FOR CONTRACT NO.: 12-0F0324

INFORMATION HANDOUT

MATERIALS INFORMATION

FINAL FOUNDATION REPORT

ROUTE: 12-Ora-57-18.4/20.9

Final Foundation Report

SR-57 Northbound Widening (Northern Segment) Retaining Walls and Sound Walls Orange County, California

Prepared for

Orange County Transportation Authority

550 South Main Street
P.O. Box 14184
Orange, CA 92863-1584

12-ORA-57
EA-0F0321
PM 18.4 - 20.9

May 18, 2010

Prepared by

CH2MHILL

6 Hutton Centre Drive, Suite 700
Santa Ana, CA 92707

Final Foundation Report

SR-57 Northbound Widening (Northern Segment) Retaining Walls and Sound Walls Orange County, California

Prepared for

Orange County Transportation Authority

550 South Main Street
P.O. Box 14184
Orange, CA 92863-1584

12-ORA-57
EA-0F0321
PM 18.4 - 20.9

May 18, 2010

Copyright ©2010 by CH2M HILL, Inc.

Reproduction and distribution in whole or in part beyond the intended scope of the contract without the written consent of CH2M HILL, Inc. is prohibited.

CH2MHILL

Acknowledgements

The following individuals have participated in the preparation of this document or have completed quality review or both.

for Hisham Nofal

Raghudeep Bethapudi, E.I.T. 94042

Hisham Nofal

Hisham Nofal, Ph.D., G.E.
Geotechnical Task Manager – Geotechnical, G.E. 2765

Yoga Chandran, Ph.D., G.E.
Senior Reviewer – Geotechnical, G.E. 2405

Contents

Section Page

Acknowledgements ..... **iii**

Acronyms and Abbreviations ..... **vii**

1. Introduction **1-1**
- 1.1 General 1-1
- 1.2 Project Location and Description 1-1
- 1.3 Purpose and Scope 1-3
- 1.4 Site Description and Existing Structures 1-3
- 1.5 Pertinent Reports and Investigations 1-4
- 1.6 Limitations 1-5

2. Geotechnical Investigation **2-1**
- 2.1 General 2-1
- 2.2 Field Exploration 2-1
  - 2.2.1 Review of Existing Information 2-1
  - 2.2.2 Current Investigation 2-3
- 2.3 Laboratory Tests 2-5

3. Geologic Hazard and Site Characterization **3-1**
- 3.1 Regional Geology 3-1
- 3.2 Site Geology 3-1
  - 3.2.1 Very Old Alluvial Fan Deposits 3-1
  - 3.2.2 La Habra Formation 3-1
- 3.3 Geologic Hazards 3-2
  - 3.3.1 Ground Rupture 3-2
  - 3.3.2 Liquefaction 3-2
  - 3.3.3 Seismically Induced Settlement 3-2
  - 3.3.4 Lateral Spreading 3-2
  - 3.3.5 Landslide and Slope Instability 3-3
  - 3.3.6 Expansive and Compressible Soil 3-3
- 3.4 Subsurface Soil Conditions 3-3
  - 3.4.1 Artificial Fill 3-3
  - 3.4.2 Young Alluvial Fan Deposits 3-3
- 3.5 Foundation Material 3-4
- 3.6 Water 3-6
  - 3.6.1 Surface Water 3-6
  - 3.6.2 Groundwater 3-6
- 3.7 Engineering Parameters 3-7
  - 3.7.1 Shear Strength 3-7
  - 3.7.2 Compressibility 3-7
  - 3.7.3 Design Parameters 3-7

4. Discussion and Recommendations 4-1
4.1 Peak Bedrock Acceleration 4-1
4.2 Scour Evaluation 4-2
4.3 Corrosivity Evaluation 4-2
4.4 Liquefaction 4-3
4.5 Global Stability Analyses 4-3
4.6 Wall Type Selection 4-4
4.7 Cantilever Retaining Walls 4-4
4.7.1 Wall Types 4-4
4.7.2 Minimum Embedment and Berm Width 4-5
4.7.3 Loading Case 4-5
4.7.4 Bearing Capacity and Foundation Type 4-6
4.7.5 Retaining Wall Backdrain 4-6
4.8 Nonstandard Retaining Walls 4-6
4.8.1 Wall Type 4-6
4.8.2 Structure Dimensions 4-6
4.8.3 Loading Case 4-9
4.8.4 Barrier Slab 4-9
4.8.5 External Stability 4-9
4.8.6 Internal Stability 4-10
4.8.7 Settlement 4-10
4.8.8 Reinforced Zone Gradation Requirement 4-10
4.8.9 MSE Wall Backdrain 4-10
4.9 Overhead Sign Structures and Sound Walls 4-10
4.9.1 Axial Capacity 4-11
4.9.2 Lateral Capacity 4-12

5. Construction Consideration 5-1
5.1 Site Preparation 5-1
5.2 Rippability 5-1
5.3 Temporary Cuts 5-1
5.4 Remedial Grading 5-1
5.5 Structural Backfill 5-2
5.6 Compaction 5-2
5.7 Geotechnical Observation 5-2
5.8 Review of Construction Plans and Specifications 5-2

6. References 6-1

Attachments

Appendixes

A Wall Layout and Boring Location Map

B Logs of Test Boring Sheets
C Geotechnical Boring Logs
C.1 Boring Logs
C.2 Cone Penetration Test Soundings

D Laboratory Test Results

E Engineering Calculations
E.1 Shear Strength Plots
E.2 Stability Analyses
E.3 Pile Foundation

Tables

1-1 Summary of Retaining and Sound Walls Information....1-2

2-1 Summary of As-Built LOTBs....2-2
2-2 Summary of Hollow Stem Auger Borings....2-4
2-3 Summary of Cone Penetration Tests....2-5
2-4 Summary of Laboratory Tests Performed....2-6

3-1 Summary of the Walls Foundation Material....3-4
3-2 Summary of Geotechnical Design Parameters....3-8

4-1 Summary of Nearby Faults....4-1
4-2 Summary of Corrosion Laboratory Test Results....4-2
4-3 Summary of Retaining Walls Foundation Recommendations....4-7
4-4 Summary of External Stability Requirement....4-10
4-5 Driven Pile Foundations Design Recommendations....4-11
4-6 CIDH Pile Foundations Design Recommendations....4-11
4-7 Summary of Lateral Pile Capacities....4-13

Figures

1-1 Site Location Map....1-6

3-1 Regional Geology Map....3-9
3-2 Seismic Hazard Zones Map....3-10

4-1 California Seismic Hazard Map....4-14

Acronyms and Abbreviations

AASHTO	American Association for State Highway and Transportation Officials
Af	artificial fill
ASTM	American Society for Testing and Materials
AT&T	American Telephone and Telegraph
bgs	below ground surface
Caltrans	California Department of Transportation
CDMG	California Division of Mines and Geology
CGS	California Geologic Survey
CIDH	cast-in-drilled-hole
cm^2	square centimeter(s)
CNO	Chino (fault)
CPT	cone penetration test
CSHM	California Seismic Hazard Map
CTM	California Test Method
DS	direct shear
EMP	El Modeno-Peralta Hills (fault)
g	acceleration due to gravity
GP	General Plan
HOV	high-occupancy vehicle
HSA	hollow-stem auger
Kip	kilo pound
lb/ft	pounds per foot
LOTB	log of test borings
MCE	maximum credible earthquake
MSE	mechanically stabilized earth
M_w	moment magnitude
NAVD	North American Vertical Datum

NGVD	1929 National Geodetic Vertical Datum
OCSD	Orange County Sanitation District
OCTA	Orange County Transportation Authority
OH	overhead
ohm-cm	ohm-centimeter
PBA	peak bedrock acceleration
pcf	pounds per cubic foot
PGA	peak ground acceleration
PM	post mile
ppm	parts per million
PS&E	Plans, Specifications, and Estimate
psf	pounds per square foot
PTH	Puente Hills blind-thrust (fault)
Qlh	La Habra Formation
Qvof	very old alluvium fan deposit
Qyf	young alluvium deposit
SCG	Southern California Gas Company
SJE	San Jose (fault)
SPT	standard penetration test
SR	State Route
RCP	reinforced concrete pipe
UC	undercrossing
Unocal	Union Oil Company of California
USACE	Unite State Army Corps of Engineers
USCS	Unified Soil Classification System
UU	unconsolidated undrained
VCP	vitrified clay pipe
WEE	Whittier-Elsinore (fault)

SECTION 1

Introduction

1.1 General

The Orange County Transportation Authority (OCTA) has retained CH2M HILL to provide the final design for the widening of the traveled way on the northbound State Route (SR) 57 in Orange County, California. The widening of the northbound lanes is proposed to address the congestion and improve the traffic capacity for a total of 4.7 miles along SR-57 between south of Orangethorpe Avenue at post mile (PM) 16.2 and south of Lambert Road at PM 20.9. Within the project limits, the alignment is divided into the northern segment (EA 12-0F0321) and the southern segment (EA-0F0311). This foundation report is prepared as part of the Plans, Specifications, and Estimate (PS&E) Phase of the project. It includes the geotechnical recommendations to aid in the foundation design of the walls proposed within the northern segment. The report also addresses the California Department of Transportation (Caltrans) review comments dated May 3, 2010, for the walls final foundation report prepared by CH2M HILL. A copy of the review comments and the responses to the comments is provided in the Attachment.

The walls referred to in this report include earth retaining walls and sound walls. A separate foundation report has been prepared by others to address the geotechnical recommendations of the walls within the southern segment of the project alignment.

1.2 Project Location and Description

The project alignment lies within the north western part of the Santa Ana Mountains in the Peninsular Ranges geomorphic province of Southern California. The northern segment of the alignment traverses the cities of Fullerton and Brea in Orange County, California. The location of the northern segment along SR-57 is shown in the Site Location Map in Figure 1-1.

The existing alignment of SR-57 was initially constructed as an eight-lane freeway and was later improved to include one high-occupancy vehicle (HOV) lane in each direction. To increase the mobility and upgrade the level of service along the northbound SR-57 main line, widening of the existing alignment is proposed. At this time, the proposed widening at the northern segment will add one mixed-flow lane from Yorba Linda Boulevard northbound on-ramp to Lambert Road northbound off-ramp, and one auxiliary lane between interchanges. As a result, the improvements will involve widening of the existing bridge structures, realignment of shoulders and ramps, the addition of several types of earth retaining walls and sound walls, and the pavement of the new lanes. The bridge structures include Bastanchury Road Undercrossing (UC), Rolling Hills Drive UC, Associated Road UC, Loftus Channel, Birch Street UC, and Brea Overhead (OH). Most of the improvements are proposed for the northbound travel way from 0.2 miles north of Yorba Linda Boulevard to Lambert Road and include widening the five bridges and constructing 15 retaining walls and 1 sound wall. In addition, the realignment of the northbound off-ramp at Imperial

Highway (SR-90/57 separation) will require the modification of the existing culvert structure where the ramp crosses Loftus Diversion Channel. The improvements proposed for the southbound travel way include only the construction of five sound walls and the widening of two bridges between 0.1 mile north of Yorba Linda Boulevard and 0.1 mile south of Associated Road. The bridge widening for the southbound portion is proposed at Bastanchury Road UC and Rolling Hills Drive UC to accommodate the proposed sound walls, and required the construction of small segments of retaining walls for these sound walls. Preliminary information regarding the locations and the dimensions of the proposed walls are presented in Table 1-1. For the tie-back wall, the geotechnical recommendations are presented in a tie-back wall foundation report under a separate cover.

TABLE 1-1
Summary of Retaining and Sound Walls Information

Structure Number	Station Limits (feet)		Station Line	Structure Type[1]	Approximate Length (feet)	Estimated Maximum Height (feet)
	From	To				
			Northbound Improvements			
RW 592	593+07.63	597+82.01	B	1	474	16
RW 598	597+50.57	601+41.42	B	1	391	18
RW 604	603+04.36	610+65.36	B	1	761	16
RW 614	612+39.49	622+15.00	B	3, 4, 5	976	18
RW 622	621+57.94	626+45.96	B	3	495	18
RW 628	627+90.50	631+23.74	B	1, 3, 4	345	16
RW 630	631 +12.28	640+21.97	B	1, 3, 4, 5	910	25
RW 642	41+88.00	44+91.44	J-5	2, 5	303	22.5
RW 646	46+01.17	48+68.96	J-5	1, 2	268	18
RW 658	59+15.03	67+26.13	J-6	1	800	14
SW 668	68+45.81	672+77.72	J-6, B	6	432	16
RW 670	672+77.72	682+01.22	B	4, 5	930	17.5
RW 684	683+67.03	693+93.38	B	2	1026	20
RW 694	693+86.49	694+22.54	B	1	66	10
RW 696	695+22.39	695+77.56	B	1	84	12
RW 698	695+68.22	14+98.60	B, K-2	4, 5	926	25
			Southbound Improvements			
SW 581	80+21.22	589+10.60	I-7, B	4, 6	876	14.3
SW 589	588+21.00	600+48.00	B	8	1225	14
SW 599	598+88.00	600+94.51	B	6,7	207	14.3
SW 603	602+61.06	626+44.00	B	6,7	2383	14.3
SW 627	627+83.83	637+17.00	B	6,7	933	14

[1] Structure type is one or more of the following:
(1) Retaining wall – Standard Type 1, (2) Mechanically stabilized earth (MSE) wall with barrier slab, (3) Sound wall on retaining wall – Caltrans Type 1SW, (4) Sound wall with barrier on retaining wall – Caltrans Type 1SWB, (5) Sound wall on MSE wall, (6) Sound wall on type 736S and 736SV barrier, (7) Sound wall on a cast-in-place (CIP) retaining wall, (8) Sound wall on pile cap.

1.3 Purpose and Scope

The purpose of the investigation is to review the available information pertinent to the existing project alignment, perform site investigations to confirm the subsurface conditions, and provide geotechnical recommendations to aid in the design of the proposed structures. The scope of work for the current study includes the following tasks.

- Review as-built bridge drawings, log of test boring (LOTB) sheets, and geologic maps
- Drilling, sampling, and logging of 30 hollow-stem auger (HSA) borings
- Perform 23 cone penetration test (CPT) soundings
- Conduct laboratory testing of selected samples to characterize the subsurface material
- Provide recommendations for seismic parameters, evaluate the potential for liquefaction and lateral spread, and develop geotechnical recommendations for foundation design
- Prepare foundation report according to the *Guidelines for Structures Foundation Reports* (Caltrans, 2006a) by California Department of Transportation (Caltrans)

1.4 Site Description and Existing Structures

The alignment for the northern segment is approximately 2.5 miles long route. It begins immediately to the north of Yorba Linda Boulevard at Station 587+15 ("B" Line) trending north and gently turns west near the Loftus Diversion Channel until it crosses Imperial Highway at Station 654+36 ("B" Line). The alignment continues north for approximately 0.1 mile, then trends northeast until it crosses Birch Street at Station 682+53 ("B" Line) and gently curves west until it reaches the northern terminus at Station 708+20 ("B" Line). The elevation along the northern segment varies from 285 feet at the southern terminus and gradually ascends to elevation 346.5 feet near Rolling Hills Drive, then descends to elevation 310 feet near Imperial Highway and ascends to its highest elevation of 450 feet at the northern terminus. The area surrounding the alignment of the northern segment is heavily urbanized by recreational, residential, and commercial developments. The terrain in the vicinity of the alignment is relatively flat.

Structures that are known to exist along the alignment include the existing bridges, the culvert structure, and sound walls. The culvert structure is a storm drainage facility that runs in a southwestern direction, roughly 1,100 feet south of Imperial Highway. The culvert conveys the discharge from the Loftus Diversion Channel on the east side of the alignment and drains into the United States Army Corps of Engineers (USACE) Fullerton Dam in Craig Park on the west side at Bastanchury Road crossing. Five of the existing sound walls will be removed to accommodate the proposed improvements at the following locations.

- Southbound along Yorba Linda Boulevard off-ramp, roughly between Station 586+77 and 588+38 ("B" Line)
- Northbound between Bastanchury Road UC and Rolling Hills Drive UC, roughly from Station 612+86 to 620+00 ("B" Line)

- Northbound between Rolling Hills Drive UC and Associated Road UC from Station 635+48 to 640+00 ("B" Line)
- Northbound between Imperial Highway and Birch Street from Station 668+30 to 681+80 ("B" Line)
- Northbound between Union Pacific Railroad and Lambert Road from Station 696+00 to 702+30 ("B" Line)

In addition, water pipelines, gas lines, underground utilities, communication lines and drainage pipes exist along and across the existing roadway alignment. The major utilities that are known to exist within the project alignment include:

- City of Fullerton underground 8-inch vitrified clay pipe (VCP) sewer line at approximately Station 587+53 ("B" Line) crossing the proposed sound wall SW581.
- American Telephone and Telegraph (AT&T) overhead communications line, Southern California Edison 12-kV overhead electric line, Time Warner overhead television cable line along the proposed sound wall SW589
- Southern California Gas Company (SCG) underground 4-inch polyethylene gas line at approximately Station 601+60 ("B" Line) crossing Bastanchury Road UC
- Orange County Sanitation District (OCSD) underground 18-inch VCP Sewer Line crossing RW614 at approximately Station 616+00 ("B" Line) and SW603 at Station 614+55 ("B" Line)
- OCSD underground abandoned 15-inch VCP sewer line crossing RW614 at approximately Station 616+10 ("B" Line), and SW603 at Station 614+55 ("B" Line)
- Union Oil Company of California (Unocal) underground 8-inch VCP sewer line crossing RW614 at approximately Station 616+00, and SW603 at Station 614+80 ("B" Line)
- AT&T underground communications line, private underground gas line, and private underground electric line runs adjacent to RW630 approximately between Stations 634+00 and 636+50 ("B" Line)
- SCG 30-inch-high pressure private line at Brea OH north abutment slope approximately at Station 695+70 ("B" Line)

1.5 Pertinent Reports and Investigations

As part of the study, CH2M HILL reviewed previous geotechnical investigation performed at the project site, including:

- CH2M HILL. 2008a. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Bastanchury Road Undercrossing, Bridge No. 55-0465.* Prepared for Orange County Transportation Authority. July.
- CH2M HILL. 2008b. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Rolling Hills Drive Undercrossing, Bridge No. 55-0483.* Prepared for Orange County Transportation Authority. July.

- CH2M HILL. 2008c. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Associated Road Undercrossing, Bridge No. 55-0466.* Prepared for Orange County Transportation Authority. July.
- CH2M HILL. 2008d. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Birch Street Undercrossing, Bridge No. 55-0485.* Prepared for Orange County Transportation Authority. July.
- CH2M HILL. 2008e. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Brea Overhead, Bridge No. 55-0482.* Prepared for Orange County Transportation Authority. August.
- Earth Mechanics, Inc. 2007. Updated Preliminary Foundation Reports and Preliminary Pavement Structural Sections, SR-57: NB Widening Project. March.
- California Department of Transportation (Caltrans). 1972. As-built Project Plans for Construction on State Highway, Orange County in and near Fullerton and Brea between 0.1 mile north of Imperial Highway and 0.3 mile south of Los Angeles County Line, California. December.
- Caltrans. 1970. As-built Project Plans for Construction on State Highway, Orange County in Fullerton and Brea between Nutwood Avenue and 0.3 mile north of Imperial Highway, California. September.

1.6 Limitations

This foundation report has been prepared for the exclusive use by Caltrans, OCTA, and CH2M HILL design engineers for the PS&E of SR-57 northbound widening project. It has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

The analyses and recommendations contained in this report are based on the data obtained from the review of available pertinent documents and the borings and the CPTs by CH2M HILL. The borings presented in the as-built plans and the LOTB sheet prepared in this investigation indicate subsurface conditions only at specific locations at the time of explorations, and only within the depths penetrated. They do not necessarily reflect subsurface variations that could exist between such locations or between samples, or changes that could take place with time. If variations in subsurface conditions from those described in this report are noted during the final design or construction, the recommendations in this report should be re-evaluated.

In the event that any change in the nature, design, or location of the proposed structures occurs, the conclusions and recommendations of this report should not be considered valid unless such changes are reviewed and the conclusions of this report are verified in writing by CH2M HILL. CH2M HILL is not responsible for any claims, damages, or liability associated with the reinterpretation or reuse of the subsurface data in this report by others.

The geotechnical recommendations presented in this report are based on the as-built drawings and the structural plans for the proposed improvements at the northern segment.

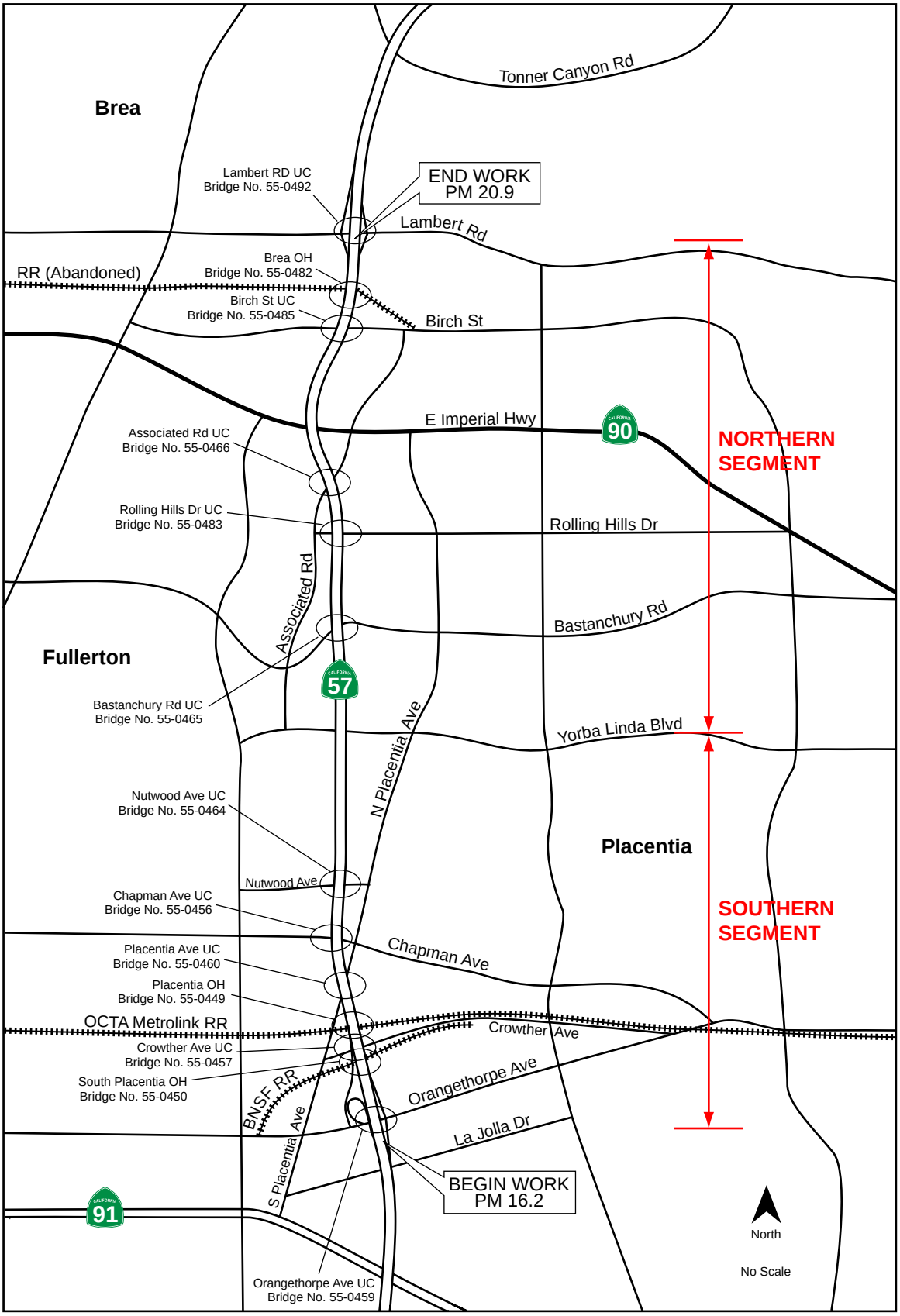


FIGURE 1-1
Site Location Map
State Route 57 Northbound Widening Project
Orange County, California

CH2MHILL

SECTION 2

Geotechnical Investigation

2.1 General

The geotechnical investigation considered in the current study included the borings drilled by Caltrans for the existing bridge structures and the site exploration by CH2M HILL conducted during the current investigation. The site exploration included borings drilled for the widening of the existing bridge structures, the proposed retaining and sound walls, and for the pavement design for the proposed widening. While all the borings provided information for the subsurface conditions and the material properties, only the borings considered in the LOTB sheets of the proposed walls are included in this report. The complete logs of borings and the laboratory test results are presented in the geotechnical design report under a separate cover. CH2M HILL site exploration considered in this report is shown on the Boring Location Map presented in Appendix A.

2.2 Field Exploration

2.2.1 Review of Existing Information

According to the as-built drawings, the most recent subsurface investigation relevant to the proposed widening was performed prior to the construction of the existing alignment. At that time, the subsurface information was obtained from 32 rotary and penetration borings advanced within the northern segment. These borings were drilled between June 1966 and November 1967 to a depth ranging between 3 and 57 feet below ground surface (bgs) to develop the geotechnical recommendations for the foundation design of the existing bridges. In the current investigation, 19 borings from the previous investigation are considered pertinent to the proposed walls in the northern segment. The borings are presented on the LOTB sheets for the bridge structures at Bastanchury Road, Rolling Hills Drive, Associated Road, SR-90, Birch Street, and Brea OH. A summary of the subsurface investigation reviewed is presented in Table 2-1.

