of 45 tons (90 kips) per the as-built plan (Class 45 precast concrete pile).
[4]Bent 2 is supported on two rows of 104 piles total with minimum pile spacing of 3.6 times the pile width.

4.3 Foundation Type

The subsurface conditions in conjunction with the magnitude of structural load indicate a shallow foundation system is not feasible. Consequently, the proposed structure will require a deep foundation system. In consideration of the magnitude of structural load and overhead clearance, we understand that CIDH pile foundation is the preferred foundation system for the proposed protection wall. As a result, the recommendations presented in this report are based upon the selected pile type and recommendations for other alternates can be provided upon request.

4.4 Axial Pile Capacities

Soil strength data collected from the exploratory soil boring performed as part of this geotechnical exploration were used to estimate pile design tip elevations for the axial load demands provided by the structural engineer. Design of the CIDH piles has been performed on the basis of shaft friction using the procedures outlined by O'Neill and Reese (1999) using the software package *SHAFT*. The results of the analysis are included in Appendix B. Based on the provided information, we understand that the minimum center-to-center spacing of the piles will be 3 times the pile diameter.

Table 6 summarizes the structural loads provided by the structural engineer and the corresponding recommended pile tip elevations based upon our evaluation of pile

capacity. It should be noted that the CIDH pile capacities shown are based on soil strengths alone. The actual structural capacities may be limited to lesser values by the strength of pile materials and connections. The piles and related connections should be evaluated for structural capacity as part of the structural design.

Table 6 – Pile Data Table

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevation (feet)	Specified Tip Elevation (feet)
		Compression	Tension		
Protection Wall	24-inch diameter CIDH Pile	35	-	159 (a) 159 (c) 139 (d)	139.0
Design tip elevations are controlled by: (a) Compression, (c) Settlement, and (d) Lateral Load The specified tip elevation shall not be raised above the design tip elevations for compression, lateral and tolerable settlement.					

Settlements of piles generally result from settlement of the supporting soils and elastic compression of piles. The settlement due to the axial load is expected to be less than ½ inch.

4.5 Lateral Pile Capacities

The lateral capacities of a 24-inch diameter CIDH pile were calculated using the computer program *LPILE* (Reese and Wang, 2000). A shear force of 80 kips and moment of 640 kips-feet, as provided by the structural engineer, were applied at the top of the CIDH pile. The analyses were based upon the pile length indicated in Table 6 and a reduced or effective Moment of Inertia ($I_{effective}$) per the structural engineer.

The results of the analysis are summarized in Table 7 and the computer printouts of the analysis are included in Appendix B. Following the guidelines in Section 10 of *California Amendments to AASHTO LRFD Bridge Design Specifications* (Caltrans, 2008b), the lateral pile capacities shown in Table 8 were calculated considering p-multiplier of 0.9 (perpendicular loading case with the pile spacing of 3 times of pile diameter).

Table 7 – Lateral Capacities of 24-inch Diameter CIDH Pile

Pile Head Deflection (inches)	Shear Force at Pile Top (kips)	Maximum Bending Moment (kips-ft)	Depth to Maximum Moment (feet)
2	80	840	4.1

4.6 Lateral Resistance of Pile Cap

Passive earth pressure developed against the pile caps can be used to resist a portion of the lateral loads transferred from the substructure to the soil during a seismic or short-term event. The earth pressure resisting the pile cap can be assumed to have a trapezoidal distribution that increases linearly from the top of the pile cap to the bottom of the pile cap. An equivalent passive fluid pressure of 400 pound per square foot (psf) per foot may be used to calculate the passive pressure for level in front of the pile cap.

Development of full passive earth pressure in sandy soil requires a lateral pile cap displacement equal to 0.2 percent of the pile cap thickness (NAVFAC, 1986). Soil surrounding and above pile caps should be placed and compacted in accordance with Section 19-3 of the Caltrans *Standard Specifications* (Caltrans, 2006a) and in accordance with Section 5.4 of this report. Pile caps should be backfilled with the low expansion material (Expansion Index (EI) < 50 and Sand Equivalent (SE) > 20).