TABLE 2-1
Summary of As-Built LOTBs

Exploration Number	SR-57 Centerline Station[1] (feet)	Offset from SR-57 Centerline (feet)	Date Performed	Penetration Depth (feet)	Estimated Top of Boring Elevation[2] (feet)	Estimated Groundwater Elevation[2] (feet)
Bastanchury Road UC (Bridge No. 55-0465)						
B-1	601+29	68 RT	6/21/1966	30	283.9	NE
B-3	600+86	71 LT	6/21/1966	16	285.8	NE
B-4	602+77	71 LT	6/22/1966	18	285.9	NE
B-6	603+00	70 LT	6/22/1966	5	289.0	NE
Rolling Hills Drive UC (Bridge No. 55-0483)						
B-1	627+87	44 LT	4/10/1967	45	358.2	NE
B-2	626+47	63.5 RT	4/11/1967	55	367.3	NE
B-3	626+46	74 LT	4/13/1967	3.33	364.7	NE
B-4	627+89	73 RT	4/13/1967	30	355.7	NE
Associated Road UC (Bridge No. 55-0466)						
B-1	641+56	58 RT	6/20/1966	40	290.3	274.7
B-3	639+80	58 RT	6/20/1966	31	289.6	276.4
Route 90 (Bridge No. 55-0469)						
B-4	55+89	10 LT	6/16/1966	7	337.3	NE
B-5	56+61	16 LT	6/17/1966	21	335.1	NE
Birch Street UC (Bridge No. 55-0485)						
B-2	683+13	71 RT	11/3/1967	2.90	356.3	NE
B-3	683+17	68 RT	11/3/1967	16.50	356.4	NE
B-4	682+15	58 RT	11/3/1967	22	356.4	NE
Brea Overhead (Bridge No. 55-0482)						
B-1	695+14	64 RT	11/15/1967	47	370.9	NE
B-4	694+24	59 RT	11/15/1967	17	367.8	NE
B-5	694+22	65 RT	11/15/1967	34	367.9	NE
B-6	695+73	59 RT	11/15/1967	35	373.8	NE

[1] Station is referenced to the center line of SR-57 shown on the as-built plans
[2] Elevation is referenced to the 1929 National Geodetic Vertical Datum (NGVD)
LT = left
RT = right
NE = not encountered

2.2.2 Current Investigation

CH2M HILL conducted the site exploration between June 26 and September 25, 2008, to investigate and evaluate the subsurface conditions along the project alignment. Before starting the site investigation, field reconnaissance was conducted to select the location of the exploration and evaluate accessibility constraints. Generally, the site exploration was conducted on the north- and southbound at approximately 450-foot intervals to characterize the foundation soil for the proposed structures. The CH2M HILL site exploration included a total of 30 HSA borings and 23 CPT soundings advanced to investigate the subsurface conditions in the northern segment. The HSA borings were designated A-08-001 through A-08-030, and the CPT soundings were designated CPT-08-001 through CPT-08-023 (Caltrans, 2007). In this report, 26 HSA borings and 23 CPTs were considered for the LOTB sheets of the proposed walls in the northern segment. The LOTB sheets for the proposed walls are presented in Appendix B. Descriptions of the HSA borings and the CPT tests are presented next.

2.2.2.1 Hollow-Stem Auger Borings

The HSA borings were drilled by 2R Drilling, Inc. of Chino, California, under a subcontract to CH2M HILL using a truck-mounted (CME-75) drill rig and a limited access (CME-55) drill rigs. Both drill rigs were equipped with 8-inch-diameter HSAs and an automatic hammer. The automatic hammers were estimated to have an equivalent efficiency of about 78 percent. The estimated equivalent efficiency was not calibrated during the field investigation.

Soil samples were collected every 5 feet using a standard penetration test (SPT) split-spoon sampler or modified California ring sampler. The SPT and the ring samplers were driven using a 140-pound hammer falling freely for 30 inches, for a penetration of 18 inches. Blow counts were noted on the boring logs for the last 12 inches of penetration. The sampling procedures generally followed SPT and split-barrel sampling of soils (American Society for Testing and Materials [ASTM] D1586). In addition, representative bulk samples were collected from the borings. Each soil sample collected was described using the Unified Soil Classification System (USCS) in accordance with ASTM D2487 and D2488, and the guidelines in the *Soil and Rock Logging, Classification, and Presentation Manual* (Caltrans, 2007). Following the drilling, the borings were backfilled with compacted soil cuttings to the ground surface. In the areas where the borings were performed on existing pavement, the upper 1 foot was backfilled with base material followed by 6 inches of cold asphalt patch. Soil boring information, including exploration number, station, offset, ground surface elevation, depth, and groundwater table elevation, is summarized in Table 2-2. Detailed boring logs are presented in Appendix C.1.

TABLE 2-2
Summary of Hollow-Stem Auger Borings

Soil Boring Number	Approximate Station (feet)	Approximate Offset (feet)	Approximate Ground Surface Elevation (feet)	Exploration Depth (feet)	Groundwater Table Elevation (feet)
A-08-001	588+89.2	91.4 LT	286.2	31.5	NE
A-08-002	592+68.1	85.4 RT	288.8	31.5	NE
A-08-003	596+78.9	98.0 LT	292.2	31.5	NE
A-08-004	600+05.7	69.3 RT	294.4	31.5	NE
A-08-005	600+49.6	100.3 LT	295.0	31.5	NE
A-08-007	603+52.1	72.0 RT	296.8	12.0	NE
A-08-008	606+56.1	69.9 RT	299.2	31.5	NE
A-08-009	609+78.7	68.7 LT	301.4	31.5	NE
A-08-010	611+86.1	125.1 RT	302.8	31.5	NE
A-08-011	621+17.9	69.6 LT	332.4	31.5	NE
A-08-012	626+9.6	116.1 RT	360.7	71.5	290.9
A-08-013	628+28.0	68.8 RT	347.4	71.5	289.9
A-08-014	632+55.5	71.4 LT	339.8	31.5	NE
A-08-015	634+82.7	69.8 RT	341.1	31.5	NE
A-08-016	639+77.3	78.9 RT	327.2	81.5	278.2
A-08-017	641+51.1	161.3 RT	302.0	81.5	284.0
A-08-018	650+43.4	280.6 RT	308.7	11.5	NE
A-08-021	664+80.6	122.0 RT	339.5	31.5	309.0
A-08-022	669+31.1	88.9 RT	349.9	31.5	NE
A-08-023	684+27.4	76.5 RT	390.3	81.5	315.3
A-08-024	685+84.8	69.1 RT	394.4	31.5	NE
A-08-025	693+47.7	68.7 RT	413.1	76.5	NE
A-08-026	695+00.0	86.0 RT	371.6	81.5	360.6
A-08-027	701+06.4	104.6 RT	430.1	31.5	NE
A-08-028	702+92.6	148.7 RT	429.7	31.5	NE
A-08-030	600+90.2	67.6 RT	295.0	61.5	NE

Notes:
All stations and offsets are based on the centerline of SR-57 (“B” Line)
RT = right
LT = left
NE = groundwater not encountered

2.2.2.2 Cone Penetration Tests

The CPT consists of pushing an instrumented cone-tipped probe into the ground while simultaneously recording the resistance to penetration at the cone tip and friction along the cone sleeve. The CPT data are used to continuously interpret subsurface stratigraphy. Through use of site-specific correlations, CPTs can provide data on engineering properties

of soils intended for use in design and construction of the proposed improvements. The CPT was conducted in general accordance with the current ASTM specifications (ASTM D 5778-95) using a 15-square-centimeter (cm^2) electronic cone penetrometer. The CPT information, including exploration number, station, offset, ground surface elevation, depth, and groundwater table elevation, is summarized in Table 2-3. The CPT logs and interpretations are presented in Appendix C.2.

TABLE 2-3
Summary of Cone Penetration Tests

Soil Boring Number	Approximate Station (feet)	Approximate Offset (feet)	Approximate Ground Surface Elevation (feet)	Exploration Depth (feet)	Groundwater Table Elevation (feet)
CPT-08-001	581+09.55	126.8 LT	281.7	30.2	NE
CPT-08-002	585+99.60	85.1 LT	284.7	30.2	NE
CPT-08-003	591+63.91	89.2 LT	290.9	30.1	NE
CPT-08-004	596+60.81	69.8 RT	291.6	30.2	NE
CPT-08-005	600+41.02	100.5 LT	295.2	30.2	NE
CPT-08-006	603+75.01	82.6 LT	296.1	30.2	NE
CPT-08-007	614+14.17	69.9 LT	313.7	30.2	NE
CPT-08-008	617+42.99	68.1 RT	319.3	50.2	NE
CPT-08-009	618+08.98	70.5 LT	325.6	30.2	NE
CPT-08-010	621+48.22	68.6 LT	332.6	30.2	NE
CPT-08-011	625+02.69	68.5 LT	339.7	30.1	NE
CPT-08-012	628+92.64	70.4 LT	342.1	30.2	NE
CPT-08-013	631+20.11	69.9 RT	346.9	35.1	NE
CPT-08-014	636+94.33	75.2 LT	329.6	30.1	NE
CPT-08-015	637+11.12	76.2 RT	334.8	50.2	297.8
CPT-08-016	646+05.92	144 RT	309.5	50.2	282.5
CPT-08-017	649+31.39	382.4 RT	317.2	50.2	287.2
CPT-08-018	662+83.37	133.3 RT	332.2	30.2	NE
CPT-08-019	671+42.67	86.9 RT	354.0	30.1	NE
CPT-08-020	676+09.05	72.3 RT	366.4	30.3	NE
CPT-08-021	681+36.85	70.0 RT	382.7	80.1	350.7
CPT-08-022	689+41.32	68.4 RT	402.7	35.2	NE
CPT-08-023	696+89.44	70.7 RT	421.9	35.1	NE

Notes:
All stations and offsets are based on the center line of SR-57 (“B” Line)
RT = right
LT = left
NE = groundwater not encountered

2.3 Laboratory Tests

Laboratory testing was performed on selected soil samples of the subsurface material to aid in the field classification of the samples collected and to evaluate the geotechnical engineering properties of subsurface materials. Leighton and Associates, Inc. performed the laboratory tests under a subcontract to CH2M HILL. Tests included moisture content,

in-place density, gradation analysis, Atterberg limits, consolidation, direct shear, unconsolidated undrained triaxial shear, and corrosion tests. Testing was completed in accordance with applicable ASTM standards (ASTM, 2007) or Caltrans Test Methods (CTMs) (Caltrans, 1990a). The results of the laboratory tests were reviewed for completeness and reasonableness by CH2M HILL engineers. The laboratory tests performed on the samples are summarized in Table 2-4, and the results of the tests are presented in Appendix D.

TABLE 2-4
Summary of Laboratory Tests Performed

Type of Test	Applicable Test Method
Dry Density	ASTM D 2937
Moisture Content	ASTM D 2216
Atterberg Limits	ASTM D 4318
Grain Size Distribution	ASTM D 422
Expansion Index	ASTM D 4829
Resistance “R” Value	CTM 301
Consolidation	ASTM D 2435
Direct Shear Test	ASTM D 3080
Triaxial Compressive Strength	ASTM D 2850
Modified Proctor Compaction Test	ASTM D 1557
Soil pH	CTM 532/643
Minimum Electrochemical Resistivity	CTM 532/643
Sulfate Content	CTM 417
Chloride Content	CTM 422

Notes:
ASTM = American Society for Testing and Materials
CTM = California Test Method

SECTION 3

Geologic Hazard and Site Characterization

3.1 Regional Geology

The project site is located in the Yorba Linda-La Habra Valley lowland situated south of the Puente Hills and immediately east of the East Coyote Hills. The Puente Hills are the result of uplifting between the Whittier and the Chino faults and are also the continuation to the northwest of the Santa Ana Mountains. The hills and the mountains are part of the Peninsular Ranges Geomorphic Province of Southern California (California Geologic Survey [CGS], 2002). The Puente Hills present an irregular topography and contain several peaks above 1,000 feet in elevation, whereas Coyote Hills are smoother and significantly lower in elevation. The lowland between the hills generally consists of gentle to moderately sloping alluviated surfaces that, for the most part, have been heavily urbanized. The intervening lowland areas are part of the Los Angeles Basin.

According to Morton (2004) and the California Division of Mines and Geology (CDMG) (1997), the Puente Hills is underlain by the late Miocene of the Puente Formation and the Pliocene age marine rock of the Fernando Formation. These bedrock units consist of claystone, siltstone, sandstone, and conglomerate of marine origin and represent the oldest bedrock units exposed in this area. The bedrock underlying the Coyote Hills consist of the late Pleistocene La Habra Formation, Pleistocene Coyote Hills Formation, and early Pleistocene San Pedro Formation rocks. The bedrock units exposed in the Coyote Hills consist of nonmarine mudstones and pebbly sandstone.

3.2 Site Geology

As shown in Figure 3-1, the geology of the project alignment is generally comprised of the very old alluvial fan deposits underlain by the La Habra Formation. Descriptions of the generalized characteristic of the geologic groups are given next.

3.2.1 Very Old Alluvial Fan Deposits

The very old alluvial fan deposits (Qvof) represent the dominant geologic group encountered along the project alignment. These deposits are well dissected, well indurated, and of Pleistocene age. The very old alluvial fan deposits are characterized, for the most part, by high SPT and CPT penetration resistance and consist of stiff to hard silt, sandy clay, lean clay with sand, lean clay, and fat clay with interbedded dense to very dense clayey sand and silty sand layers. These deposits vary in thickness from nonexistent to greater than 50 feet and are poorly sorted and crudely layered.

3.2.2 La Habra Formation

The Pleistocene age nonmarine rocks of the La Habra Formation (Qlh) is exposed in the Coyote Hills, south of the Whittier Fault in the Puente Hills, and along the project alignment

at the Rolling Hills UC site. This formational material generally consists of floodplain deposits of mudstone, siltstone, thick-bedded sandstone, conglomerate and pebbly sandstone (Morton, 2004; CDMG, 1997). Based on the result of the site field investigation, the La Habra Formation is highly weathered and consists predominately of claystone and siltstone.

3.3 Geologic Hazards

3.3.1 Ground Rupture

The project alignment is not located within an established Alquist-Priolo (AP) Earthquake fault zone (CGS, 2007); therefore, the potential for surface rupture to occur along the project alignment is considered low.

3.3.2 Liquefaction

Liquefaction is a seismic phenomenon in which loose, saturated, fine-grained granular soils behave like a fluid when subjected to high-intensity ground shaking. Liquefaction occurs when three general conditions exist: (1) shallow groundwater, (2) low-density sandy soils, and (3) high-intensity ground motion. Studies indicate that saturated, loose and medium-dense, near-surface, cohesionless soils exhibit the highest liquefaction potential; whereas, dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. Effects of liquefaction on level ground include sand boils, settlement, and failures of bearing capacity below structural foundations.

According to the Seismic Hazard Zones for the La Habra quadrangle (CGS, 1998), the project alignment traverses two zones of required investigation as shown in Figure 3-2. The first zone is in the young alluvial fan deposits located at the Associated Road UC south of SR-90, and the second zone is located between Bastanchury Road UC and Rolling Hills Drive UC. Based on the results of the field investigation, borings A-08-016 and A-08-017 at the first zone and CPT-08-08 at the second zone indicate no liquefaction potential at these locations due to the depth to groundwater, the dense nature of the granular material, and the stiff to hard consistency of the fine-grained deposits. The very old alluvial fan deposits encountered along most of the project alignment and the La Habra Formation (bedrock) encountered near Rolling Hills UC are considered not susceptible to liquefaction. Therefore, the potential for liquefaction along the project alignment is generally considered very low.

3.3.3 Seismically Induced Settlement

Seismically induced settlement at the site is expected to be negligible due to the presence of predominately stiff to hard clayey material. Therefore, the hazards associated with seismically induced settlement are considered low.

3.3.4 Lateral Spreading

Lateral spreading is defined as the finite lateral displacement of gently sloping ground as a result of pore water pressure build-up or liquefaction in a shallow underlying deposit during an earthquake Therefore, due to the low liquefaction potential at the site, lateral spreading is considered low.

3.3.5 Landslide and Slope Instability

Landslides could be generated in soil or rock when pre-existing conditions inherent within the soil or the rock mass can initiate the sliding failure mechanism. In addition, landslides could be activated from natural events such as earthquakes, rainfall, and erosion, or from man-made activities such as removal of lateral supports near the base of unstable hillside areas.

Based on field reconnaissance and on the review of the available geologic maps, no known landslides are mapped within the project site. Therefore, the potential for landsliding is considered low.

3.3.6 Expansive and Compressible Soil

The results of the field investigation indicate that the subsurface conditions within the northern segment are fairly uniform and predominantly consist of the clayey material of low compressibility, which contains low to medium plasticity clay layers. Therefore, the potential hazards from expansive material at the site are generally considered low to high, and from compressible soil are considered low to moderate. In the area near Rolling Hills UC, the expansion index for the samples of the La Habra Formation and the very old alluvium fan deposits exhibit high expansion potential. Areas along the alignment that are likely to have soil with high expansion potential are expected to be from Station 604+00 to 610+50; and from Station 621+50 to 634+50 (“B” line).

3.4 Subsurface Soil Conditions

3.4.1 Artificial Fill

Artificial fills (Af) were encountered at several locations along the northern segment of the project alignment. Generally, the subsurface information from the borehole logs and the as-built grading plans for the original roadway alignment were used to estimate the thickness of the artificial fill used for the construction of the roadway embankment fills. This material was encountered between Stations 611+00 and 620+50, and between Stations 635+50 and 648+00, and from Station 669+00 to the northern terminus at Station 708+00 (“B” line). The thickness of the fill generally varies from a few feet up to approximately 45 feet. The similarity in character between the artificial fill and the native material encountered along the project alignment suggests the artificial fill might have been derived from local material in the cut sections during the initial grading of the project alignment. The artificial fill predominantly consists of stiff to hard sandy clay, lean clay with sand, lean clay and fat clay; with dense to very dense sandy material at some isolated locations. Based on the available documentation, it is not known if this material was placed as engineered fill.

3.4.2 Young Alluvial Fan Deposits

The young alluvial fan deposits (Qyf) represent the smallest geologic materials encountered along the project alignment. The young alluvial fan deposits were differentiated from the older alluvial fan deposits following the published geologic maps (Morton, 2004) and the results of the penetration tests obtained during the field investigation. These materials have

limited spatial distribution along the project alignment and were mainly deposited as slope wash and debris flows originating from the surrounding mountains as encountered in boring A-08-006 near Bastanchury Road, and in borings A-08-016 and A-08-017 near Associated Road. These deposits are considered to be of Holocene and late Pleistocene age and are generally dominated by medium stiff to very stiff clayey material.

3.5 Foundation Material

The interpreted subsurface conditions discussed above were used along with the boring-specific information to provide the anticipated foundation material at the location of the proposed walls. Table 3-1 summarizes the anticipated groundwater elevation and the characteristic of the foundation material based on the information presented on the LOTB sheet for each wall.

TABLE 3-1
Summary of the Walls Foundation Material

Wall No.	Borings[1]	Groundwater Elevation (feet)	Description of Foundation Material
SW 581	CPT-08-001, CPT-08-002, A-08-001	251.47	Hard sandy lean clay approximately 20 feet thick underlain by dense to very dense silty sand, clayey sand and sand with silt (**Qvof**)
SW 589	A-08-001, CPT-08-003, A-08-003, CPT-08-005, A-08-005	254.67	Hard sandy lean clay approximately 10-20 feet thick underlain by medium dense to very dense silty sand, clayey sand, sand with silt, silty gravel with sand and hard sandy lean clay (**Qvof**)
RW 592	A-08-002, CPT-08-004, A-08-004	257.32	Varies from very stiff sandy lean clay (near the south end) to sand with silt approximately 20 feet thick underlain by stiff to hard sandy lean clay (near the north end) (**Qvof**)
RW 598	A-08-004, A-08-030	233.5	Very dense silty sand and clayey sand approximately 15-20 feet thick underlain by hard sandy lean clay (**Qvof**)
SW 599	A-08-005, CPT-08-005	263.46	Interbeds of sandy silt, silty gravel with sand, sandy lean clay approximately 20 feet thick underlain by hard sandy lean clay (**Qvof**)
SW 603	CPT-08-006, A-08-009, CPT-08-007, CPT-08-009, A-08-011, CPT-08-011	265.97	Dense clayey sand and silty clayey sand ranging in thickness from 10 feet (near the south end) to 30 feet (near the north end) and underlain by hard sandy lean clay (**Qvof**)
RW 604	A-08-007, A-08-008	267.68	Dense silty sand (**Qvof**)
RW 614	A-08-010, CPT-08-008, CPT-08-010	271.34	Very stiff to hard lean clay to medium dense clayey sand (**Qvof**)
RW 622	CPT-08-010, A-08-012	290.9	Interbedded hard lean clay and very dense clayey sand (**Qvof**) (at the south end) to highly weathered claystone (at the north end) (**Qlh**)

TABLE 3-1
Summary of the Walls Foundation Material

Wall No.	Borings[1]	Groundwater Elevation (feet)	Description of Foundation Material
SW 627	CPT-08-012, A-08-014, CPT-08-014	308.34	Highly weathered claystone (**Qlh**) (at the south end) to very dense sand with gravel, silty sand with gravel approximately 20 feet thick overlying hard sandy lean clay (**Qvof**) (at the north end)
RW 628	A-08-013, CPT-08-013	289.89	Highly weathered claystone (**Qlh**)
RW 630	CPT-08-013, A-08-015, A-08-016, CPT-08-015	278.2 - 287	Varies from hard sandy clay (**Qvof**) (at the south end) to very stiff to hard lean clay approximately 5-35 feet thick (**Af**) overlying stiff to hard sandy clay (**Qvof**)
RW 642	A-08-017	283.97	Medium stiff lean clay with sand (**Af**) approximately 8 feet thick underlain by alternating layers of hard lean clay with sand and hard fat clay (**Qyf**)
RW 646	CPT-08-016, CPT-08-017	287.2	Very stiff to hard sandy clay approximately 35 feet thick underlain by very dense sand and sandy gravel (**Qvof**)
RW 658	CPT-08-018, A-08-021	309.5	Alternating layers of hard lean clay and very dense sand with silt (**Qvof**)
SW 668	A-08-022, CPT-08-019	318.36	Dense clayey sand (**Af**) approximately 10-15 feet thick underlain by very stiff to hard sandy lean clay and very dense silty sand (**Qvof**)
RW 670	CPT-08-019, CPT-08-020, CPT-08-021	350.7	Dense clayey sand (**Af**) approximately 10-15 feet thick (at the south end) and up to 45 feet thick (at the north end). The fill is underlain by very stiff to hard sandy lean clay and very dense silty sand (**Qvof**)
RW 684	A-08-023, A-08-024, CPT-08-022, A-08-025	315.34	Alternating layer of hard sandy lean clay and dense to very dense clayey sand and silty sand approximately 30 feet thick (**Af**)
RW 694	A-08-025, A-08-026	360.58	Alternating layers of stiff to hard sand lean clay and dense silty sand and clayey sand (**Qvof**)
RW 696	A-08-025, A-08-026	360.58	Alternating layers of stiff to hard sand lean clay and dense silty sand and clayey sand (**Qvof**)
RW 698	CPT-08-023, A-08-027, A-08-028	361 - 371	Hard sandy lean clay approximately 15 feet thick underlain by very dense clayey sand (**Af**)

Notes

Af = artificial fill
Qlh = La Habra Formation
Qvof = very old alluvium fan deposit
Qyf = young alluvium fan deposit

3.6 Water

3.6.1 Surface Water

As discussed in Section 1.4, the project alignment traverses Loftus Diversion Channel that drains into Fullerton Dam. The size of the flood control pool at the top of the dam is approximately 62 acres. No other surface bodies of water exist within the project right-of-way.

3.6.1.1 Scour

The existing inlets and the outlets of the culvert structure in Loftus Diversion Channel are protected from scour either by concrete lining or by rock slope protection. Except at this location, the project alignment does not cross water courses.

3.6.1.2 Erosion

Most of the existing cut-and-fill slope surfaces are covered by landscape vegetation. Except at some locations along the alignment, the soils have low to moderate potential for erosion. Some of the proposed retaining structures along the project alignment might require grading in the cut areas. To minimize the long-term erosion of the soil in these areas, it is recommended that all exposed slope surfaces be planted with protective vegetation.

3.6.2 Ground Water

The northern segment of the project alignment lies within the Orange County Groundwater Basin (Orange County Basin) located in the northernwest portion of the Coastal Plain of Orange County (DWR, 2004). The basin is bounded by bedrock exposed to the north in the Puente and Chino Hills, on the east in the Santa Ana Mountains, on the south in the San Joaquin Hills, and by the Pacific Ocean on the southwest. In the basin area, three fault zones are considered restrictive geologic structures to the groundwater flow. These faults include Whittier-Elsinore, Norwalk, and Newport-Inglewood fault zones (DWR, 1967). The most relevant to the project alignment is the Whittier-Elsinore fault zone, which forms a barrier to the groundwater flow at the northeastern boundary of the basin along the Puente Hills.

The Orange County Basin is recognized to have three aquifer systems, upper, middle, and lower aquifers. Generally, the near-surface material encountered in the current investigation is predominately fine-grained, which forms non-water-bearing strata in the upper aquifer system. Accordingly, the groundwater table along the northern segment of the project alignment is expected to be deep. However, if the groundwater is encountered in the upper aquifer (i.e., less than 800 feet from the ground surface), it is expected to be in isolated areas and under perched conditions.

As presented in Tables 2-1 through 2-3, groundwater was encountered in some of the borings drilled in the current and the previous field investigation. Generally, the elevation of the groundwater levels encountered along the alignment ranges between 275 and 361 feet. These elevations generally correspond to a depth of approximately 30 feet or greater below the ground surface of SR-57, and reaches its shallowest depth of approximately 13 feet at SR-90. The variations in the groundwater conditions along the project alignment appear to be affected by the local geology. Review of the published information indicates that the depth to the historical high groundwater is approximately

10 feet bgs in the areas underlain by the young alluvial deposits (CDMG, 1997). The groundwater levels might fluctuate due to seasonal variations, nearby construction, irrigation, and numerous other man-made and natural influences.

3.7 Engineering Parameters

The geotechnical design parameters for the different geologic groups encountered within the northern segment were developed to provide the geotechnical recommendations for the design of the proposed improvements. Generally, the selection of the geotechnical design parameters was based on the result of the in situ and the laboratory tests performed. Prior to the selection of the design values, different materials encountered along the project alignment were classified into geologic groups. The engineering parameters for each group were selected from the available test results; however, these parameters were slightly adjusted based on experience and engineering judgment to provide reasonable values, particularly in the absence of laboratory tests.

3.7.1 Shear Strength

The laboratory testing included direct shear (DS) and unconsolidated undrained (UU) triaxial shear tests to evaluate both the drained and undrained shear strength of the soil. For each geologic group, the generalized effective shear strength parameters were obtained from the single plot of the DS test results, and the undrained shear strength was estimated from the averaged results of the UU tests. The shear strength plots for each geologic group are presented in Figures E-1 through E-12 in Appendix E.1.

3.7.2 Compressibility

As discussed in Sections 3.2 and 3.4, the existing embankment fills and the very old alluvial fan deposits generally exhibit high penetration resistance, which suggests low to moderate compressibility characteristics. These two geologic groups predominantly underlie the alignment in the northern segment. Therefore, settlement of the proposed structures is expected to be mostly elastic and should occur shortly after the application of the load. In the current evaluation for the compressibility of the soil, a correlation between the corrected SPT N-value and the compression index for the soil is used to estimate the elastic settlement of the foundation soil (AASHTO, 2007). At locations where the penetration resistance is relatively low, the results from the one-dimensional consolidation tests were used to adjust the compressibility values.

3.7.3 Design Parameters

The design parameters selected are presented in a range to provide the lower and the upper bounds, with an average being the recommended values. A summary of the select design values for the shear strength and the compressibility of different geologic groups is presented in Table 3-2.

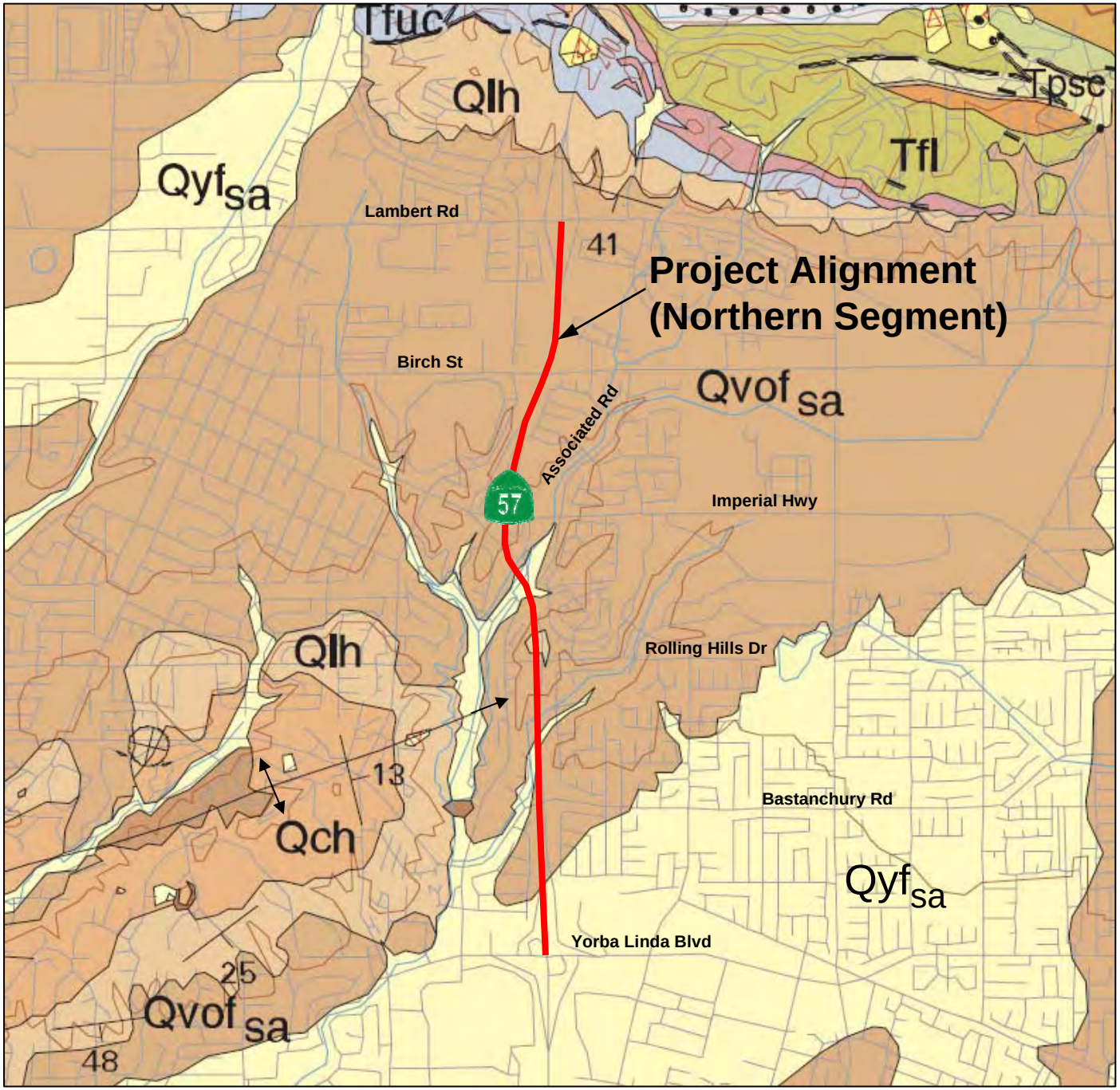
TABLE 3-2
Summary of Geotechnical Design Parameters

Material Property[1]	Material Type[2]	Geologic Group[3]				
		Qvof	Qyf	Qlh	Af (Existing)	Af (Remolded)
Unit Weight (pcf)	I	130	120	130	130	120
	II	120	-	-	120	120
Effective Peak Shear Strength						
Friction Angle (degree)	I	30 (25 – 34)	14 (13 – 16)	30 (28 – 33)	33 (27 – 38)	29 (26 – 31)
	II	38 (35 – 41)	-	-	39 (37 – 41)	34 (31 – 37)
Cohesion (psf)	I	950 (350 – 1500)	1400 (1200 – 1500)	1500 (1000 – 1800)	800 (500 – 1400)	200 (50 – 350)
	II	400 (0 – 800)	-	-	900 (750 –1100)	250 (0 – 450)
Effective Ultimate Shear Strength						
Friction Angle (degree)	I	28 (26 – 30)	15 (14 – 16)	26 (24 – 28)	30 (28 – 31)	30
	II	36 (35 – 37)	-	-	35	33 (31 – 34)
Cohesion (psf)	I	180 (0 – 350)	900 (800 – 1000)	300 (50 – 550)	100 (0 – 200)	0
	II	100 (0 – 200)	-	-	25 (0 – 50)	0
Undrained Shear Strength (psf)	II	7000 (2185 – 10800)	3500	12000 (11600 - 13830)	-	-
Compression Ratio	I	0.011 (0.031 – 0.006)	0.020 (0.035 – 0.009)	0.009 (0.015 – 0.005)	0.011 (0.028 – 0.006)	0.011 (0.028 – 0.006)
	II	0.006 (0.018 – 0.004)	-	-	0.007 (0.014 – 0.004)	0.007 (0.014 – 0.004)

[1] Material property is given as an average value, and in parenthesis for the range of values
[2] Material type explanation: I=Cohesive soil, claystone and siltstone, II=Cohesionless soil and sandstone
[3] Geologic groups are:

Qvof = very old alluvium fan deposits
Qyf = young alluvium fan deposits
Qlh = La Habra Formation
Af = artificial fill

psf = pounds per square foot
pcf = pounds per cubic foot



DESCRIPTION OF MAP UNITS

Qyf sa	**Young alluvial fan deposits (Holocene and late Pleistocene) –** Gravel, sand and silt mixtures, some contain boulders, unconsolidated
Qvof sa	**Very old alluvial fan deposits (middle to early Pleistocene) –** Sandy alluvium; reddish-brown, well-indurated, fan surfaces well dissected
Qlh	**La Habra Formation (Pleistocene) –** Non-marine mudstone, fluvial sandstone and conglomerate
Qch	**Coyote Hills Formation (Pleistocene) –** Mostly mudstone and pebbly sandstone, non-marine
Tfl	**Fernando Formation, Lower Member (Pliocene) –** Siltstone, sandstone and conglomerate
Tfuc	**Fernando Formation, Upper Member Subdivision (Pliocene) –** Conglomerate
Tpsc	**Puente Formation, Sycamore Canyon Member (early Pliocene and Miocene) –** Mostly sandstone and pebbly conglomerate

EXPLANATION

Anticline – solid were accurately located; dotted were concealed. Arrowhead on axis shows direction of plunge

13 **Strike and Dip of Bedding**

Fault – solid were accurately located; dashed were approximately located or inferred; dotted were concealed.

0 North 1.0 Mile

Approximate Scale

FIGURE 3-1
Regional Geology Map
State Route 57 Northbound Widening Project
Orange County, California

CH2MHILL

Source: Morton, D. M., 2004, Preliminary Digital Geologic Map of Santa Ana 30' x 60' Quadrangle, Southern California, Open File Report 99-172.

Source: CGS Seismic Hazard Zones, La Habra (April, 1998) and Yorba Linda (August, 2005) Quadrangles, Official Maps

MAP EXPLANATION

Zones of Required Investigation:

Liquefaction – Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground-water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake Induced Landslides – Areas where previous occurrence of landslide movement, or local geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

North

0 — 1 Mile

Approximate Scale

FIGURE 3-2

Seismic Hazard Zones Map
State Route 57 Northbound Widening Project
Orange County, California

CH2MHILL

SECTION 4

Discussion and Recommendations

The results of the current study were used to develop geotechnical recommendations for the foundation design of the proposed structures along the alignment. The recommendations are based on data provided in the previous LOTB sheets and the conditions encountered in the current investigation.

4.1 Peak Bedrock Acceleration

The seismic design methodology adopted for the current study is based on the following Caltrans guidelines:

1. Seismic Design Criteria (Caltrans, 2006b)
2. Guidelines for Structures Foundation Reports (Caltrans, 2006a)
3. California Seismic Hazard Map (CSHM)(Caltrans, 1996a)

The alignment of the northern segment is located within a seismically active area in Southern California. Several active faults have been mapped within the general vicinity of the project site. Based on the CSHM (Caltrans, 1996a), significant faults close to the site include the Whittier-Elsinore (WEE), El Modeno-Peralta Hills (EMP), San Jose (SJE), and Chino (CNO). Other faults close to the site that are not recognized on CSHM and are known to be active faults include the Puente Hills (PTH) blind-thrust fault (Bilodeau et al., 2007). This fault was formerly known as the Lower Elysian Park blind thrust (Shaw and Shearer, 1999). The Maximum Credible Earthquake (MCE) magnitude and the style of faulting are presented in Table 4-1. The location of the alignment relative to the nearby faults is shown in Figure 4-1.

TABLE 4-1
Summary of Nearby Faults

Fault	Maximum Credible Earthquake (M_W)	Style
Whittier-Elsinore (WEE)	7.5	Strike-Slip
Puente-Hills (PTH)	7.25[1]	Blind Thrust
El-Modeno-Peralta Hills (EMP)	6.5	Not Known[2]
San Jose (SJE)	6.75	Reverse
Chino (CNO)	6.5	Strike-Slip

[1] Magnitude 7.25 is assigned to the Maximum Credible Earthquake.
[2] Reverse style is assumed for not known/published style of faulting.
M_W = moment magnitude

The peak bedrock acceleration (PBA) values were determined based on the CSHM (Caltrans, 1996a) and were verified with the Sadigh et al. (1997) attenuation relationship. The PBA along the northern segment is estimated to range from 0.6 acceleration due to gravity (g) to 0.7 g. For design, a PBA value of 0.6 g is recommended for the segment between Bastanchury Road UC and just south of Birch Street UC, and 0.7 g is recommended from Birch Street UC to the northern terminus of the project. While the PTH fault is considered to be the controlling fault from Birch Street to the northern terminus of the project, both PTH and WEE faults are the controlling faults from south of Birch street to the southern terminus of the project.

4.2 Scour Evaluation

Scour in the northern segment of the project alignment is not a design consideration.

4.3 Corrosivity Evaluation

Twenty-seven soil samples collected at the project site were tested for minimum soil resistivity, soil pH, water-soluble sulfate content, and chloride content using the procedures described in Caltrans Tests 417, 422, 532, and 634 (Caltrans, 1990a). The results of those laboratory tests are presented in Appendix D and are summarized in Table 4-2. Caltrans *Bridge Memo to Designers 3-1* (Caltrans, 1998) and Caltrans *Corrosion Guidelines, Version 1.0* (Caltrans, 2003) regarding foundations define a corrosive environment as being a site where the soil has sulfate content greater than 2,000 parts per million (ppm), a chloride content greater than 500 ppm, or a pH of less than 5.5. Comparison between the corrosion test results and the Caltrans corrosion criteria indicates that the onsite soils within the project limits are generally not corrosive to structural elements; therefore, corrosion mitigation is not recommended.

TABLE 4-2
Summary of Corrosion Laboratory Test Results

Boring	Sample	Depth (feet)	Soil Type	Minimum Resistivity @ Moisture Content (ohm-cm @ %)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
A-08-001	Bag-1	0-7	s(CL)	1525@26.5	7.55	40	77
A-08-002	Bag-1	2-7	s(CL)	1100@28.0	6.93	71	76
A-08-003	Bag-1	0-7	s(CL)	1315@28.0	7.53	73	55
A-08-004	Bag-1	0-7	(SP-SM)g	10080@25.0	7.90	77	31
A-08-005	Bag-1	0-7	s(CL)	1218@29.8	7.46	60	42
A-08-008	Bag-1	0-7	(CL)s	1070@41.0	8.05	95	31
A-08-009	Bag-1	0-7	SC	1140@29.0	7.86	108	76
A-08-010	Bag-1	0-7	SC	1012@29.1	7.82	121	116
A-08-011	Bag-1	0-7	SC	1410@30.5	7.48	84	34
A-08-012	Bag-1	35-40	(CL)s	484@42.0	7.88	41	453

TABLE 4-2
Summary of Corrosion Laboratory Test Results

Boring	Sample	Depth (feet)	Soil Type	Minimum Resistivity @ Moisture Content (ohm-cm @ %)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
A-08-013	Bag-1	15-20	(CH)s	606@41.0	7.83	46	180
A-08-013	Bag-2	25-30	CH	1079@42.8	8.17	96	64
A-08-014	Bag-1	0-7	SC	1180@27.5	7.19	85	87
A-08-015	Bag-1	0-7	(CL)s	860@35.5	7.96	43	54
A-08-016	Bag-1	15-20	(CL)s	660@25.0	7.22	79	214
A-08-016	Bag-2	25-30	(CL)s	720@40.0	7.86	82	168
A-08-019	Bag-1	15-20	s(CL)	1683@33.3	8.01	79	48
A-08-020	Bag-1	15-20	(CL)s	456@31.0	7.03	92	591
A-08-021	Bag-1	2-7	s(CL)	705@34.7	8.02	68	94
A-08-022	Bag-1	2-7	SC	1075@28.0	8.22	150	107
A-08-023	Bag-1	20-25	SC	1615@32.0	8.14	81	46
A-08-024	Bag-1	2-7	(CL)s	575@52.1	7.19	251	115
A-08-025	Bag-1	20-25	CL	742@33.2	7.79	148	76
A-08-025	Bag-2	25-30	(CL)s	980@35.7	7.96	88	83
A-08-027	Bag-1	0-7	s(CL)	860@32.0	7.32	216	78
A-08-028	Bag-1	0-7	s(CL)g	1079@33.7	7.80	41	66
A-08-030	Bag-2	25-30	s(CL)	1600@26.0	8.21	70	74

ohm-cm = ohm-centimeter
ppm = parts per million

4.4 Liquefaction

Liquefaction in the northern segment of the project alignment is not a design consideration.

4.5 Global Stability Analyses

The global stability of the proposed earth retaining structures and the slopes associated with these structures within the northern segment was evaluated using the SLIDE (version 5.0) computer software (Rocscience, 2006). The modified Bishop's Method was used to compute the static and the pseudo-static factor of safety for the most critical circular failure surfaces. Generally, a critical section was selected for the global stability analysis of each wall. The section was selected at the maximum wall height or the maximum slope height or at the combination of both, as applicable. A surcharge load of 240 pounds per square foot (psf) was applied for walls retaining roadway at the top of the backfill. Soil properties used in the

analyses are presented in Table 3-2. Both ultimate and peak shear strength were used in the static and pseudo-static analyses, respectively.

In the pseudo-static analyses, a seismic force was applied to the soil mass using a horizontal seismic acceleration coefficient (k_h) depending on the location of the proposed structure. The horizontal seismic acceleration coefficient corresponds to one-third of the peak ground acceleration (PGA) produced by the MCE event.

The minimum requirement for the factors of safety used in the analyses was 1.5 and 1.1 for static and pseudo-static conditions, respectively. Slope stability analyses were performed for all the proposed walls, and the results indicate that the computed factors of safety for the static and pseudo-static cases are greater than 1.5 and 1.1, respectively. Therefore, the proposed retaining walls in the northern segment are considered globally stable at the static and the seismic loading conditions. The results of the global stability analyses are presented in Appendix E.2.

4.6 Wall Type Selection

The proposed widening in the northern segment will require cut and fill grading in the northbound, as a result, several cut walls and fill walls are being considered. Selection of the appropriate retaining wall type depends on several factors that require consideration to the design loads, cross-sectional geometry of the roadway, physical constraints of the site, characteristics of the foundation soil, and the constructability and maintenance of the wall. These factors were evaluated, and the two wall types selected included a cantilever retaining wall and a mechanically stabilized earth (MSE) wall. Generally, the MSE wall can tolerate more differential settlement than the conventional cantilever retaining wall. Therefore, considering the grading for the proposed cross-sectional geometry of the roadway, the characteristics of the foundation soil, and site constraints, the MSE wall was considered feasible for the fill wall construction, and the conventional cantilever retaining wall was considered feasible for the cut wall construction. Within the MSE wall type, if an overhead sign structure is required, a cantilever retaining wall segment will be used to support the sign structure. An exception was made for the selection of cantilever retaining walls to accommodate the proposed surface drainage inlets at the roadway of SR-57. This exception was necessary to avoid the conflict of the drainage inlets with the reinforcement elements of the MSE wall, particularly if several of these inlets are needed within the reinforced zone of the MSE wall. The geotechnical recommendations for the design of the cantilever and the MSE walls are addressed in this report.

4.7 Cantilever Retaining Walls

4.7.1 Wall Types

Two types of conventional cantilever retaining walls are considered in the northern segment, Type 1 walls in the *Standard Plan* (Caltrans, 2006c) and Type 1SWB walls in the *Bridge Standard Detail Sheet XS14-220* (Caltrans, 2008a). Generally, the Standard Type 1SWB retaining wall is considered when a sound wall is required above the retaining wall. The Standard Type 1 wall, however, has the advantage of a narrower base width that makes it more suitable for locations with tight space or right-of-way constraints.

4.7.2 Minimum Embedment and Berm Width

According to the standard plans, the minimum depth of embedment for the footing of the retaining walls depends on the wall height and the minimum requirement for the soil cover. In general, a minimum soil cover at the toe of the wall of 1.5 feet, measured from the adjacent finished grade to the top of the footing, should be provided. A minimum of 3 feet of embedment, measured from the adjacent finished grade to the bottom of the footing, is recommended to conform to the embedment requirement for shallow foundation (Caltrans, 2004). For footings constructed at the top of slopes, a minimum horizontal distance (bench) of 5 feet should be provided between the near face of the footing and the hinge point of the finished slope.

4.7.3 Loading Case

The magnitude and the direction of the loading on the retaining wall footing were evaluated using the loading case design data depending on the wall type. According to Caltrans practice, the effect of the earthquake should be considered for retaining walls designed with low tolerance for failure. This is usually the case when the retaining wall is supporting a bridge abutment or sound walls. Therefore, Standard Type 1 walls are considered for loading case without including the seismic loading from the retaining wall inertia and the lateral earth pressure increase of the backfill material. The loads on the retaining wall included the following loading case design data:

Standard Type 1 Walls

- Surcharge load of 240 pounds per square foot (psf) on the wall backfill
- Dead load of barrier equal to 1,900 pounds per foot (lb/ft) for barriers on the finished grade of the roadway against the stem face of the wall
- Lateral earth pressure using a unit weight of 120 pounds per cubic foot (pcf) and friction angle of 34 degrees for the wall backfill material

Standard Type 1SWB Walls

- Surcharge load of 240 psf on the wall backfill
- Dead load of sound wall equal to 88H lb/ft, where H is the sound wall height
- Dead load of barrier equal to 470 lb/ft for barriers supporting a sound wall
- Wind load of 33 psf
- Lateral earth pressure using a unit weight of 120 pcf and friction angle of 34 degrees for the wall backfill material
- Seismic loading from the wall and the soil equivalent to 0.57 times the wall dead load and the lateral earth pressure using horizontal seismic coefficient of 0.3 g in the Mononobe-Okabe method

4.7.4 Bearing Capacity and Foundation Type

Selection of the foundation type and the bearing capacity depends mostly on the shear strength of the foundation soil; therefore, the bearing capacity varies depending on foundation soil type along the alignment. The bearing capacities at different wall locations were calculated using the methods described in the Caltrans *Bridge Design Specifications* (Caltrans, 2004) for level and sloping ground. Table 4-3 summarizes the proposed wall information, the foundation type, and the recommended allowable bearing capacity. The allowable bearing capacities were estimated from the ultimate bearing capacity using a factor of safety of 3.0, or from the equivalent pressure at the bottom of the footing to produce 1-inch total settlement, whichever is less. If the allowable bearing capacity is less than the wall toe pressure for a given load case, either a deep foundation or a shallow foundation can be selected. Shallow foundations are recommended if the bearing capacity of the foundation soil is greater than the demand; however, adjustment of the standard footing width, for some cases, is necessary to meet the bearing capacity requirement.

4.7.5 Retaining Wall Backdrain

Hydrostatic pressure is not allowed to build up behind the retaining walls. For free draining backfill conditions, weep holes and pervious backfill should be provided as shown on Caltrans *Standard Plans*, sheet B0-3 detail 3-1 (Caltrans, 2006c).

4.8 Nonstandard Retaining Walls

4.8.1 Wall Type

Caltrans Standard MSE wall with precast concrete face panels (5 feet by 5 feet) connected to metallic welded wire mat soil reinforcement is recommended for walls in fill construction. The design details for this wall are shown on the *Bridge Standard Details Sheets* XS 13-020-1e through 6e (Caltrans, 2008a).

4.8.2 Structure Dimensions

The structure dimensions of the MSE walls should be determined to verify that minimum design requirements for external stability are satisfied. In general, the soil reinforcement length should be a minimum of 70 percent of the wall height and not less than 8 feet. The minimum depth of embedment should not be less than 2 feet or 10 percent of the wall height, whichever is greater. In addition, the depth to the lowest level of soil reinforcement should be a minimum of 0.5 feet below the adjacent finished grade in front of the wall. For MSE walls constructed at the top of the slopes, a minimum horizontal distance of 4 feet or 10 percent of the wall height, whichever is greater, should be provided between the face of the wall panels below the ground surface and the hinge point of the finished slope.