5.0 CONSTRUCTION CONSIDERATIONS

5.1 CIDH Pile Construction

CIDH piles will be constructed using the conventional soil augering equipment and technique to advance the drilled hole and remove soil cuttings. The drilling operations are recommended to be observed and evaluated by a representative of the geotechnical engineer to allow further evaluation of the actual subsurface conditions. Based on the available borings, caving may occur during drilling due to the granular nature of the soil. Since the existing Bent 2 piles are in close proximity of the proposed CIDH piles, temporary casing or drilling slurry should be employed to facilitate construction of the CIDH piles. The installation/removal of temporary casing or the use of slurry for borehole stability should be in accordance with the Caltrans *Standard Specifications* to reduce the potential for adversely affecting the frictional resistance of the soils and, thereby, reducing the load capacity of the piles. If wet method is used for the CIDH pile installation, Gamma-Gamma tests should be performed to verify the integrity of the piles and the tests should be performed in accordance with Caltrans specifications.

The construction of the piles should also include considerations with regard to temporary stability of the boreholes and sequence of construction. To maintain a relatively clean hole and to achieve high quality CIDH pile construction, it is recommended that the entire construction operation including drilling of the CIDH pile, lowering of the reinforcing cage, and the concrete placement, be carried out consecutively in the same day. Boreholes that are successfully advanced by the dry method are recommended to be left open in an unsupported condition for the minimum length of time as permitted by construction, but not longer than one day. Consequently, the reinforcing steel is recommended to be set and the concrete placed within one day of drilling to reduce the potential for caving. We further recommend that the use of a drop chute or a tremie pipe with pump concrete be considered to avoid concrete segregation during CIDH pile construction.

The sequence of pile construction is of importance with respect to the spacing of the pile groups. The drilling sequence should be such that for every pile drilled, at least one pile is skipped. The piles adjacent to the freshly poured pile may only be drilled a minimum 24 hours after placement of concrete or as directed by the structural engineer considering concrete curing and concrete strength.

5.2 Temporary Excavations

Excavations for the pile caps that are 5 feet or deeper should be laid back or shored in accordance with OSHA requirements before personnel are allowed to enter. For temporary excavations greater than 5 feet in depth that cannot be adequately sloped for stability, some form of temporary external support will be required. In consideration of the type of construction, the most practical method is expected to be excavation bracing. The lateral earth pressure for this type of shoring is estimated as 25H psf where H is the depth of excavation and the resulting lateral pressure distribution is rectangular pressure. This above lateral pressure is only appropriate for level backfill and a drained condition behind the shoring. Shoring should also be designed to resist lateral surcharge from adjacent vehicular traffic, construction equipment, and existing structures.

5.3 Earthwork

Onsite soils to be used as compacted structural fill should be free of organic material and/or construction debris. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches for structural fill placement, moisture-conditioned as necessary to within three percent above optimum, and compacted to a minimum of 90 percent of the maximum density as determined by Caltrans Test Method 216. Subgrade within a depth of 30 inches below the finished grade should also be compacted to at least 95 percent relative compaction. Earthwork should be in accordance with Section 19 of Caltrans *Standard Specifications.*

5.4 Additional Geotechnical Services

The proposed construction involves various activities that would require geotechnical observation and testing. These include:

- Pile cap excavation;
- CIDH pile installation; and
- Placement of compacted fill.

These and other soils related activities should be observed and tested by a qualified representative of the geotechnical engineer.

Geotechnical recommendations presented in this report are based on the conditions encountered at the test boring locations and information gained from review of as-built plans as well as our understanding of the current project plan. Our recommendations should be revised, as necessary, based on the actual soil condition and any modification of the current plans, and incorporated into the final design plans and specifications. Conclusions and recommendations presented in this report should be reviewed and verified by the geotechnical engineer during site construction and revised accordingly, if exposed geotechnical conditions vary from our current understanding and interpretations.

6.0 REFERENCES

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T R A N S M I T T A L

To: HDR Engineering, Inc.
3230 El Camino Real, Suite 200
Irvine, California 92602

Date: April 19, 2010

Project No. 602231-002

Attention: Mr. Scott Bacsikin

Transmitted:		The Following:		For:	
	Mail		Draft Report	X	Your Use
X	Courier/Overnight	X	Final Report		As Requested
	Pick Up		Extra Report		
			Proposal		
			Other		

Subject: Foundation Report for Proposed Protection Wall for Douglass Overhead (Bridge No. 55-0337), Northbound State Route 57, Orange County, California

LEIGHTON CONSULTING, INC.

By: Djan Chandra

Distribution (6) Addressee