TABLE 4-3
Summary of Retaining Walls Foundation Recommendations

Wall No.	Wall LOL Station (feet) From	Wall LOL Station (feet) To	Wall Type	Wall Construction	Foundation Soil Type	Foundation Soil Cohesion (psf)	Foundation Soil Friction (degree)	Design Height (feet)	Foundation Type	Allowable Bearing Capacity (ksf)	Pile Length[1] (feet)	Remarks
RW 592	10+00.00	14+75.00	Type 1	Cut	Qvof	950	30	8 - 16	Shallow	8.5	NA[2]	
RW 598	10+00.00	13+91.15	Type 1	Cut	Qvof	400	38	8 - 18	Shallow	6.5	NA	
RW 604	10+00.00	17+61.00	Type 1	Cut	Qvof	400	38	6 - 16	Shallow	5.0	NA	Grade preparation required[3]
RW 614	10+00.00	10+98.00	1SWB	Fill	Af	900	39	8	Shallow	4.0	NA	
	10+98.00	13+48.00	MSE	Fill	Af	900	39	10 - 15				
	13+48.00	13+93.00	1SWB	Fill	Af	900	39	14				
	13+93.00	17+33.00	MSE	Fill	Af	950	30	10 - 17.5				
	17+33.00	19+60.31	1SW	Cut	Qvof	400	38	8 - 18				Grade preparation required[3]
RW 622	10+00.00	10+32.00	SW	Cut	Qvof	-	30	8	Deep	NA	SP[4]	
	10+32.00	14+94.66	1SW		Qvof	950	30	8 - 18	Shallow	4.5	NA	Grade preparation required[3]
RW 628	10+00.00	10+24.00	1SWB	Cut	Qlh	1800	33	12 - 16	Shallow	7.0	NA	Grade preparation required[3]
	10+24.00	10+48.00	1SWB	Cut	Qlh	1800	33	6 - 8		3.5	NA	Grade preparation required[3]
	10+48.00	12+12.00	1SW	Cut	Qlh	1800	33	6 - 14		7.0	NA	Grade preparation required[3]
	12+12.00	13+33.33	Type 1	Cut	Qlh	1800	33	8 - 16		7.0	NA	Grade preparation required[3]
RW 630	10+00.00	11+48.00	Type 1	Cut	Qvof	950	30	14 - 20	Shallow	5.0	NA	Grade preparation required[3]
	11+48.00	13+10.00	1SW	Cut	Qvof	950	30	10 - 18	Shallow		NA	Grade preparation required[3]
	13+10.00	15+29.81	1SWB	Fill	Af	800	33	8 - 20	Shallow		NA	
	15+29.81	17+99.81	MSE	Fill	Af	800	33	20 - 22.5	Shallow		NA	
	17+99.81	18+24.81	1SWBP	Fill	Af	800	33	22	Deep	NA	30	
	18+24.81	19+44.81	MSE	Fill	Af	800	33	22.5 - 25	Shallow	3.5	NA	
RW 642	10+00.00	13+01.68	MSE	Fill	Af	800	33	17.5 - 22.5	Shallow	7.0	NA	
RW 646	10+00.00	10+50.00	Type 1	Fill	Qvof	950	30	12 - 18	Shallow	5.5	NA	
	10+50.00	12+45.00	MSE	Fill	Qvof	950	30	10 - 12.5				
	12+45.00	12+54.21	Type 1	Cut	Qvof	950	30	8				
RW 658	10+00.00	18+00.00	Type 1	Cut	Qvof	400	38	8 -14	Shallow	4.5	NA	

TABLE 4-3
Summary of Retaining Walls Foundation Recommendations

Wall No.	Wall LOL Station (feet) From	Wall LOL Station (feet) To	Wall Type	Wall Construction	Foundation Soil Type	Foundation Soil Cohesion (psf)	Foundation Soil Friction (degree)	Design Height (feet)	Foundation Type	Allowable Bearing Capacity (ksf)	Pile Length[1] (feet)	Remarks
RW 670	10+00.00	10+99.00	1SWB	Fill	Af	800	33	6	Shallow	4.5	NA	
	10+99.00	15+14.00	MSE	Fill	Af	800	33	7.5 - 17.5	Shallow	2.5	NA	
	15+14.00	15+35.00	1SWBP	Fill	Af	800	33	16	Deep	NA	30	
	15+35.00	19+30.00	MSE	Fill	Af	800	33	17.5	Shallow	2.5	NA	
RW 684	10+00.00	20+35.39	MSE	Fill	Af	800	33	15 - 20	Shallow	2.5	NA	
RW 694	10+00.00	10+68.00	Type 1	Fill	Qvof	100	34	6 - 8	Shallow	2.5	NA	Overexcavate 4 feet
RW 696	10+00.00	10+87.00	Type 1	Fill	Qvof	100	34	10 -12	Shallow	2.5	NA	Overexcavate 4 feet
RW 698	10+00.00	12+25.00	MSE	Fill	Af	250	47	15 - 25	Shallow	6.5	NA	
	12+25.00	12+45.00	1SWBP	Fill	Af	800	33	16	Deep	NA	33	
	12+45.00	18+71.00	1SWB	Fill	Af	800	33	6 - 18	Deep	NA	39	
	18+71.00	19+25.67	Barrier	Fill	Af	800	33					
SW 581	15+60.00	17+54.67	1SWBP	Fill	Qvof	400	38	8 - 10	Deep	NA	26	
SW 599	11+98.62	12+06.62	CIP	Cut	Qvof	400	38	12	Deep	NA	30	
SW603	10+00.00	10+08.00	CIP	Cut	Qvof	400	38	12	Deep	NA	31	
	33+82.46	33+90.46	CIP	Cut	Qvof	400	38	12	Deep	NA	20	
SW627	10+00.00	10+12.00	CIP	Cut	Qvof	400	38	12	Deep	NA	16	

[1] Approximate pile length to provide 45 tons axial capacity, the geotechnical foundations design recommendations are given in Tables 4-5 through 4-7.
[2] NA = Not Applicable.
[3] Overexcavation of 6 inches below the bottom of the footing is recommended.
[4] SP = Standard Plan pile, length is determined based on the pile spacing.

4.8.3 Loading Case

The magnitude and the direction of the loading on the MSE wall footing were evaluated using the loading case design data with and without a sound wall above the MSE wall. Loading Case I (concrete barrier and surcharge load of 240 psf on level ground backfill above the wall) was used for the design of all the MSE walls supporting a concrete barrier and was modified to include additional loads when a sound wall above the MSE wall is required. According to Caltrans practice, the effects of seismic shaking should be considered in the design of retaining walls, with low tolerance for failure. This is usually the case when the retaining wall is supporting a bridge abutment or sound walls; therefore, MSE walls supporting sound walls were considered for the loading case, including the seismic loading from the wall's inertia and the lateral earth pressure increase of the backfill material. The loads on the MSE wall supporting sound walls included the following loading case design data:

- Surcharge load of 240 psf on the wall backfill
- Dead load of sound wall equal to 88H lb/ft, where H is the sound wall height
- Dead load of barrier equal to 470 lb/ft for barriers supporting a sound wall
- Wind load of 33 psf
- Lateral earth pressure using a unit weight of 120 pcf and friction angle of 34 degrees for the wall backfill material
- Seismic loading from the wall and the soil equivalent to 0.57 times the sound wall dead load, 0.3 times the MSE wall dead load, and the lateral earth pressure using horizontal seismic coefficient of 0.3 g in the Mononobe-Okabe method

4.8.4 Barrier Slab

Some of the proposed MSE walls will be required to provide support to sound walls mounted on traffic barriers above the MSE wall. For this case, the barrier slab is designed with 18-inch cast-in-drilled-hole (CIDH) piles installed within the reinforced soil mass at a distance of 4 feet from the center of the pile to the back face of the MSE wall panels. Using the loading case design data and considering the CIDH piles installed at 10 feet on center, the anticipated vertical uplift load ranges between 29 and 35 kips, and the lateral load ranges between 13 and 16 kips per pile. The estimated pile length to provide the required uplift resistance is approximately 22 feet and would apply an estimated lateral pressure of 1,400 psf on the back face of the first panel from top. This additional lateral pressure should be considered in the internal stability analyses of the reinforced soil mass.

4.8.5 External Stability

The preliminary length of the soil reinforcement of the MSE walls were used in the external stability analyses to verify that the walls have adequate factors of safety against bearing capacity failure, sliding, and overturning. The external stability criteria used in the current investigation (Caltrans, 2004) is presented in Table 4-4. If the external stability analyses resulted in a factor of safety less than the minimum, the preliminary length of the soil reinforcement was increased until the stability requirement was satisfied.

TABLE 4-4
Summary of External Stability Requirement

Failure Mode	Minimum Factor of Safety	
	Static	Pseudo-Static[1]
Bearing Capacity	2.0	1.0
Sliding	1.5	1.0
Overturning[2]	2.0	1.0

[1] Pseudo-static factor of safety adopted in the current investigation
[2] Maximum eccentricity of the resultant force acting on the base of the wall should be within the middle one-third of the base width

4.8.6 Internal Stability

The length of the soil reinforcement should be verified in the internal stability analyses to ensure the reinforced soil mass has an adequate factor of safety against soil reinforcement rupture and soil reinforcement pullout. It is the responsibility of the contractor to provide the evaluation for the internal stability of the MSE walls, and the evaluation should conform to the requirements presented in Caltrans *Bridge Design Specifications* (Caltrans, 2004).

4.8.7 Settlement

The maximum anticipated total settlement is estimated to be less than 2 inches and is expected to be mostly elastic and should occur shortly after the construction of the MSE walls.

4.8.8 Reinforced Zone Gradation Requirement

The backfill of the reinforced soil mass should consist of structural backfill material and should conform to the gradation and property requirements in Caltrans *Bridge Design Specifications* (Caltrans, 2004) for the inextensible soil reinforcement. It is anticipated that most of the cut areas will generate material that is predominantly fine grained with percent passing #200 sieve greater than 50. Such material can not be used as structure backfill in the reinforced zone of the MSE walls.

4.8.9 MSE Wall Backdrain

Hydrostatic pressure is not allowed to build up behind the MSE walls. A standard underdrain placed under the welded wire mat soil reinforcement is recommended to drain the anticipated surface runoff. Generally, the underdrain outlets should be placed along the length of the underdrain at a spacing of 200 feet or less, as necessary. The installation of the outlets to drain under the leveling pad is recommended. Due to the anticipated low levels of groundwater in the northern segment, a chimney drain behind the reinforced soil mass is not recommended.

4.9 Overhead Sign Structures and Sound Walls

Several overhead sign structures and sound walls are proposed for the northbound widening in the northern segment. The locations of the overhead sign structures and the sound walls are shown on the General Plan (GP) for retaining walls RW 630, RW 670 and

RW 698, and the GP for the sound walls, respectively. All the proposed overhead sign structures are mounted on nonstandard cantilever retaining walls supported by deep foundations. CIDH concrete piles are generally considered a feasible foundation type for overhead sign structures, except at RW 630 where driven concrete piles are recommended.

For the foundation design of the sound walls, it is recommended to use CIDH piles for the support of all the sound walls proposed within the northern segment. The segment of the proposed SW 581 between Station 15+60.67 and 17+54.67 (wall Layout Line) will traverse the existing 3-foot-diameter reinforced concrete pipe (RCP) pipe. To minimize the impact of the new sound wall on the existing RCP pipe, it is recommended to support sound wall SW 581 between Station 15+60.00 and 17+54.67 on a retaining wall established on pile foundations.

4.9.1 Axial Capacity

The geotechnical axial capacity of the recommended piles was estimated using the computer programs SHAFT version 5.0 (Ensoft, 2003) and APILE version 4.0 (Ensoft, 2004) for the analysis of CIDH and driven piles, respectively. The geotechnical axial capacity of the CIDH concrete piles was estimated using the side resistance along the pile, and both the side resistance and the end bearing were mobilized to estimate the axial capacity of the driven concrete piles. Tables 4-5 and 4-6 present the geotechnical recommendations for the foundation design of the proposed structures. For the Standard Plan sound wall foundations, a friction angle of 30 degrees is recommended for the foundation soil to estimate the length of the CIDH piles.

TABLE 4-5
Driven Pile Foundations Design Recommendations

Support No.	Pile Type	Bottom of Pile Cap Elevation (feet)	Nominal Resistance[1] (Kips)	Design Pile Tip Elevation[2] (feet)	Specified Pile Tip Elevation[3] (feet)	Driving Resistance (Kips)
RW 630	Class 90 12-inch	307.13	180	277.00 (a) 277.00 (c) 292.38 (d)	277	180

[1] The nominal resistance is rounded up to the nearest 10 Kips.
[2] Design pile tip elevations are controlled by: (a) Compression, (c) Settlement, and (d) Lateral Load
[3] The specified pile tip elevation shall not be raised above the design tip elevations for lateral capacity and tolerable settlement.

TABLE 4-6
CIDH Pile Foundations Design Recommendations

Support No.	Wall LOL Station (ft) From	Wall LOL Station (ft) To	Pile Type	Bottom of Pile Cap Elevation (feet)	Nominal Resistance[1] (Kips)	Design Pile Tip Elevation[2] (feet)	Specified Pile Tip Elevation[3] (feet)
SW 581	15+60	17+54.67	16-inch CIDH	277.72	180	252.00 (a) 262.97 (c) 264.97 (d)	252
SW 599	11+98.62	12+06.62	16-inch CIDH	281.95	180	252.00 (a) 261.44 (c) 264.97 (d)	252
SW 603	10+00.00	10+08.00	16-inch CIDH	283.15	180	252.00 (a) 262.64 (c) 272.15 (d)	252
	33+82.46	33+90.46	16-inch CIDH	327.29	180	307.00 (a) 313.71 (c) 311.29 (d)	307
SW 627	10+00.00	10+12.00	16-inch CIDH	328.29	180	313.29 (a) 316.29 (c) 312.00 (d)	312
RW 670	15+14	15+35	16-inch CIDH	355.25	180	325.00 (a) 335.50 (c) 335.50 (d)	325
RW 698	12+25	12+45	16-inch CIDH	407.75	180	375.00 (a) 386.00 (c) 388.00 (d)	375
	12+45	12+71	16-inch CIDH	407.75	180	369.00 (a) 385.75 (c) 387.75 (d)	369
	12+71	14+91	16-inch CIDH	411.25 - 413.00	180	373.00 (a) 389.25 (c) 391.25 (d)	373
	14+91	16+11	16-inch CIDH	415.25 - 417.25	180	377.00 (a) 393.25 (c) 395.25 (d)	377
	16+11	16+75	16-inch CIDH	419.25 - 421.25	180	381.00 (a) 397.25 (c) 399.25 (d)	381
	16+75	17+71	16-inch CIDH	422.25 - 424.25	180	384.00 (a) 400.25 (c) 402.25 (d)	384
	17+71	18+71	16-inch CIDH	426.25 - 428.25	180	388.00 (a) 404.25 (c) 406.25 (d)	388

[1] The nominal resistance is rounded up to the nearest 10 Kips.
[2] Design pile tip elevations are controlled by: (a) Compression, (c) Settlement and (d) Lateral Load.
[3] The specified pile tip elevation shall not be raised above the design tip elevations for lateral capacity and tolerable settlement.

4.9.2 Lateral Capacity

The geotechnical lateral capacity of the piles was evaluated, using LPILE Plus version 5.0 software (Ensoft, 2005). The lateral capacity was estimated at an increment of 0.25 inch to a maximum of 1.0 inch top pile or cap displacement. Table 4-7 shows the shear force and maximum bending moment for the proposed piles assuming a pin-head condition at the top of the pile.

TABLE 4-7
Summary of Lateral Pile Capacities

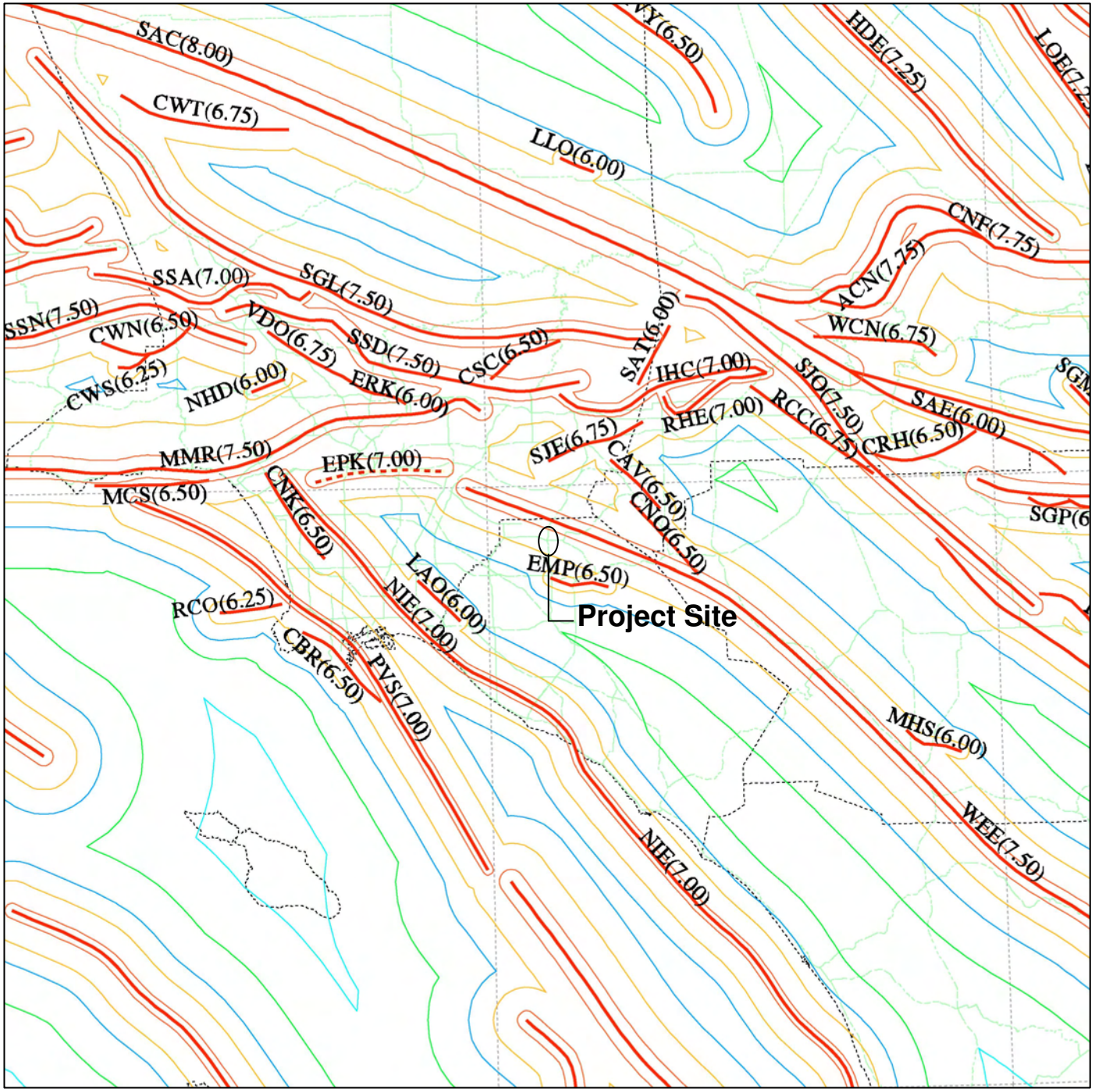
Support	Pile Head Deflection (inches)	Maximum Shear Force (Kips)	Maximum Bending Moment (Kips-foot)	Depth to Maximum Bending Moment [1] (feet)
SW 581 and SW 599	0.25	54	69	2.55
	0.5	85	119	2.85
	0.75	111	164	3.00
	1.0	130	205	3.15
SW 603 and SW 627	0.25	59	75	2.56
	0.5	81	117	3.04
	0.75	97	150	3.20
	1.0	110	180	3.36
RW 630	0.25	15	31	4.20
	0.5	21	48	4.80
	0.75	25	61	5.20
	1.0	28	71	5.60
RW 670	0.25	130	110	1.80
	0.5	210	198	2.00
	0.75	275	275	2.20
	1.0	318	345	2.20
RW 698	0.25	107	90	2.00
	0.5	179	170	2.00
	0.75	236	241	2.20
	1.0	273	303	2.40

[1] Depth is measured from the top of the pile.

The lateral resistance of the pile group could be estimated using group efficiency factor η as follows:

- $\eta = 0.7$, for pile spacing of 3 times pile diameter
- $\eta = 0.9$, for pile spacing of 5 times pile diameter
- $\eta = 1.0$, for pile spacing of 8 times pile diameter

The above group efficiency applies for loading in the longitudinal and the transverse directions. According to Caltrans practice, the allowable horizontal resistance of the piles should be considered as the lateral load evaluated at 0.25-inch pile top or cap displacement (Caltrans, 2008c). Therefore, the horizontal load on the pile from the controlling load case should be less than the allowable horizontal resistance.



ACN	Arrastre Canyon	MVY	Mirage Valley
CAV	Central Avenue	NHD	North Hollywood
CBR	Cabrillo	NIE	Newport-Inglewood-Rose Canyon/W
CNF	Cleghorn-North Frontal	PVS	Palos Verdes
CNK	Charneek	RCC	Rialto-Colton-Claremont
CNO	Chino	RCO	Redonodo Canyon
CRH	Crafton Hills	RHE	Redhill-Etiwanda Avenue
CSC	Clamshell Sawpit Canyon	SAC	San Andreas/C
CWN	Chatworth/N	SAE	San Andreas/S/E
CWS	Chatworth/S	SAT	San Antonio
CWT	Clearwater	SGL	San Gabriel
EMP	El Modeno-Peralta Hills	SGM	San Gorgonio Mountain
EPK	Elysian Park Seismic Zone	SGP	San Gorgonio Pass
ERK	Eagle Rock	SJE	San Jose
HDE	Helendale	SJO	San Jacinto
IHC	Indian Hills Cucamonga	SSA	Santa Susana
LAO	Los Alamitos	SSD	San Fernando Sierra Madre-Duarte
LLO	Llano	SSN	SImi-Santa Rosa-Northridge Hills
LOE	Lenwood-Old Woman Springs/E	VDO	Verdugo
MCS	Malibu Coast/S (offshore)	WCN	Waterman Canyon
MHS	Murietta Hot Spring	WEE	Whittier-Elsinore
MMR	Malibu Coast-Santa Monica-Hollywood-Raymond		

- 0.7g Peak Acceleration Contour
- 0.6g Peak Acceleration Contour
- 0.5g Peak Acceleration Contour
- 0.4g Peak Acceleration Contour
- 0.3g Peak Acceleration Contour
- 0.2g Peak Acceleration Contour
- 0.1g Peak Acceleration Contour
- Special Seismic Source (SSS)
- Faults with Fault Codes (MCE)
- State Highways
- County Boundary
- Latitude & Longitude

North

0 50

Approximate Distance in Kilometers

Source: California Seismic Hazard Map, California Department of Transportation, 1996

FIGURE 4-1

California Seismic Hazard Map
State Route 57 Northbound Widening Project
Orange County, California

CH2MHILL

SECTION 5

Construction Consideration

5.1 Site Preparation

Site preparation for the proposed retaining walls will include removal of surface vegetation, organic soil, and any trash or debris in the areas where structure foundations will be located. Loose, soft, or wet material should be removed and replaced with competent backfill. Removed material should not be used as structure backfill and should be disposed of offsite. The subgrade within the footprint of the proposed abutments should be graded level, proof-rolled, and compacted as described in Section 5.6. Drainage structures and other existing structures might need to be removed or protected prior to construction of the abutments.

Site preparation shall be performed in accordance with Sections 16 and 19 of the Caltrans *Standard Specifications* (Caltrans, 2006d).

5.2 Rippability

Geophysical surveys were not performed to evaluate the rippability of the subsurface material in the northern segment. However, all the locations for the proposed cuts for the construction of the proposed retaining walls are in the areas underlain by the very old alluvial deposits. Based on the information from the soil borings in these areas, it is anticipated that the alluvial deposits can be excavated using standard heavy-duty construction equipment. Oversized materials might be encountered within these deposits.

5.3 Temporary Cuts

Excavation of the temporary cut slopes greater than 5 feet in height should be no steeper than a gradient of 1:1 (horizontal to vertical), or as the field conditions dictate, to provide safe and stable slopes. All temporary excavations should be performed in accordance with the safety requirements of California Occupational Safety and Health Administration. Shoring, if required, could be designed in accordance with methods presented in the Caltrans *Trenching and Shoring Manual* (Caltrans, 1990b). It is the responsibility of the contractor to provide stable excavation for the temporary cuts at the site.

5.4 Remedial Grading

If unsuitable materials, such as loose or soft soil, are encountered below the grading plane for the retaining walls footings, an overexcavation will be required. The overexcavation should extend a minimum depth of 4 feet below the bottom of the footings within the limits established by inclined planes sloping 1.5:1 (horizontal to vertical) out and down from lines 1 foot outside the bottom edges of the footings. The excavated material should be replaced with a structural backfill material as described in Section 5.5, and compacted as described in

Section 5.6. If expansive material is encountered in the proposed cut sections, the overexcavation should extend a minimum depth of 6 inches below the bottom of the footings, and out and down from lines 1 foot outside the bottom edges of the footings.

5.5 Structural Backfill

Specifications for the structural backfill material should conform to Section 19-3.06 of Caltrans *Standard Specifications* (Caltrans, 2006d).

5.6 Compaction

Structural backfill for the proposed retaining walls should be compacted to a relative compaction of not less than 90 percent in accordance with ASTM D1557. If the structural backfill for the retaining wall is within a 150 feet from a bridge abutment, the structural backfill should be compacted to a relative compaction of not less than 95 percent.

In the event the retaining wall is constructed on the slopes of the existing roadway embankment fills, a relative compaction of not less than 95 percent is required for the structural backfill under the retaining wall footings within the limits established by inclined planes slopping 1.5:1 (horizontal to vertical) out and down from lines 1 foot outside the bottom edges of the footings. The depth of the structural backfill under the retaining wall should extend to the native material, or to a depth not greater than the footing width.

5.7 Geotechnical Observation

Preparations for subgrade and backfill selection and placement should be observed by a geotechnical specialist or a technician under the supervision of a geotechnical specialist. Variations in soil and geologic conditions might be encountered during construction. To permit correlation between the exploration data and the actual conditions encountered during construction, a qualified geotechnical specialist should perform onsite review during construction.

5.8 Review of Construction Plans and Specifications

A geotechnical designer should review the construction plans and the specifications to verify that the geotechnical recommendations have been incorporated into the design of the proposed retaining walls. If the nature, design, or location of the proposed retaining walls varies from what was used to develop the recommendations provided in this report, the recommendations should be re-evaluated.

SECTION 6

References

American Society for Testing and Materials (ASTM). 2007. *Annual Book of Standards. Soil and Rock; Dimension Stone; Geosynthetics.* Volumes 04.08 and 04.09.

American Association for State Highway and Transportation Officials (AASHTO). 2007. *Load and Resistance Factor Design Bridge Design Specifications. Customary U.S. Units, 4th Edition*.

Bilodeau, W.L., S.W. Bilodeau, E.M. Gath, M. Oborne, and R.J. Proctor. 2007. "Geology of Los Angeles, California, United States of America: Association of Environmental and Engineering Geologists and Geological Society of America." *Environmental & Engineering Geoscience Bulletin*. Vol. XIII, No. 2. Pp. 99-160.

California Department of Transportation (Caltrans). 1972. As-built Project Plans for Construction on State Highway, Orange County in and near Fullerton and Brea between 0.1-mile north of Imperial Highway and 0.3-mile south of Los Angles County Line, California, December 12.

California Department of Transportation (Caltrans). 1970. As-built Project Plans for Construction on State Highway, Orange County in Fullerton and Brea between Nutwood Avenue and 0.3 mile north of Imperial Highway, California. September.

California Department of Transportation (Caltrans). 1990a. *Standard Test Methods,* Volumes I, II, and III. Testing & Control Procedures.

California Department of Transportation (Caltrans). 1990b. *Trenching and Shoring Manual*. January.

California Department of Transportation (Caltrans). 1996a. California Seismic Hazard Map (based on maximum credible earthquakes). July.

California Department of Transportation (Caltrans). 1996b. *A Technical Report to Accompany the Caltrans Seismic Hazard Map.* Prepared by L. Mualchin. July.

California Department of Transportation (Caltrans). 1998. *Bridge Memo to Designers 3-1.* Memorandum.

California Department of Transportation (Caltrans). 2003. *Corrosion Guidelines Version 1.0, Division of Engineering Services, Material Engineering and Testing Services, Corrosion Technology Branch*. September.

California Department of Transportation (Caltrans). 2004. *Bridge Design Specifications*. August.

California Department of Transportation (Caltrans). 2006a. *Guidelines for Structures Foundation Investigation and Reports.* Version 2.0. March.

California Department of Transportation (Caltrans). 2006b. *Seismic Design Criteria*. Version 1.4. June.

California Department of Transportation (Caltrans). 2006c. *Standard Plans.* May.

California Department of Transportation (Caltrans). 2006d. *Standard Specifications.* May.

California Department of Transportation (Caltrans). 2007. *Soil and Rock Logging, Classification, and Presentation Manual*. Division of Engineering Services, Geotechnical Services. June.

California Department of Transportation (Caltrans). 2008a. *Bridge Standard Detail Sheets* (XS sheet). May.

California Department of Transportation (Caltrans). 2008b. *Bridge Design Aids*, Interim. September.

California Department of Transportation (Caltrans). 2008c. *Memo to Designers 3-1*. July.

California Division of Mines and Geology (CDMG). 1997. *Seismic Hazard Zone Report for the La Habra 7.5-Minute Quadrangle*. Los Angeles and Orange Counties, California: Seismic Hazard Zone Report 09.

California Geologic Survey (formerly CDMG). 1998. *Seismic Hazard Zones, La Habra Quadrangle*. April.

California Geologic Survey (CGS). 2005. *Seismic Hazard Zones, Yorba Linda Quadrangle*. August.

California Geologic Survey (CGS). 2007. *Fault-Rupture Hazard Zones In California*. Special Publication 42, Interim Revision.

California Geological Survey (CGS). 2002. *California Geomorphic Provinces, Note 36*.

CH2M HILL. 2008a. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Bastanchury Road Undercrossing, Bridge No. 55-0465.* Prepared for Orange County Transportation Authority. July.

CH2M HILL. 2008b. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Rolling Hills Drive Undercrossing, Bridge No. 55-0483.* Prepared for Orange County Transportation Authority. July.

CH2M HILL. 2008c. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Associated Road Undercrossing, Bridge No. 55-0466.* Prepared for Orange County Transportation Authority. July.

CH2M HILL. 2008d. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Birch Street Undercrossing, Bridge No. 55-0485.* Prepared for Orange County Transportation Authority. July.

CH2M HILL. 2008e. *Preliminary Foundation Report, SR-57 Northbound Widening (Northern Segment), Brea Overhead, Bridge No. 55-0482.* Prepared for Orange County Transportation Authority. August.

Department of Water Resources (DWR). 2004. *Coastal Plain of Orange County Groundwater Basin, California's Groundwater*. Bulletin 118. February.

Department of Water Resources (DWR). 1967. *Progress Report on Groundwater Geology of the Coastal Plain of Orange County*.

Earth Mechanics Inc. 2007. Updated Preliminary Foundation Reports and Preliminary Pavement Structural Sections, SR-57: NB Widening Project. March.

Ensoft, Inc. 2003. SHAFT. Version 5.0.

Ensoft, Inc. 2004. APILE. Version 4.0.

Ensoft, Inc. 2005. LPILE Plus. Version 5.0.

Morton, D.M. 2004. *Preliminary Digital Geologic Map of the Santa Ana 30′ x 60′ Quadrangle.* Southern California: SCAMP – Southern California Mapping Project, Open-File Report 99-172, Version 2.0. Prepared by the United States Geological Survey in cooperation with the California Geological Survey.

Rocscience. 2006. SLIDE, version 5.0.

Sadigh, K., C.Y. Chang, J.A. Egan, F. Makdisi, and R.R. Youngs. 1997. "Attenuation Relationships for Shallow Crustal Earthquakes based on California Strong Motion Data." *Seismological Research Letters*. Volume 68, No. 1. Pp. 180-189.

Shaw, J.H., and P.M. Shearer. 1999. "An Elusive Blind-Thrust Fault beneath Metropolitan Los Angeles." *Science*. Vol. 283. Pp. 1516-1518.

ATTACHMENTS

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: May 3, 2010
File: 12-ORA-57-PM 18.4/20.9
12-0F0321

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 1 MS # 18

Retaining Walls & Sound Walls
SR-57 Northbound Widening

Subject: Reply to Consultant's 2nd Response

On April 29, 2010, we received an email attachment of Consultant's 2nd Response to Final Foundation Report review dated February 10, 2010. The following replies are based on CH2MHILL's Response dated April 28, 2010 to our February 24, 2010 reply comments.

Caltrans Comment (02/10/10):
2) Partial layout of RW 592 should be deleted in Plan View of Sound Wall No. 589.

CH2M Response (04/28/10):
Please, let us know if the SW 589 LOTB needs to be revised at this stage.

Caltrans Reply (05/03/10):
Please correct the Plan View of SW 589 LOTB.

Caltrans Comment (02/10/10):
3) Partial layout of RW 592 should be deleted in Plan View of Sound Wall No. 598.

CH2M Response (04/28/10):
Please, let us know if the SW 598 LOTB needs to be revised at this stage.

Caltrans Reply (05/03/10):
Please correct the Plan View of SW 598 LOTB.

Response to comments 1, 4 & 5 are acceptable. 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:

REGISTERED PROFESSIONAL ENGINEER
CHI-TSENG TED LIU
No. 2669
Exp. 6-30-2010
GEOTECHNICAL
STATE OF CALIFORNIA

Retaining Walls and Sound Walls
SR-57 Northbound Widening

Response to Caltrans Reply comments (02/24/2010) on 2nd Review of Final Foundation Report

Appendix B – Log of Test Borings (LOTB) Sheets

Caltrans Comment:

1) Bridge No. Designation is not required as presented in LOTB of Sound Wall No. 581.

Response by CH2M:

A bridge number was assigned by Caltrans and was used as provided to us.

Caltrans Reply:

Based on phone conversation with Mr. Seyed Moakhar (Liaison Engineer), it is not Caltrans policy to assign bridge No. to any sound wall.

Response by CH2M (04/28/2010):

Though it is named Sound Wall No. 581, a portion of it is non-standard retaining wall. Please, refer to the attached e-mail where bridge numbers were given .

Caltrans Comment:

2) Partial layout of RW 592 should be deleted in Plan View of Sound Wall No. 589.

Response by CH2M:

The plan view of Sound Wall No. 589 is OK as it is at this time.

Caltrans Reply:

The actual plan view of sound wall No. 589 is not in question, but portion of the RW 592 layout that is showing on the NB side!

Response by CH2M (04/28/2010):

Please, let us know if the SW 589 LOTB needs to be revised at this stage.

Caltrans Comment:

3) Partial layout of RW 592 should be deleted in Plan View of Retaining Wall No. 598.

Response by CH2M:

The plan view of Sound Wall No. 598 is OK as it is at this time.

Caltrans Reply:

Again the actual plan view of retaining wall (not sound wall) No. 598 is not in question, but portion of the RW 592 layout that is showing south of begin retaining wall 598!

Response by CH2M (04/28/2010):

Please, let us know if the RW 598 LOTB needs to be revised at this stage.

Caltrans Comment:

4) As Built LOTBs of Bastanchury Road UC (Br. #55-0465) and Rolling Hills Drive UC (Br. #55-0483) should be included in Log of Test Borings of Sound Wall No. 603.

Response by CH2M:

The as-built LOTBs of Bastanchury Road UC and Rolling Hills Drive UC will be included in the LOTB sheets for Sound Wall No. 603.

Caltrans Reply:

The response is satisfactory.

Response by CH2M (04/28/2010):

SW 603 plans already being revised to include the as-built LOTBs of those bridges . Only the Final Foundation Report (for Retaining Walls & Sound Walls) needs to be updated.

Caltrans Comment:

5) The reason for providing two sets of LOTBs for Retaining Wall No. 670, one set has 2 sheets (1 of 3 & 2 of 3, 3 of 3 is missing); second set has 4 sheets (1 of 4 to 4 of 4). Also begin wall is marked at 672+77.72 but layout plan (A-8) shows RW 670 to be extended to about station ±670+00.

Response by CH2M:

Set one was misplaced in the final submittal and should be removed.

Caltrans Reply:

Second part of this comment (Also begin wall is marked…) is not answered.

Response by CH2M (04/28/2010):

The correct "Begin Wall" station of RW No. 670 is 672+77.72. That is consistent with the latest plans. The sheet A-8 in the report will be revised to reflect that.

State of California | Business, Transportation and Housing Agency

M e m o r a d u m

Flex your power!
Be energy efficient!

TO: **MR. SUDHAKAR VATTI**
Office of Special Funded Projects

Date: February 10, 2010
File: 12-ORA-57-PM 18.4/20.9
12-0F0321

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design -South 1 MS # 18

Retaining Walls & Sound Walls
SR-57 Northbound Widening

Subject: 2nd Review of the Final Foundation Report

On November 10, 2009, we received an email attachment of Final Foundation Report for retaining walls and sound walls as part of the SR-57 Northbound improvement between Yorba Linda Blvd. to Lambert Road. The following comments are based on review of the subject report prepared by CH2M HILL, dated September 28, 2009. Original review dated July 13, 2009, was conducted by Chungkeun Lee which is currently on rotation.

Appendix B – Log of Test Borings (LOTB) Sheets

- Bridge No. Designation is not required as presented in LOTB of Sound Wall No. 581.

  A bridge number was assigned by Caltrans and was used as provided to us.

- Partial layout of RW 592 should be deleted in Plan View of Sound Wall No. 589.

  The plan view of Sound Wall No. 589 is OK as it is at this time.

- Partial layout of RW 592 should be deleted in Plan View of Retaining Wall No. 598.

  The plan view of Sound Wall No. 598 is OK as it is at this time.

- As Built LOTBs of Bastanchury Road UC (Br. #55-0465) and Rolling Hills Drive UC (Br. # 55-0483) should be included in Log of Test Borings of Sound Wall No. 603.

  The as-built LOTBs of Bastanchury Road UC and Rolling Hills Drive UC will be included in the LOTB sheets for Sound wall No. 603.

- The reason for providing two sets of LOTBs for Retaining Wall No. 670, one set has 2 sheets (1 of 3 & 2 of 3, 3 of 3 is missing); second set has 4 sheets (1of 4 to 4 of 4). Also begin wall is marked at 672+77.72 but layout plan (A-8) shows RW 670 to be extended to about station ±670+00.

  Set one was misplaced in the final submittal and should be removed.

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: 2/10/2010

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. 2069
Exp. 6-30-2010
GEOTECHNICAL
STATE OF CALIFORNIA

"Caltrans improves mobility across California"

APPENDIX A

Wall Layouts and Boring Location Map

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	1	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

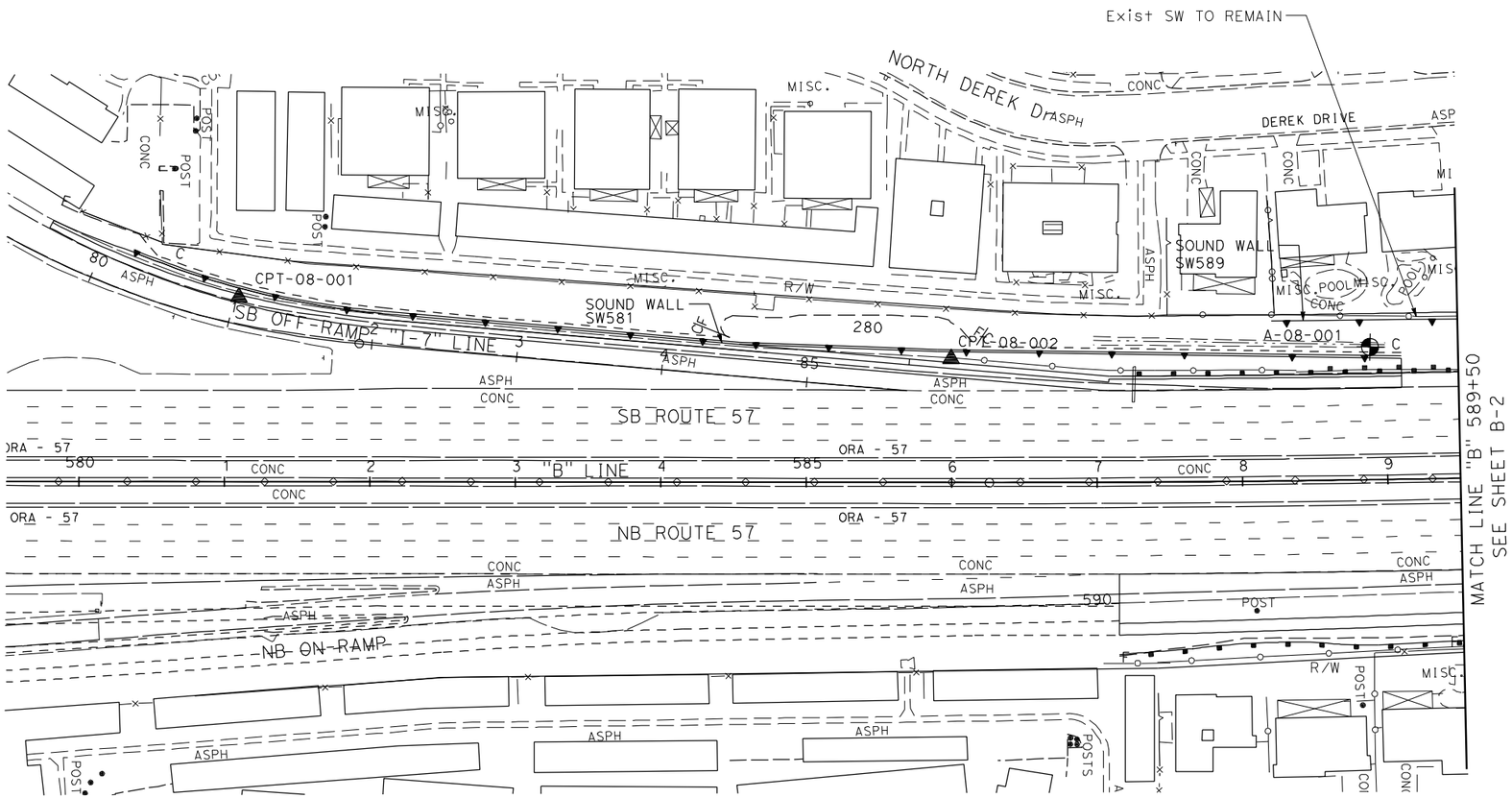
CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-001	588+89.2	91.4' Lt	31.5'	286.2'
CPT-08-001	581+09.55	126.8' Lt	30.2'	281.7'
CPT-08-002	585+99.60	85.1' Lt	30.2'	284.7'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)



LEGEND

▲ CONE PENETRATION TEST

⊕ HOLLOW STEM AUGER BORING

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50'

A-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA

CALCULATED-DESIGNED BY: RYAN MITRY X

CHECKED BY: MARK FRICKE X

REVISED BY / DATE REVISED

LAST REVISION 00-00-00 | DATE PLOTTED => $DATE | TIME PLOTTED => $TIME

BORDER LAST REVISED 2/1/2008 | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | USERNAME => $USER | DGN FILE => $REQUEST | CU 12220 | EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	2	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

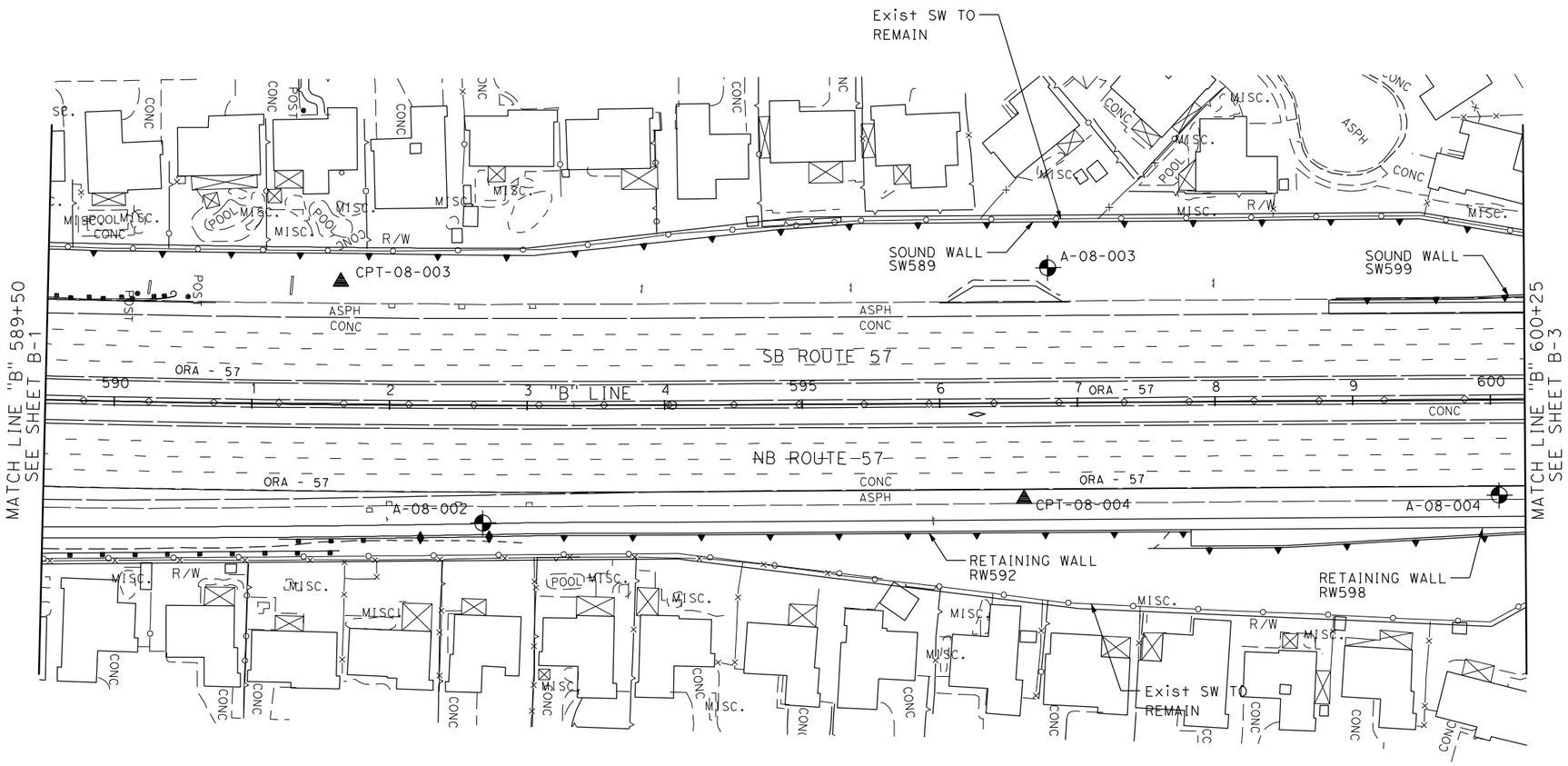
CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-002	592+68.1	85.4' Rt	31.5'	288.8'
A-08-003	596+78.9	98.0' Lt	31.5'	292.2'
A-08-004	600+05.7	69.3' Rt	31.5'	294.4'
CPT-08-003	591+63.91	89.2' Lt	30.1'	290.9'
CPT-08-004	596+60.81	69.8' Rt	30.2'	291.6'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)



LEGEND

▲ CONE PENETRATION TEST

⊕ HOLLOW STEM AUGER BORING

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50'

A-2

REVISED BY	DATE REVISED
BRYAN MITRY	
MARK FRICKE	

CALCULATED-DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR

THOMAS IONTA

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	3	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

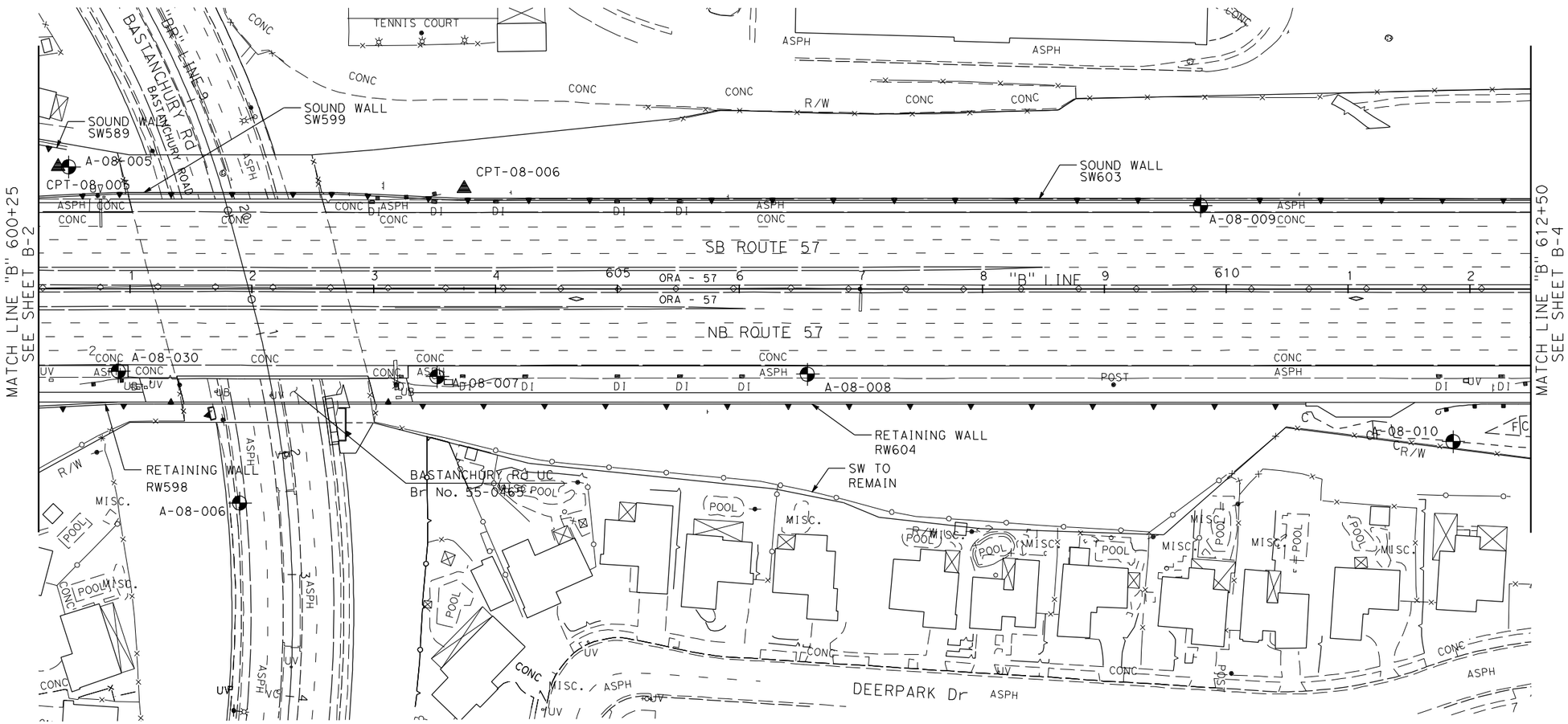
BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-005	600+49.6	100.3' Lt	31.5'	295.0'
A-08-006	601+90.0	175.8' Rt	31.5'	274.2'
A-08-007	603+52.1	72.0' Rt	12.0'	296.8'
A-08-008	606+56.1	69.9' Rt	31.5'	299.2'
A-08-009	609+78.7	68.7' Lt	31.5'	301.4'
A-08-010	611+86.1	125.1' Rt	31.5'	302.8'
A-08-030	600+90.2	67.6' Rt	61.5'	295.0'
CPT-08-005	600+41.02	100.5' Lt	30.2'	295.2'
CPT-08-006	603+75.01	82.6' Lt	30.2'	296.1'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)

LEGEND

- CONE PENETRATION TEST
- HOLLOW STEM AUGER BORING



WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50'

A-3

FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA

CALCULATED-DESIGNED BY: BRYAN MITRY

CHECKED BY: MARK FRICKE

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

BORDER LAST REVISED 2/1/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 12220

EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	4	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

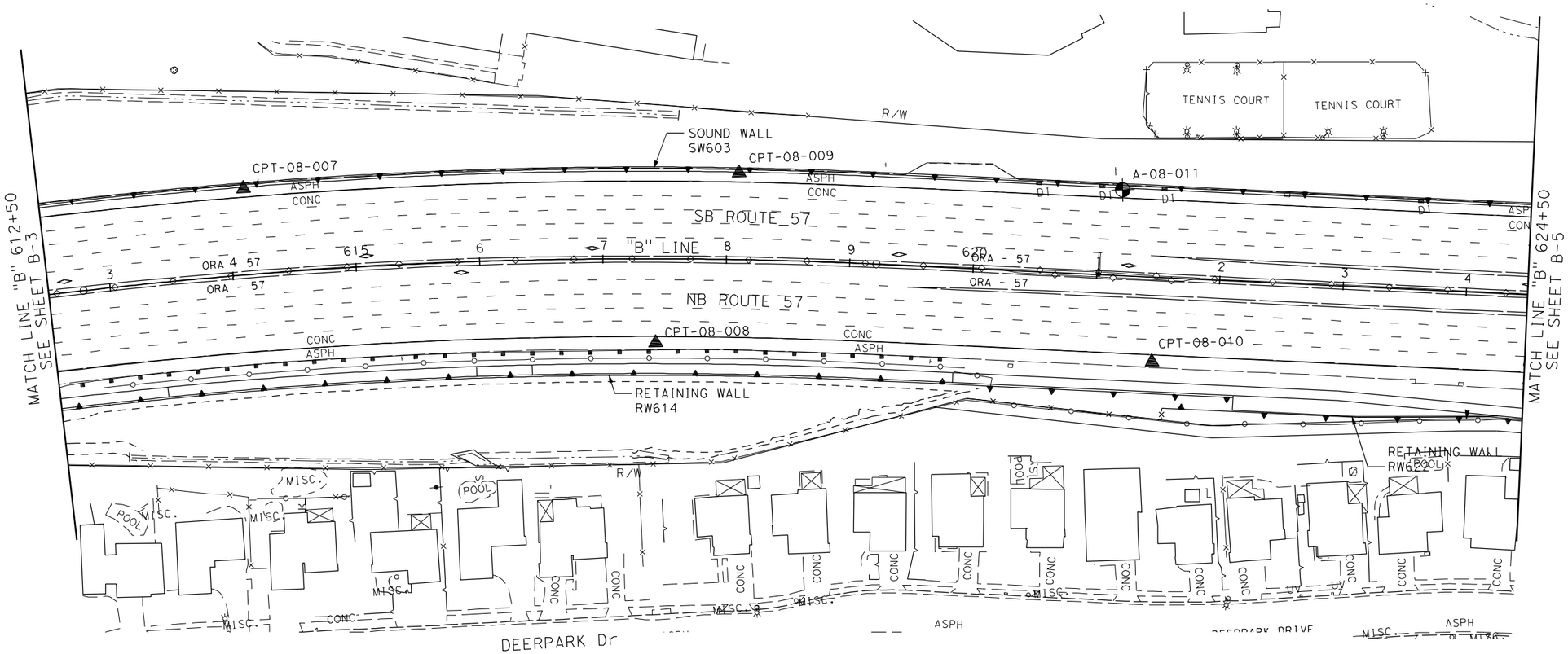
No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-011	621+17.9	69.6' Lt	31.5'	332.4'
CPT-08-007	614+14.17	69.9' Lt	30.2'	313.7'
CPT-08-008	617+42.99	68.1' Rt	50.2'	319.3'
CPT-08-009	618+08.98	70.5' Lt	30.2'	325.6'
CPT-08-010	621+48.22	68.6' Rt	30.2'	332.6'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)

LEGEND

▲ CONE PENETRATION TEST

⊕ HOLLOW STEM AUGER BORING



FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50'

A-4

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA

CALCULATED-DESIGNED BY: BRYAN MITRY

CHECKED BY: MARK FRICKE

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

BORDER LAST REVISED 2/1/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => $USER

DGN FILE => $REQUEST

CU 12220

EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	5	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-012	626+09.6	116.1' Rt	71.5'	360.7'
A-08-013	626+28.0	68.8' Rt	71.5'	347.4'
A-08-014	632+55.5	71.4' Lt	31.5'	339.8'
A-08-015	634+82.7	69.8' Rt	31.5'	341.1'
CPT-08-011	625+02.69	68.5' Lt	30.1'	339.7'
CPT-08-012	628+92.64	70.4' Lt	30.2'	342.1'
CPT-08-013	631+20.11	69.9' Rt	35.1'	346.9'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)

LEGEND

CONE PENETRATION TEST

HOLLOW STEM AUGER BORING

FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50'

A-5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA

CALCULATED-DESIGNED BY: RYAN MITRY

CHECKED BY: MARK FRICKE

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

BORDER LAST REVISED 2/1/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 12220

EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	6	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

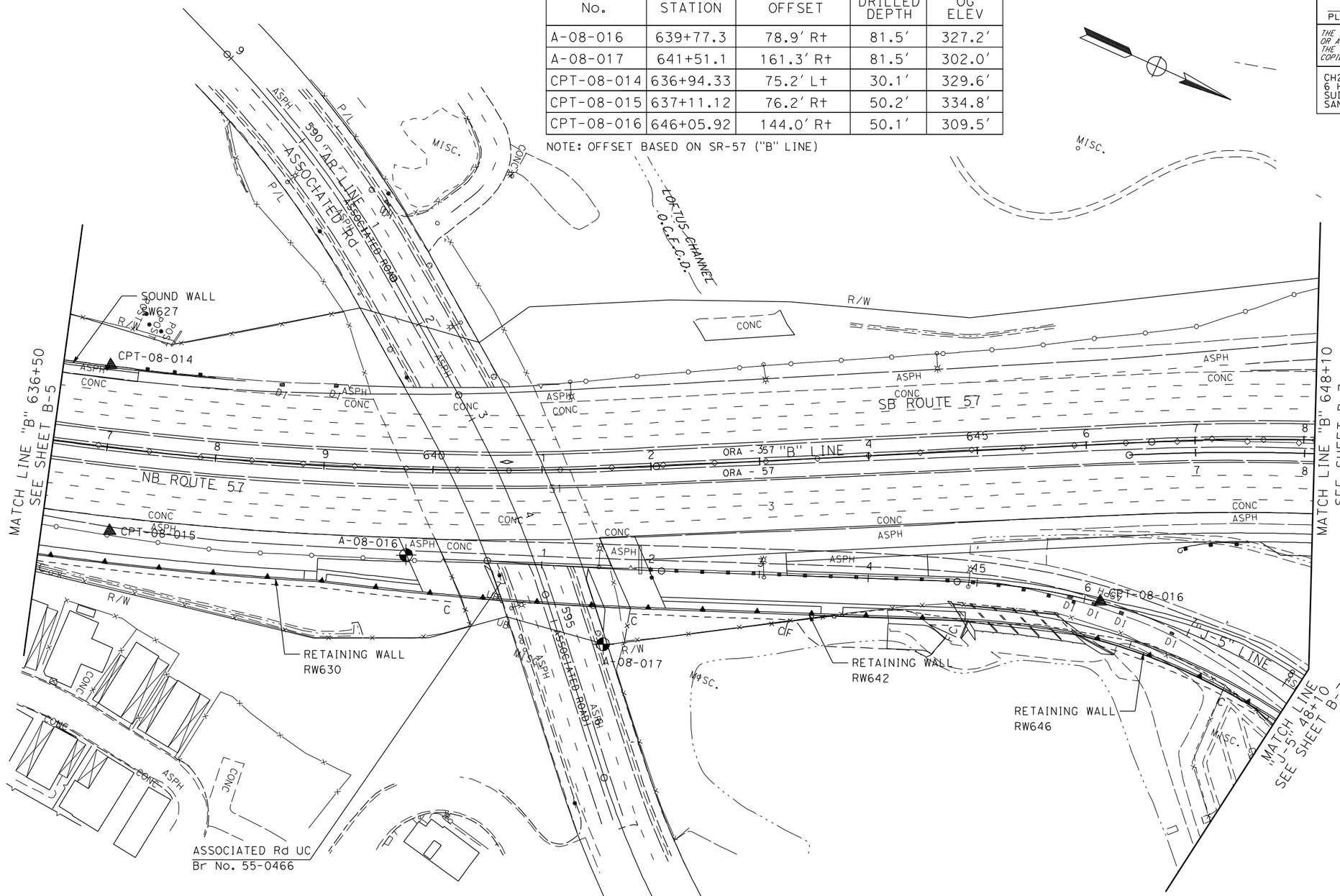
CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-016	639+77.3	78.9' Rt	81.5'	327.2'
A-08-017	641+51.1	161.3' Rt	81.5'	302.0'
CPT-08-014	636+94.33	75.2' Lt	30.1'	329.6'
CPT-08-015	637+11.12	76.2' Rt	50.2'	334.8'
CPT-08-016	646+05.92	144.0' Rt	50.1'	309.5'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)



FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50'

A-6

REVISED BY | DATE REVISED
RYAN MITRY | MARK FRICKE
CALCULATED-DESIGNED BY | CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR
THOMAS IONTA

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 00-00-00 | DATE PLOTTED => $DATE | TIME PLOTTED => $TIME

BORDER LAST REVISED 2/1/2008 | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | USERNAME => $USER | DGN FILE => $REQUEST | CU 12220 | EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	7	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

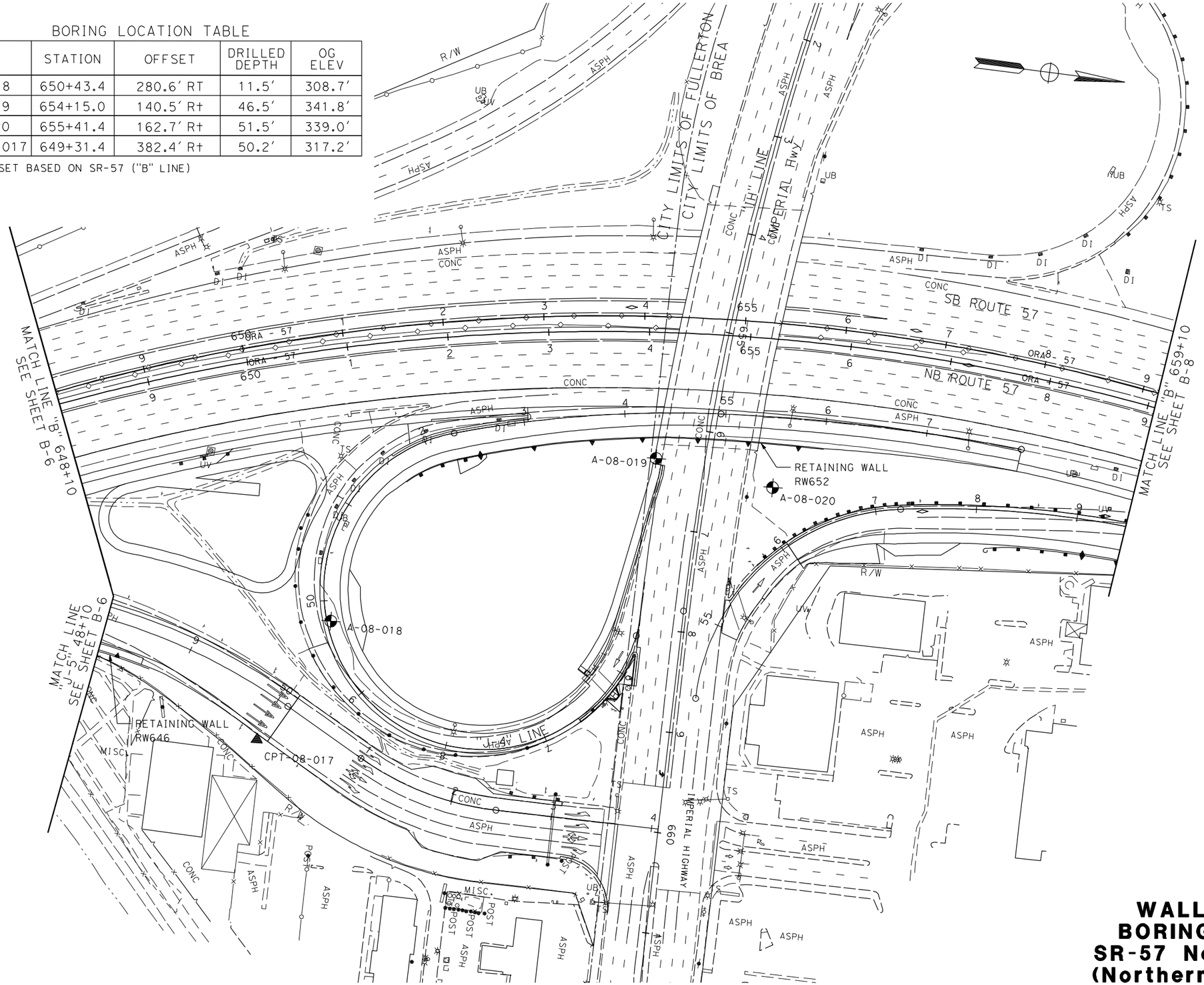
CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-018	650+43.4	280.6' RT	11.5'	308.7'
A-08-019	654+15.0	140.5' Rt	46.5'	341.8'
A-08-020	655+41.4	162.7' Rt	51.5'	339.0'
CPT-08-017	649+31.4	382.4' Rt	50.2'	317.2'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)



FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

LEGEND

▲ CONE PENETRATION TEST

✦ HOLLOW STEM AUGER BORING

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50'

A-7

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA

CALCULATED-DESIGNED BY: RYAN MITRY

CHECKED BY: MARK FRICKE

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

BORDER LAST REVISED 2/1/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 12220

EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	8	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
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.

CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

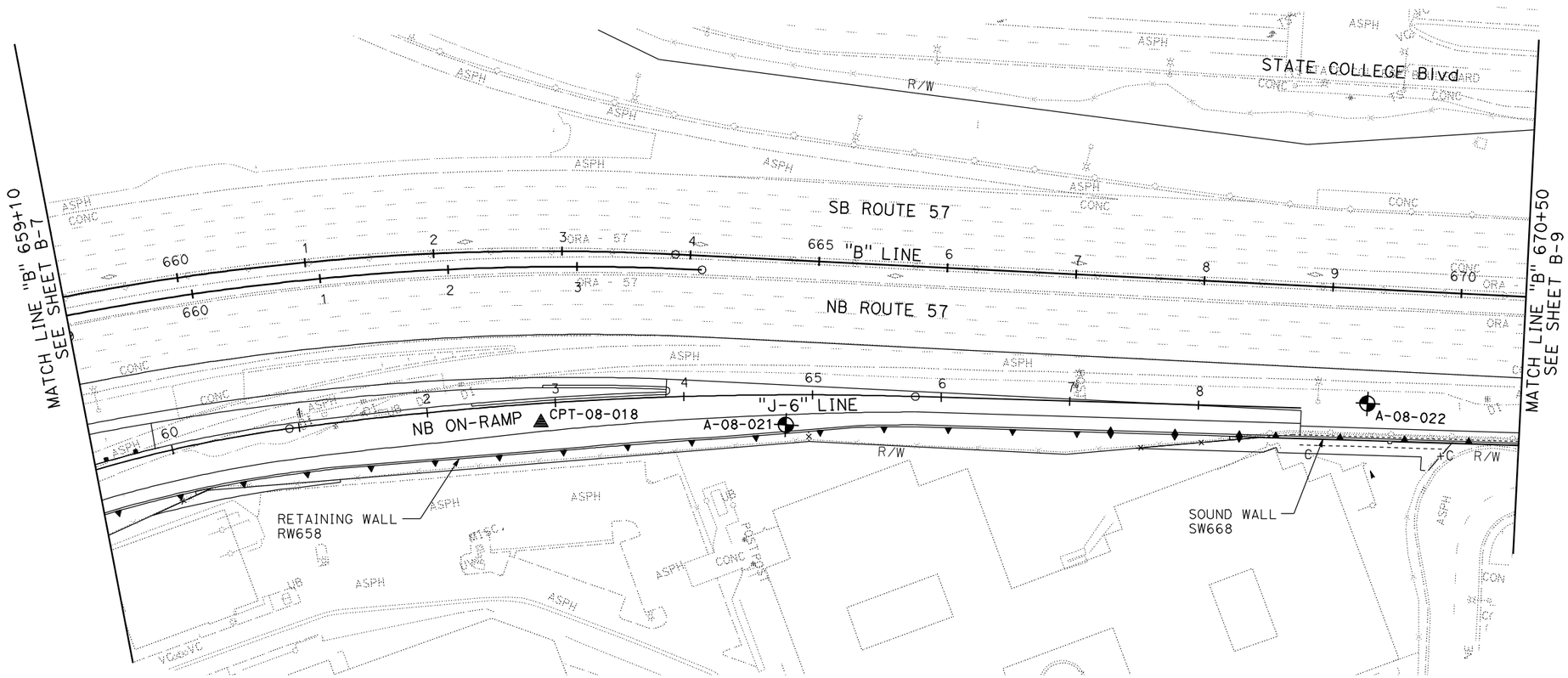
No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-021	664+80.6	122.0′ Rt	31.5′	339.5′
A-08-022	669+31.1	88.9′ Rt	31.5′	349.9′
CPT-08-018	662+83.37	133.3 Rt	30.2′	332.2′

NOTE: OFFSET BASED ON SR-57 ("B" LINE)

LEGEND

CONE PENETRATION TEST

HOLLOW STEM AUGER BORING



FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50′

A-8

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA
CALCULATED-DESIGNED BY: RYAN MITRY
CHECKED BY: MARK FRICKE
REVISED BY
DATE REVISED

LAST REVISION 00-00-00
DATE PLOTTED => 06-MAY-2010
TIME PLOTTED => 16:34

BORDER LAST REVISED 2/1/2008
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
USERNAME => nmorales
DGN FILE => c0F032gt008.dgn
CU 12220
EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	9	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

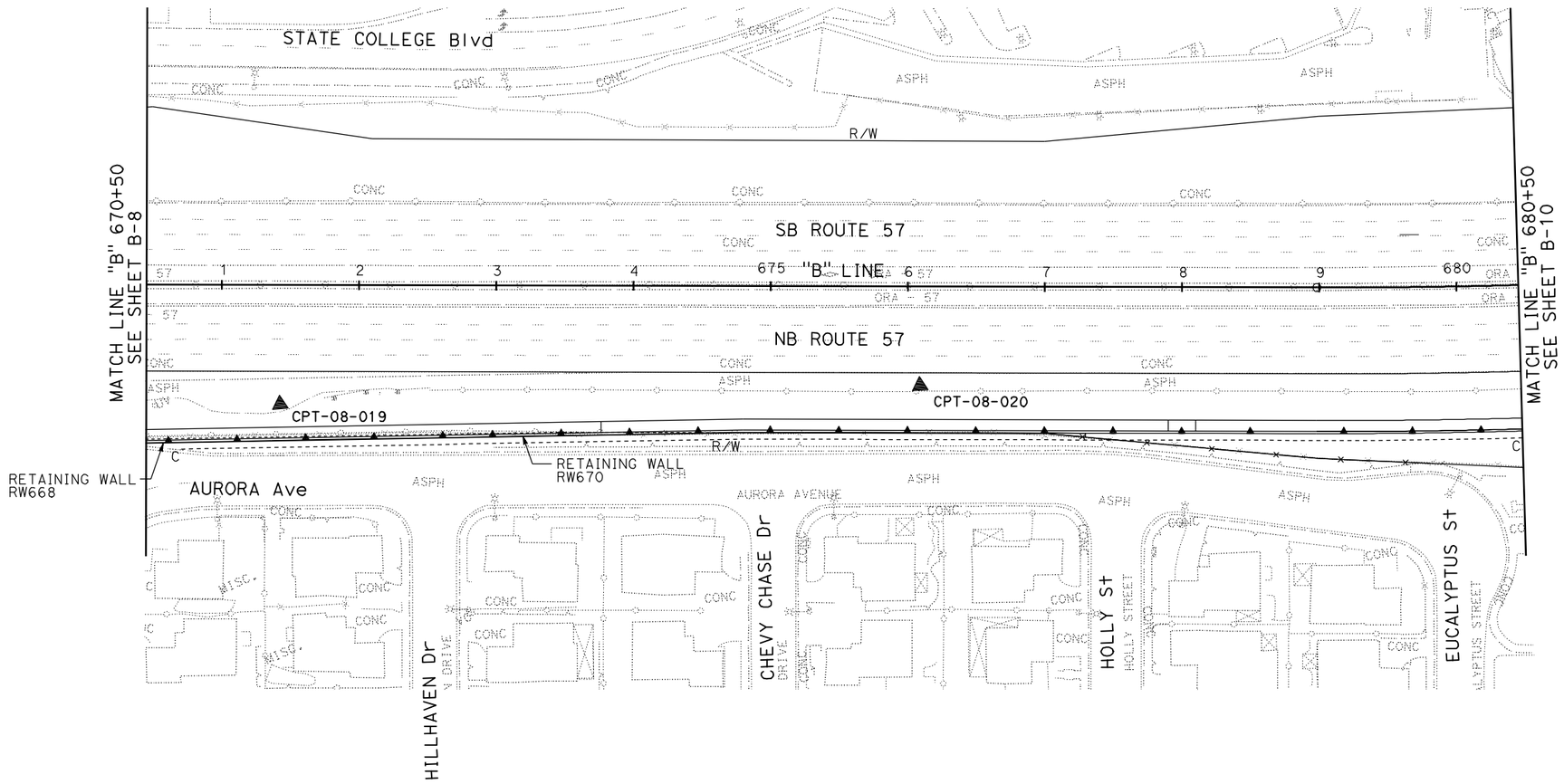
CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
CPT-08-019	671+42.67	86.9' Rt	30.1'	354.0'
CPT-08-020	676+09.05	72.3' Rt	30.3'	366.4'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)



LEGEND

- ▲ CONE PENETRATION TEST
- ⊕ HOLLOW STEM AUGER BORING

FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50'

A-9

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA

CALCULATED-DESIGNED BY: RYAN MITRY

CHECKED BY: MARK FRICKE

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 06-MAY-2010
TIME PLOTTED => 16:37

BORDER LAST REVISED 2/1/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => nmorales
DGN FILE => c0F032gt009.dgn

CU 12220

EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	10	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
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.

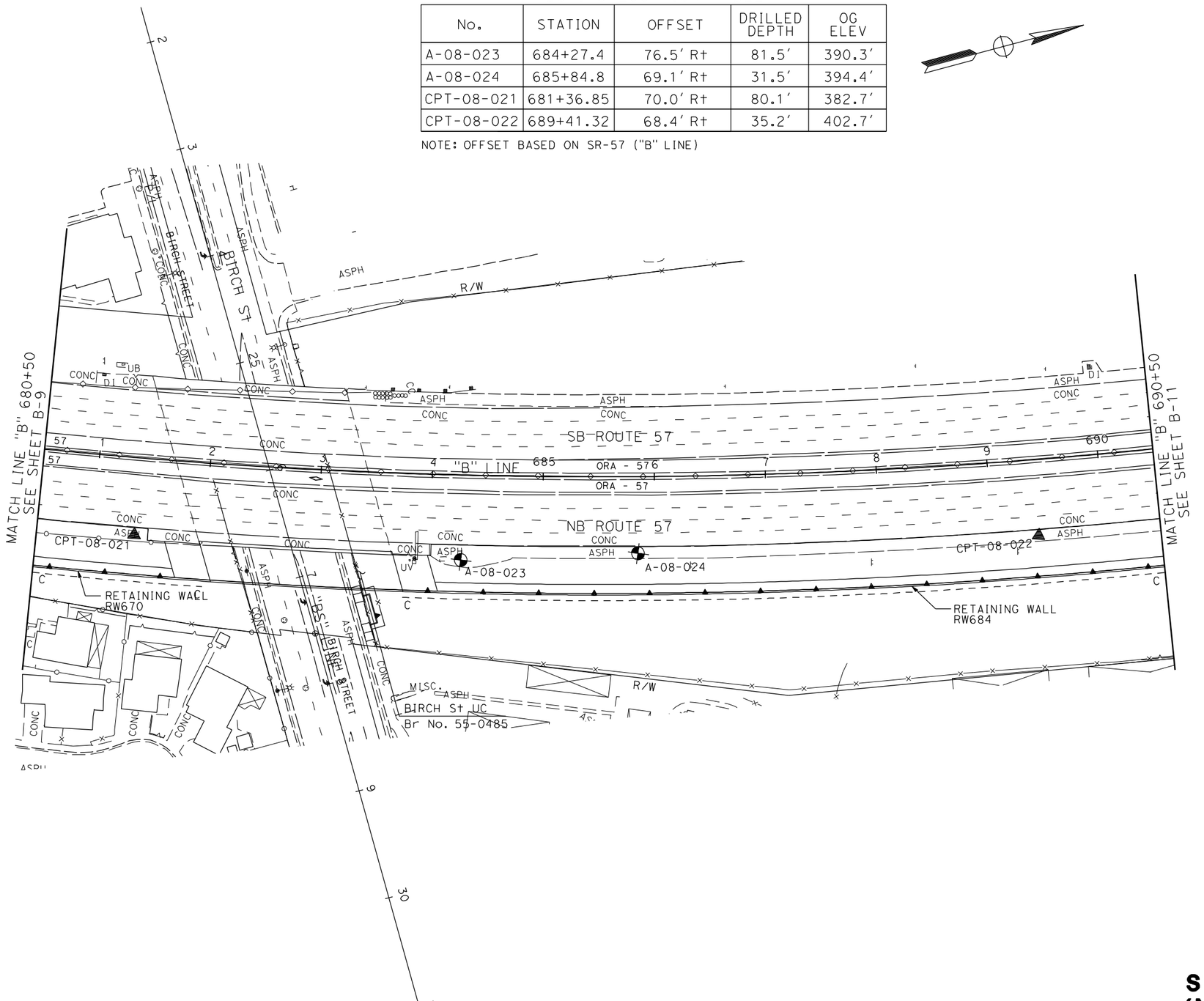
CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-023	684+27.4	76.5' Rt	81.5'	390.3'
A-08-024	685+84.8	69.1' Rt	31.5'	394.4'
CPT-08-021	681+36.85	70.0' Rt	80.1'	382.7'
CPT-08-022	689+41.32	68.4' Rt	35.2'	402.7'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)



FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

LEGEND

- ▲ CONE PENETRATION TEST
- ⊕ HOLLOW STEM AUGER BORING

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50'

A-10

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans®

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA
CALCULATED-DESIGNED BY: RYAN MITRY
CHECKED BY: MARK FRICKE
REVISED BY
DATE REVISED

LAST REVISION 00-00-00
DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

BORDER LAST REVISED 2/1/2008
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
USERNAME => $USER
DGN FILE => $REQUEST
CU 12220
EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	11	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

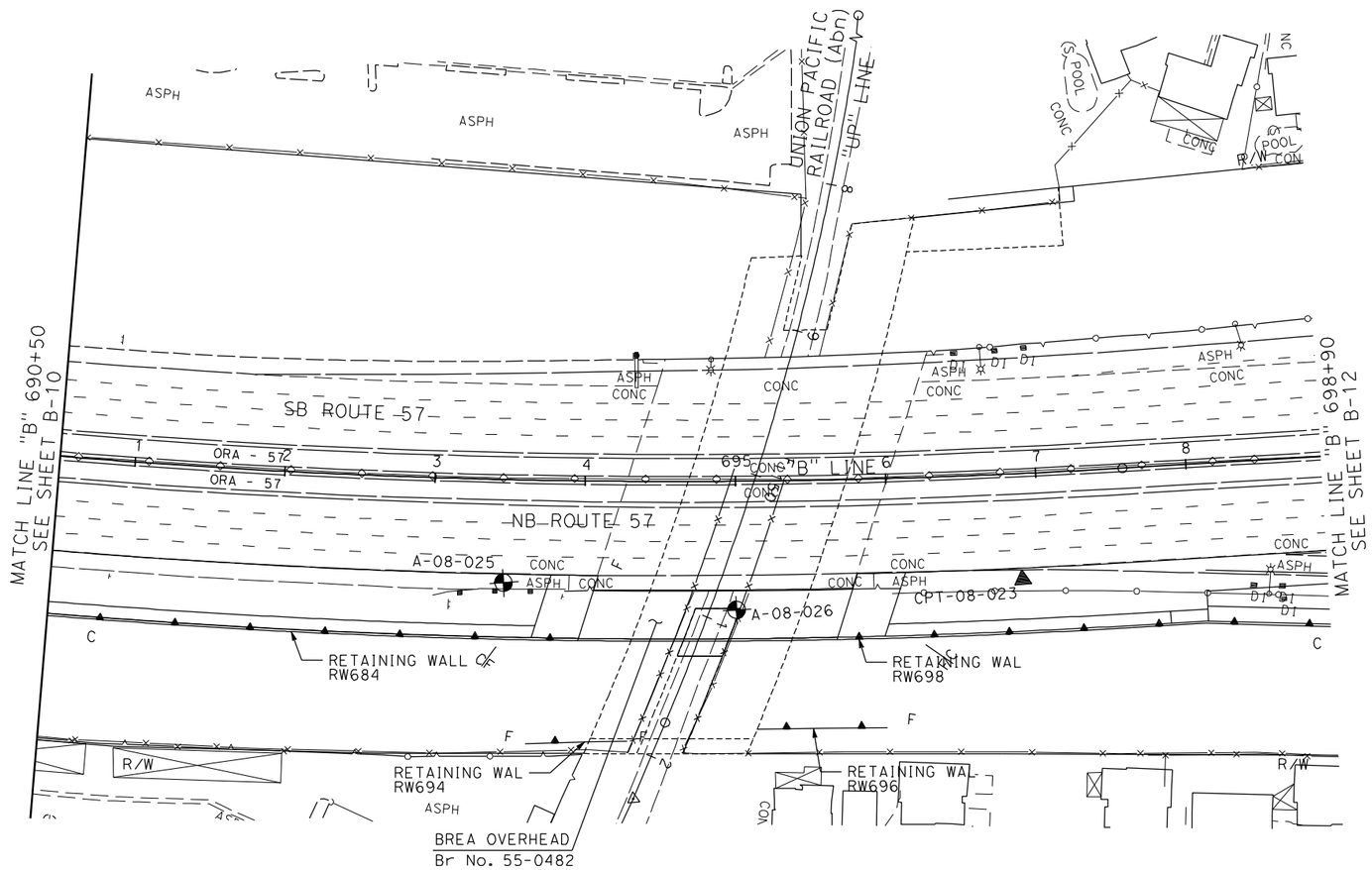
CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-025	693+47.7	68.7' Rt	76.5'	413.1'
A-08-026	695+00.0	86.0' Rt	81.5'	371.6'
CPT-08-023	696+89.44	70.7' Rt	35.1'	421.9'

NOTE: OFFSET BASED ON SR-57 ("B" LINE)



LEGEND

- CONE PENETRATION TEST
- HOLLOW STEM AUGER BORING

FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

A-11

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA

CALCULATED-DESIGNED BY: RYAN MITRY

CHECKED BY: MARK FRICKE

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

BORDER LAST REVISED 2/1/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 12220

EA 0F0321

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	57	18.4 / 20.9	12	12

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 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.

CH2M HILL
6 HUTTON CENTRE DRIVE,
SUITE 700
SANTA ANA, CA 92707

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

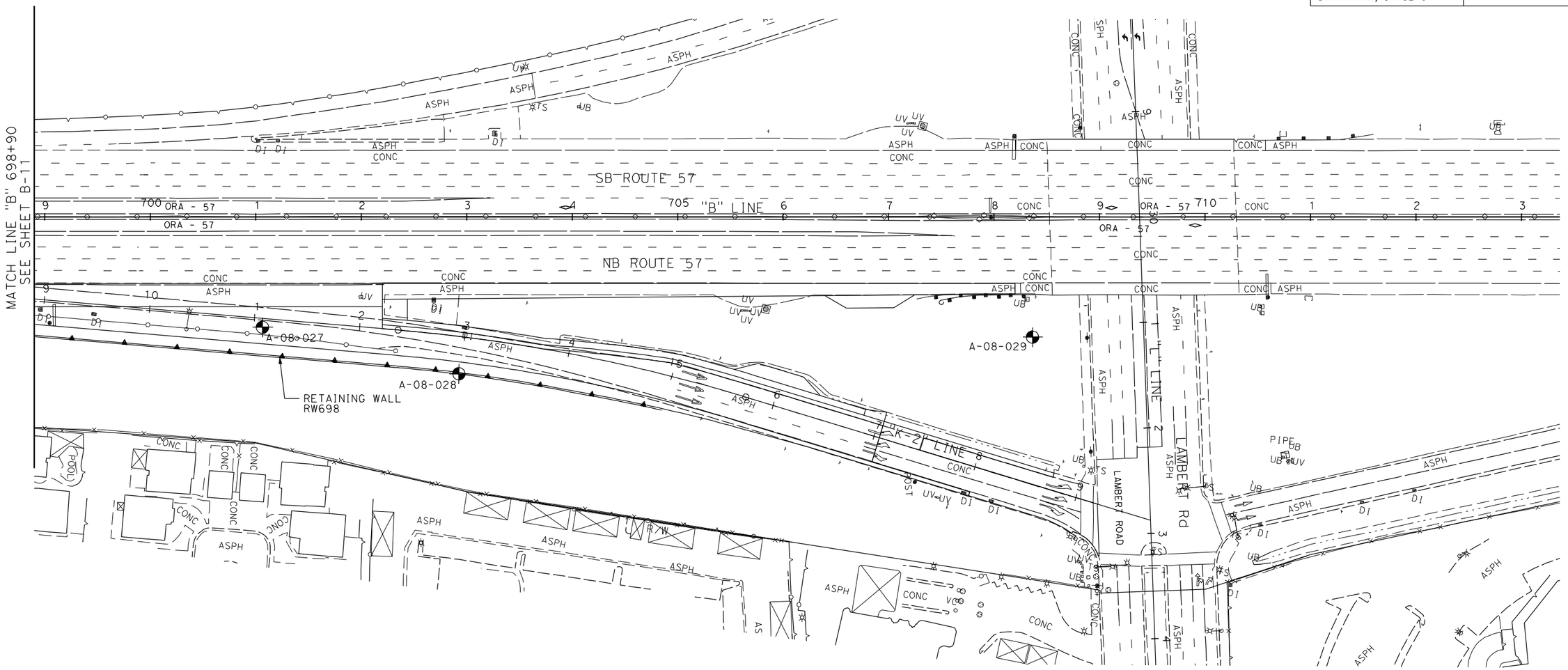
BORING LOCATION TABLE

No.	STATION	OFFSET	DRILLED DEPTH	OG ELEV
A-08-027	701+06.4	104.6′ Rt	31.5′	430.1′
A-08-028	702+92.6	148.7′ Rt	31.5′	429.7′
A-08-029	708+36.4	113.6′ Rt	81.5′	447.1′

LEGEND

▲ CONE PENETRATION TEST

⊕ HOLLOW STEM AUGER BORING



FOR COMPLETE RIGHT OF WAY DATA SEE
RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

WALLS LAYOUT AND BORING LOCATION MAP
SR-57 Northbound Widening (Northern Segment) Project

SCALE: 1" = 50′

A-12

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: THOMAS IONTA

CALCULATED-DESIGNED BY: RYAN MITRY X

CHECKED BY: MARK FRICKE X

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => $DATE

TIME PLOTTED => $TIME

BORDER LAST REVISED 2/1/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => $USER

DGN FILE => $REQUEST

CU 12220

EA 0F0321

APPENDIX B

Logs of Test Boring Sheets

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1057: N2273578.007, E6066831.271, Elev 294.844

SAMPLER TYPES:

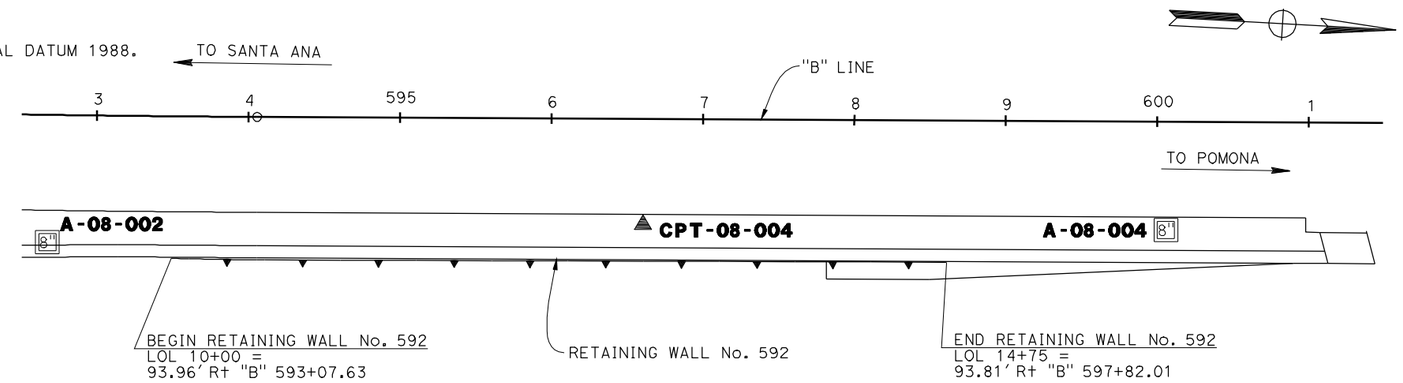
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

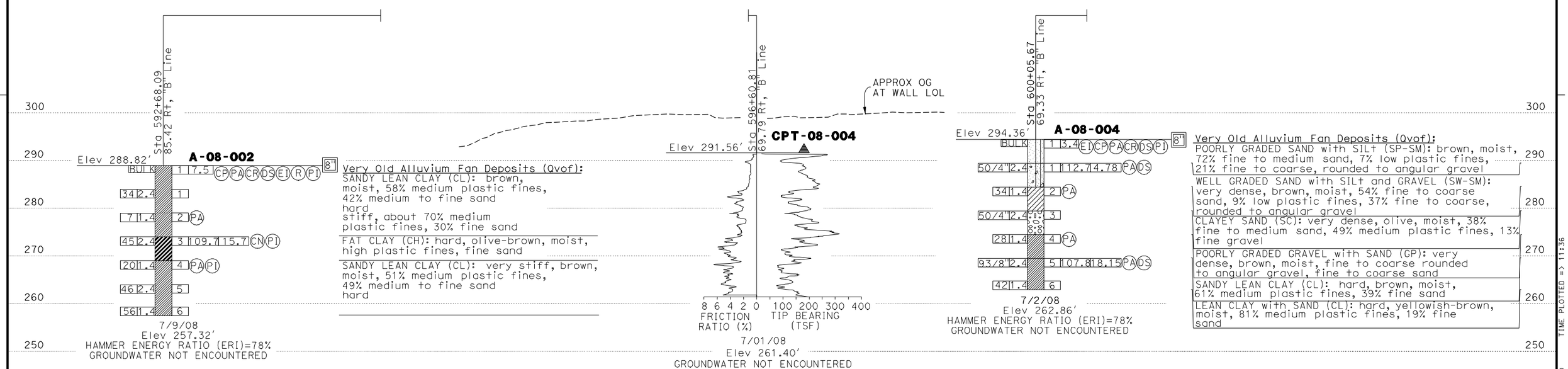
AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "B" LINE
9 590 1 2 3 4 595 6 7 8 9 600 1 2 3 4

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.
POST MILES

RETAINING WALL No. 592

LOG OF TEST BORINGS SHEET 1 OF 2 R-4

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032ga004.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:36

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	18.4/20.9		

HishamNofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

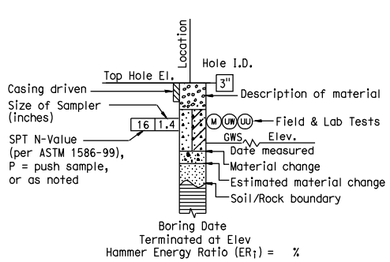
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

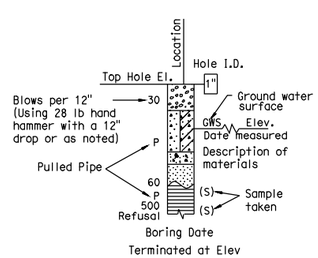
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

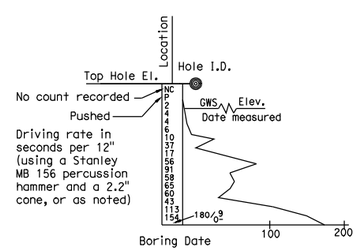
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



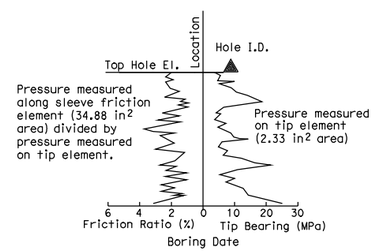
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

RETAINING WALL No. 592

LOG OF TEST BORINGS SHEET 2 OF 2

R-5

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

FILE => c0F032qa005.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 06/15/09

SHEET OF

USERNAME => jellis5 DATE PLOTTED => 15-JUN-2009 TIME PLOTTED => 11:58

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1048: N2273923.989, E6066816.158, Elev 297.698
Pt 1057: N2273578.007, E6066831.271, Elev 294.844

SAMPLER TYPES:

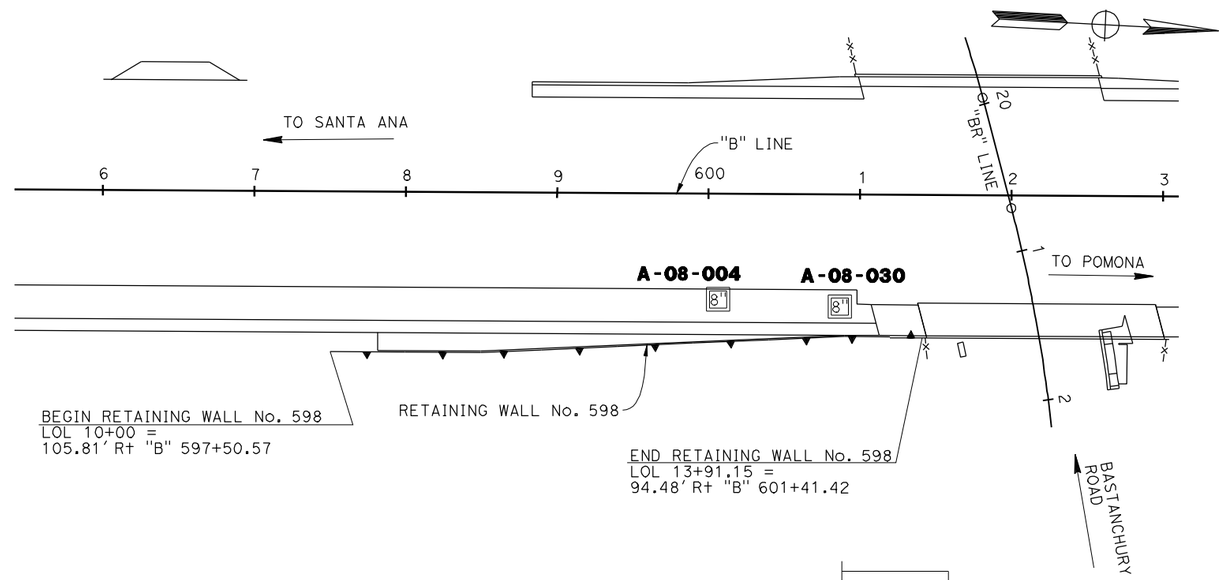
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

AUTOMATIC HAMMER

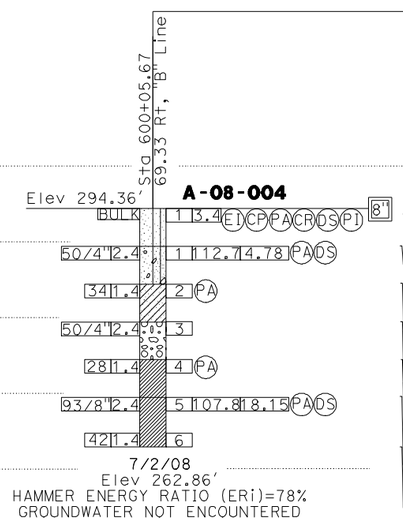
CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN

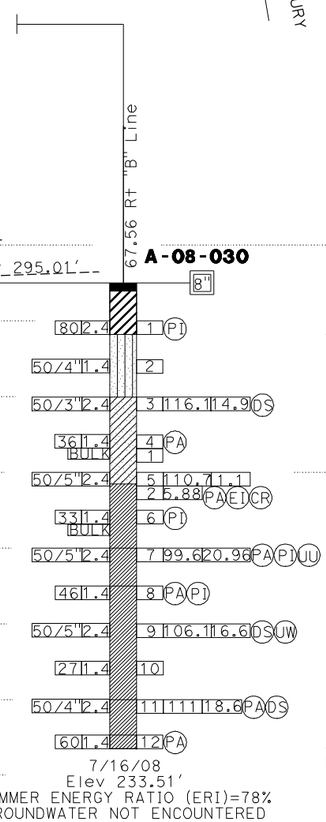
1"=50'



Very Old Alluvium Fan Deposits (Qvof):
POORLY GRADED SAND with SILT (SP-SM): brown, moist, 72% fine to medium sand, 7% low plastic fines, 21% fine to coarse, rounded to angular gravel
WELL GRADED SAND with SILT and GRAVEL (SW-SM): very dense, brown, moist, 54% fine to coarse sand, 9% low plastic fines, 37% fine to coarse, rounded to angular gravel
CLAYEY SAND (SC): very dense, olive, moist, 38% fine to medium sand, 49% medium plastic fines, 13% fine gravel
POORLY GRADED GRAVEL with SAND (GP): very dense, brown, moist, fine to coarse rounded to angular gravel, fine to coarse sand
SANDY LEAN CLAY (CL): hard, brown, moist, 61% medium plastic fines, 39% fine sand
LEAN CLAY with SAND (CL): hard, yellowish-brown, moist, 81% medium plastic fines, 19% fine sand

Approx OG AT WALL LOL

Elev 295.01'



5" Asphalt concrete layer, 9" Base Coarse Layer
Very Old Alluvium Fan Deposits (Qvof):
FAT CLAY with sand (CH): hard, yellowish-brown, moist, fine to coarse
SILTY SAND with GRAVEL (SM): very dense, yellowish-brown, moist, fine to coarse sand, rounded to subangular gravel up to 1/2" size
CLAYEY SAND (SC): very dense, brown, moist, fine to medium sand, medium plastic fines grades with 42% fines
SANDY LEAN CLAY (CL): hard, light olive-brown, moist, trace fine gravel, 43% sand brown, moist, low plastic fines, fine sand
LEAN CLAY with SAND (CL): hard, yellowish-brown, moist, medium plastic fines, 15% fine sand
SANDY LEAN CLAY (CL): hard, brown, moist, 70% medium plastic fines, 30% fine to medium sand
yellowish-brown
very stiff
LEAN CLAY with SAND (CL): hard, brown, moist, 85% medium plastic fines, 15% fine sand
SANDY LEAN CLAY (CL): hard, olive-brown, moist, 57% medium plastic fines, 41% fine to coarse sand, trace gravel

PROFILE

Horz: 1"=50'
Vert: 1"=10'

STATIONING "B" LINE

DESIGN OVERSIGHT	BRIDGE NO.	DRAWN BY K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Ayman Salama PROJECT ENGINEER	BRIDGE NO.	RETAINING WALL No. 598
SIGN OFF DATE		CHECKED BY H. Nofal	DATE			POST MILES	LOG OF TEST BORINGS SHEET 1 OF 3 — R-9

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY): 02/17/09 04/07/09 06/15/09 05/06/10 — SHEET OF

FILE => c0F032gb004.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:37

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/11
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

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

CEMENTATION

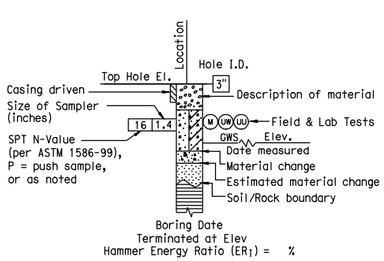
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

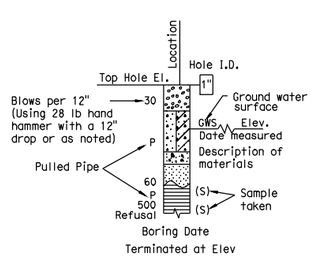
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

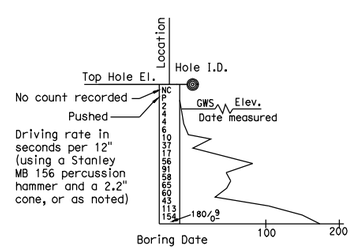
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



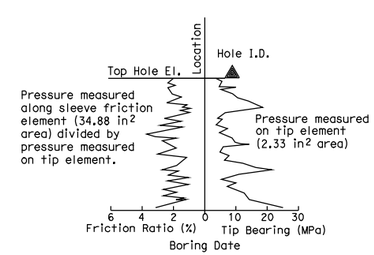
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

RETAINING WALL No. 598

LOG OF TEST BORINGS SHEET 2 OF 3

R-10

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032qb005.dgn

USERNAME => rmitry DATE PLOTTED => 06-NOV-2009 TIME PLOTTED => 09:58

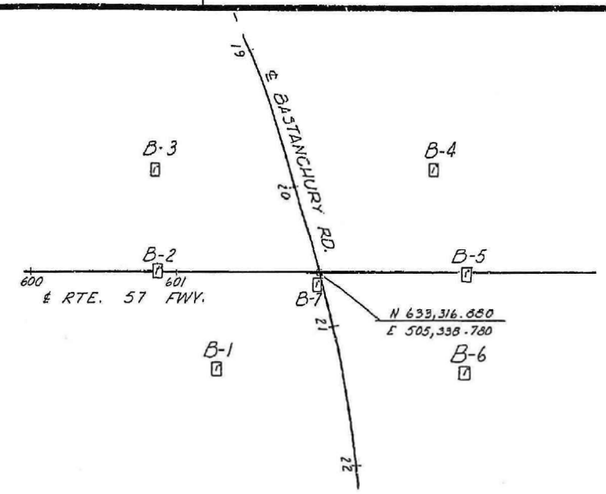
FED. ROAD DIV. No.	STATE	F.A. PROJECT No.	SHEET No.	TOTAL SHEETS
7	CALIF.			

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
07	ORA	57	19/202	150	180

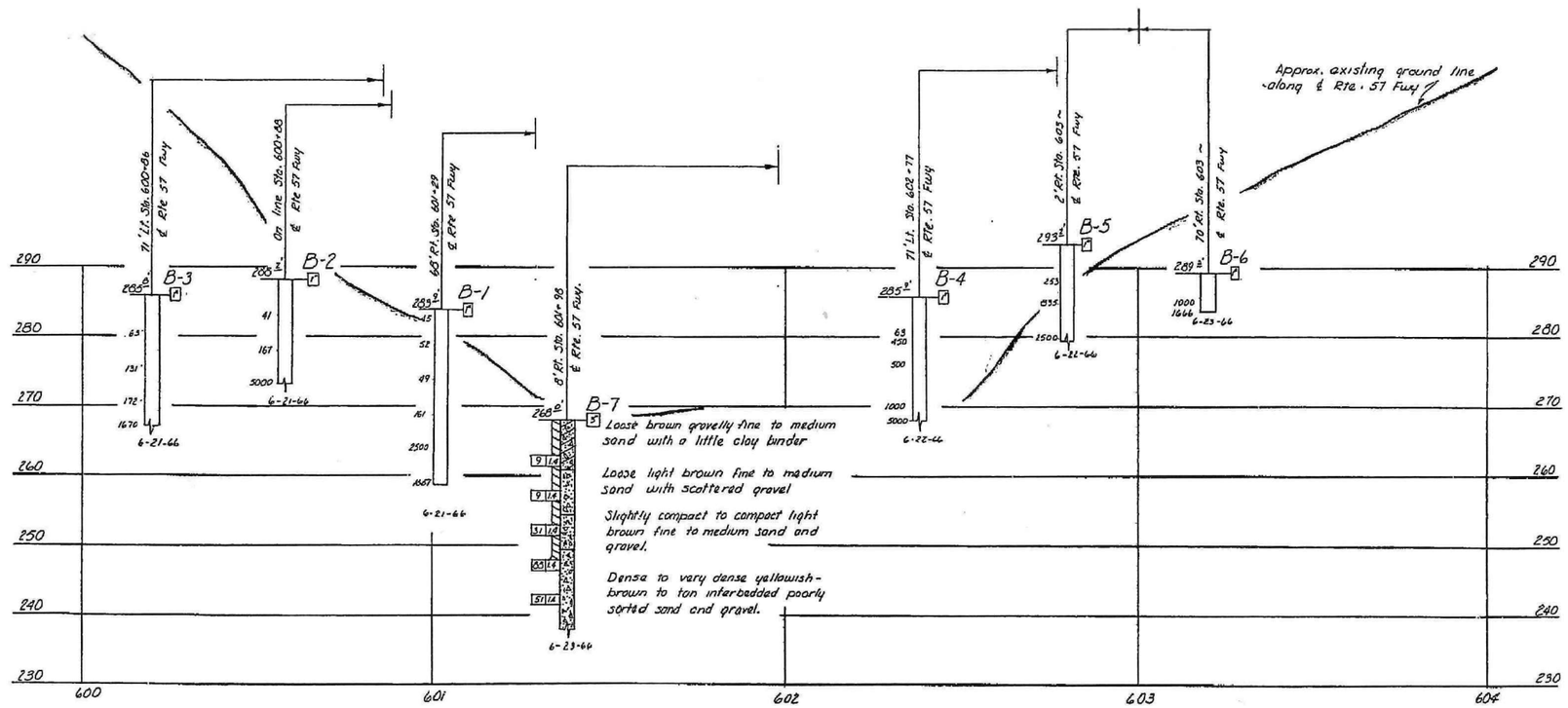
Date Approved September 30, 1968

BENCH MARK

BM 35-19A-56 Elev. 281.90
Set ch. knob on S.W. cor of drop inlet @ W. end of conc. flume 234' E. of Sta. 53B-74' P Line & 1320'± No. of Pioneer Ave.



PLAN
Scale 1"=50'



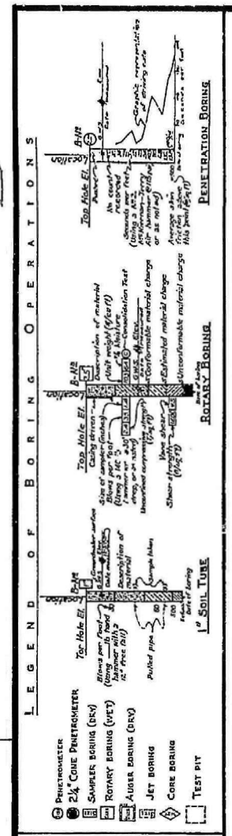
PROFILE
Scale Vert. 1"=10', Horiz. 1"=20'

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION

NO AS Built Corrections
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE June 1966

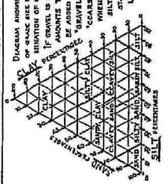
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL · SILTY CLAY OR CLAYEY SILT · SAND · CLAY 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	Jr.	D. CRAWFORD 6-23-66
DRAWN	Jr.	H. ALLEGRO 7-1-66
CHECKED	Jr.	C. Barnes 7-8-66

Approved Recommended: Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

150

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			

Hisham Nofal — 06/08/09
REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/11
GEOTECHNICAL
STATE OF CALIFORNIA

RETAINING WALL NO. 598

LOG OF TEST BORINGS SHEET 3 OF 3 R-11

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: -12220
EA: 0F0231

BRIDGE No.
Sheet of

AS BUILT PLANS
Contract No. 07-032134
Date Completed
Document No. 7000 1578

Champ 07208
W.A. 032131

Disregard prints bearing earlier revisions

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BASTANCHURY ROAD UNDERCROSSING

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE 55-465	FILE	DRAWING 55465-7

PREL. DRAWING No. PR- 130/62

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1058: N2274248.722, E6066795.515, Elev 299.982

SAMPLER TYPES:

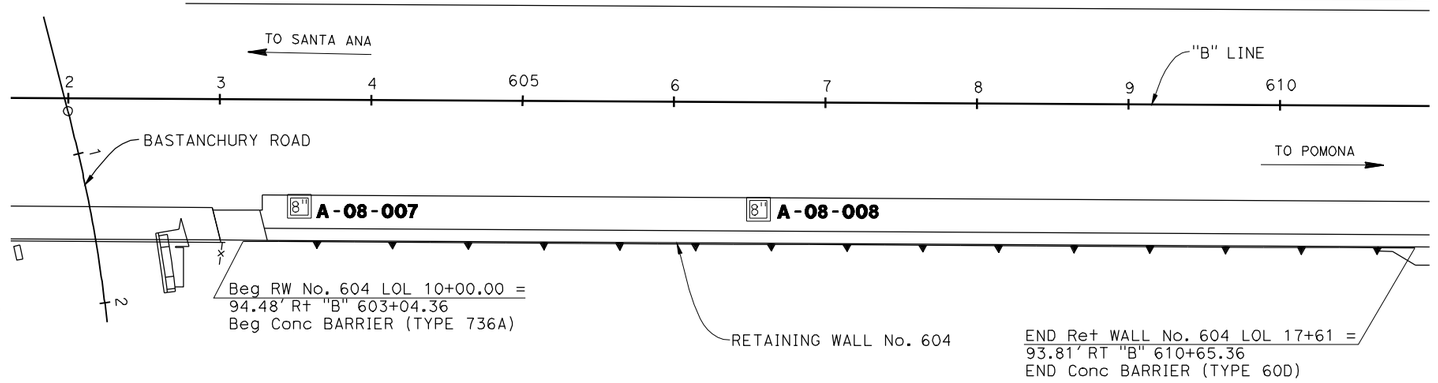
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

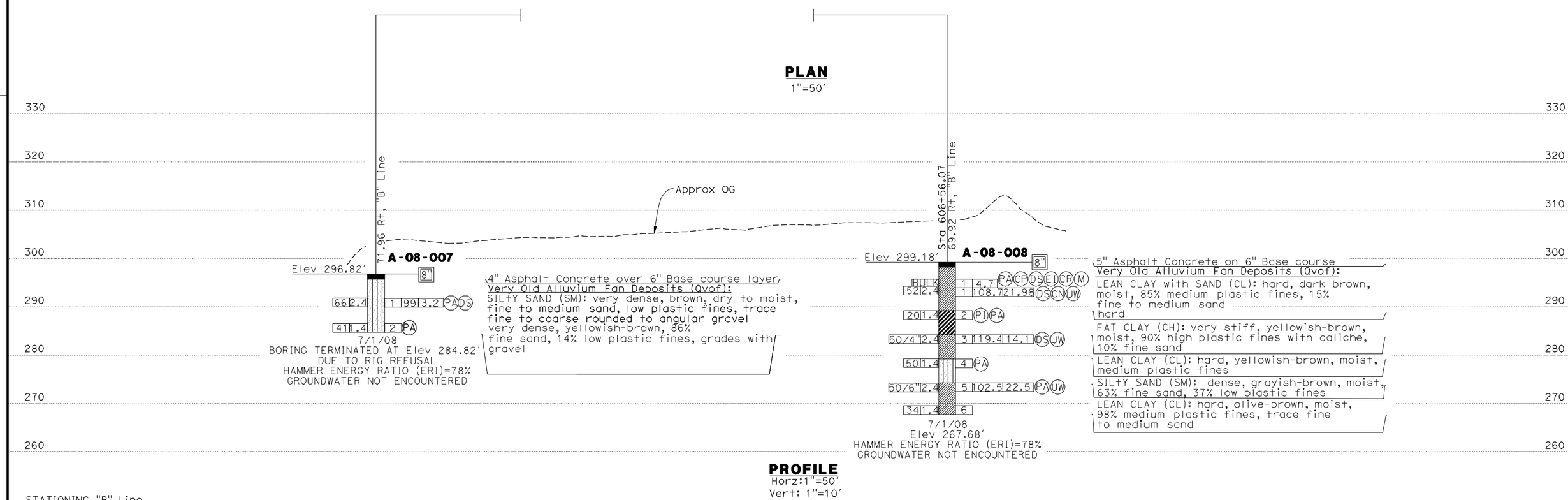
AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "B" Line
9 600 1 2 3 4 605 6 7 8 9 610 1 2 3 4

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Ayman Salama PROJECT ENGINEER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE			POST MILES

RETAINING WALL No. 604

LOG OF TEST BORINGS SHEET 1 OF 3 R-16

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/27/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032ac005.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:37

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/11 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

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

CEMENTATION

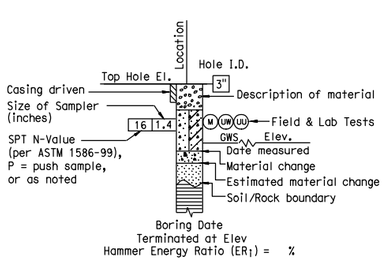
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

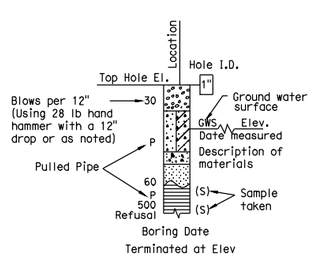
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

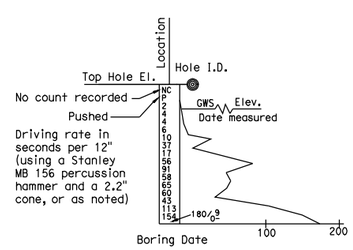
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



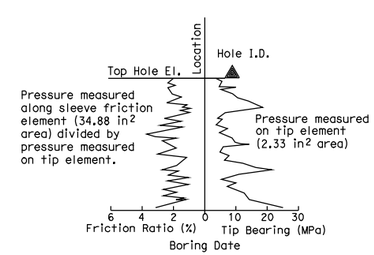
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

RETAINING WALL No. 604

LOG OF TEST BORINGS SHEET 2 OF 3 R-17

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

FILE => c0F032qc006.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 06/15/09

SHEET OF

USERNAME => rmitry DATE PLOTTED => 06-NOV-2009 TIME PLOTTED => 09:58

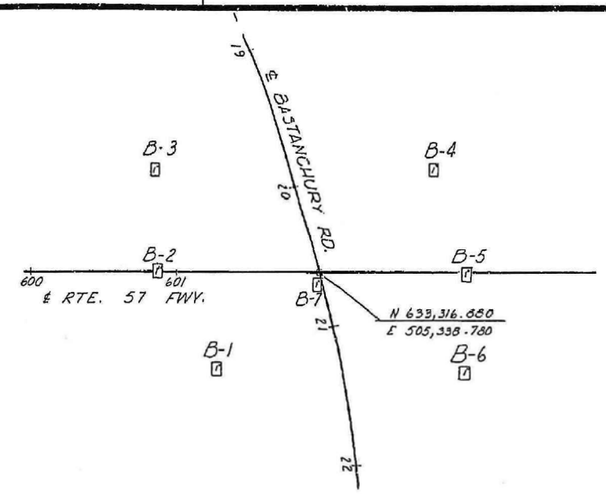
FED. ROAD DIV. No.	STATE	F.A. PROJECT No.	SHEET No.	TOTAL SHEETS
7	CALIF.			

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
07	ORA	57	19/202	150	180

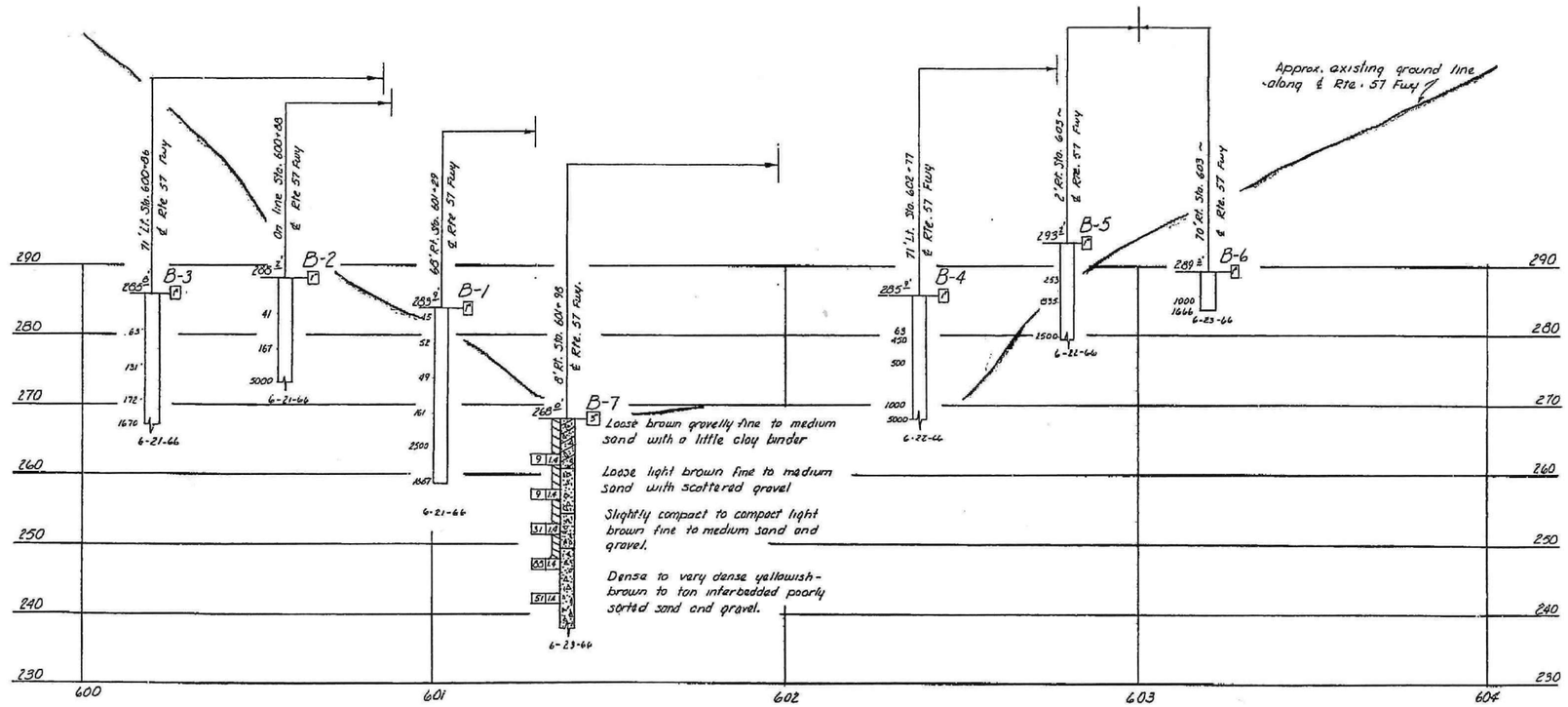
Date Approved September 30, 1968

BENCH MARK

BM 35-19A-56 Elev. 281.90
Set ch. knob on S.W. cor of drop inlet @ W. end of conc. flume 234' E. of Sta. 53B-74' P Line & 1320'± No. of Pioneer Ave.



PLAN
Scale 1"=50'



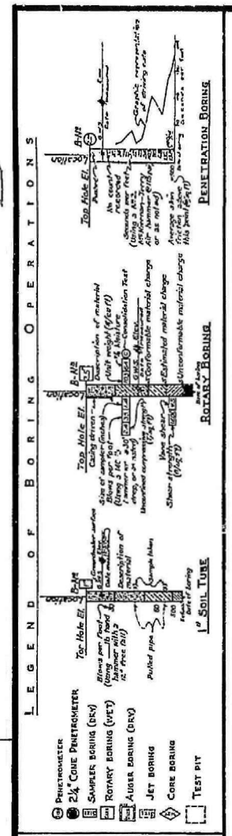
PROFILE
Scale Vert. 1"=10', Horiz. 1"=20'

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION

NO AS Built Corrections
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE June 1966

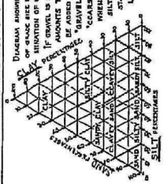
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL, SILTY CLAY OR CLAYEY SILT, SAND, CLAY 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	D. CRAWFORD 6-23-66
DRAWN	By	H. ALLEGRO 7-1-66
CHECKED	By	C. Barnes 7-8-66

Approval Recommended: Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

150

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			

Hisham Nofal — 06/08/09
REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/11
GEOTECHNICAL
STATE OF CALIFORNIA

RETAINING WALL NO. 604

LOG OF TEST BORINGS SHEET 3 OF 3 R-18

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: -12220
EA: 0F0231

BRIDGE No.
Sheet of

AS BUILT PLANS
Contract No. 07-032134
Date Completed
Document No. 7000 1578

Champ 07208
W.A. 032131

Disregard prints bearing earlier revisions

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BASTANCHURY ROAD UNDERCROSSING

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE 55-465	FILE	DRAWING 55465-7

PREL. DRAWING No. PR- 130/62

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

Hisham Nofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCA NAD-83, Zone 6.
Vertical control based on North American Vertical Datum 1988.
Pt 1065: n2276096.906, E6066849.261, Elev 345.199

SAMPLER TYPES:

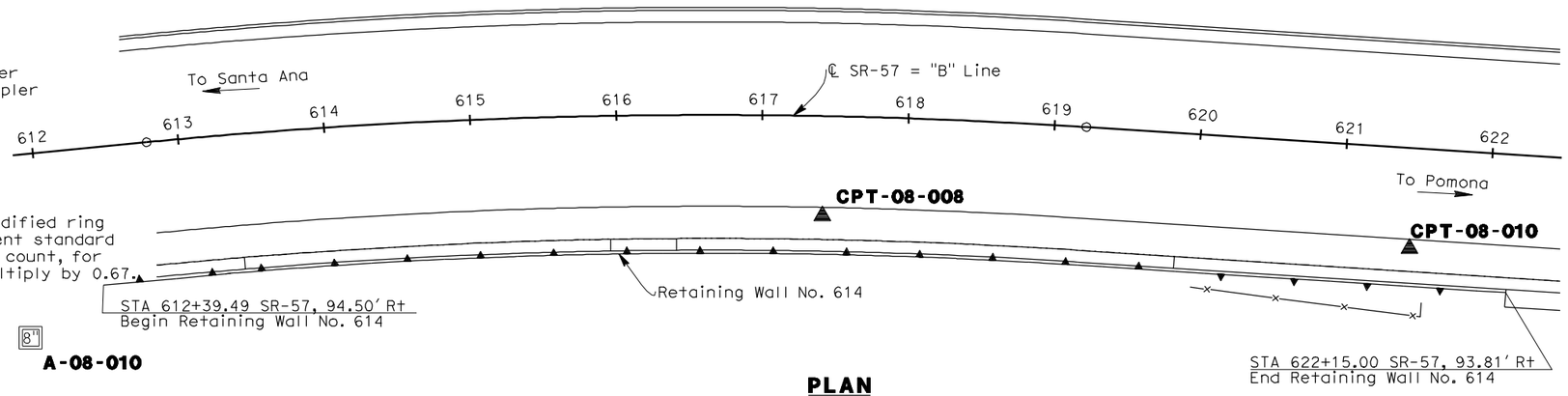
California modified ring sampler
standard penetration test sampler

HAMMER TYPE:

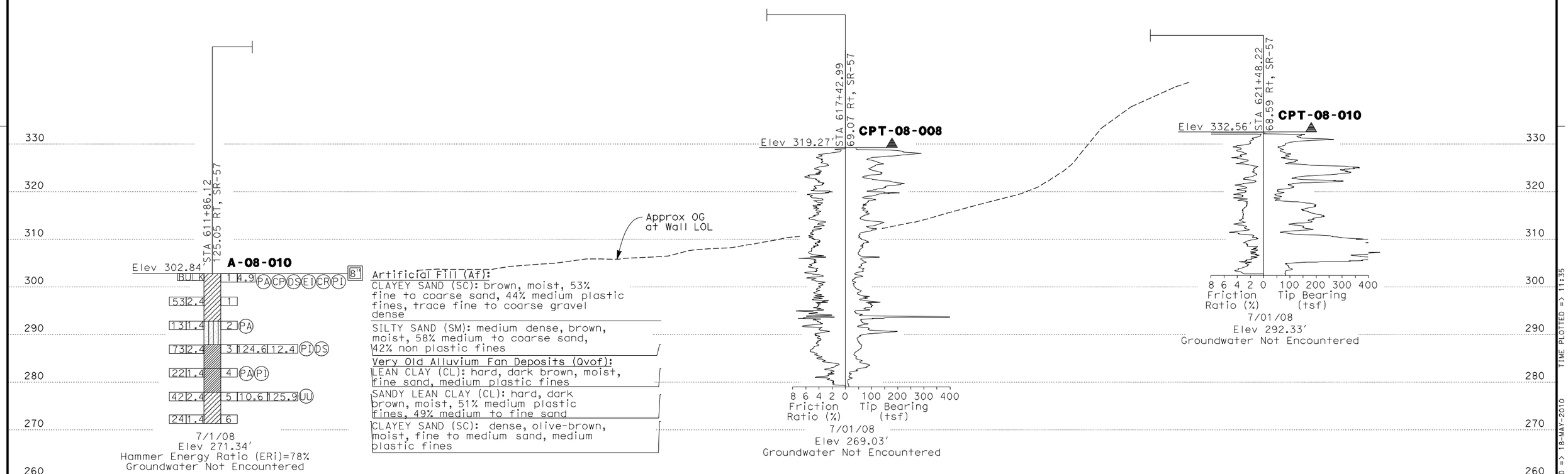
Automatic hammer

CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "SR-57" = "B" Line
610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0089
POST MILES 19.06

RETAINING WALL No. 614
LOG OF TEST BORINGS SHEET 1 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 20 OF 21

FILE => 55e0089-z-1tb01.dgn

USERNAME => mmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:35

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			

GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

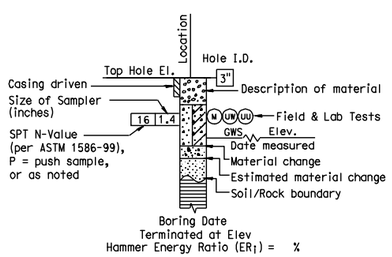
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

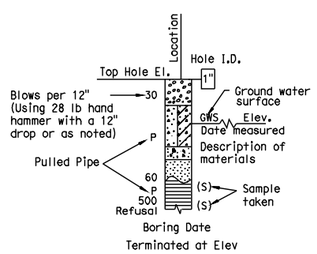
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

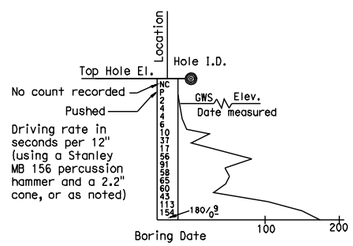
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



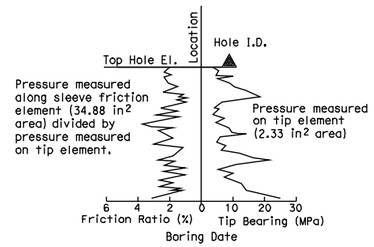
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0089

POST MILES 19.06

RETAINING WALL No. 614

SOIL LEGEND

LOG OF TEST BORINGS SHEET 2 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 04/17/09 06/08/09

SHEET 21 OF 21

FILE => 55e0089-z-1tb02.dgn

USERNAME => nmorales DATE PLOTTED => 06-JUN-2009 TIME PLOTTED => 11:45

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

GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS NAD-83, Zone 6.
vertical control based on North American Vertical Datum 1988.
Pt 1065: N2276096.906, E6066849.261, Elev 345.199

SAMPLER TYPES:

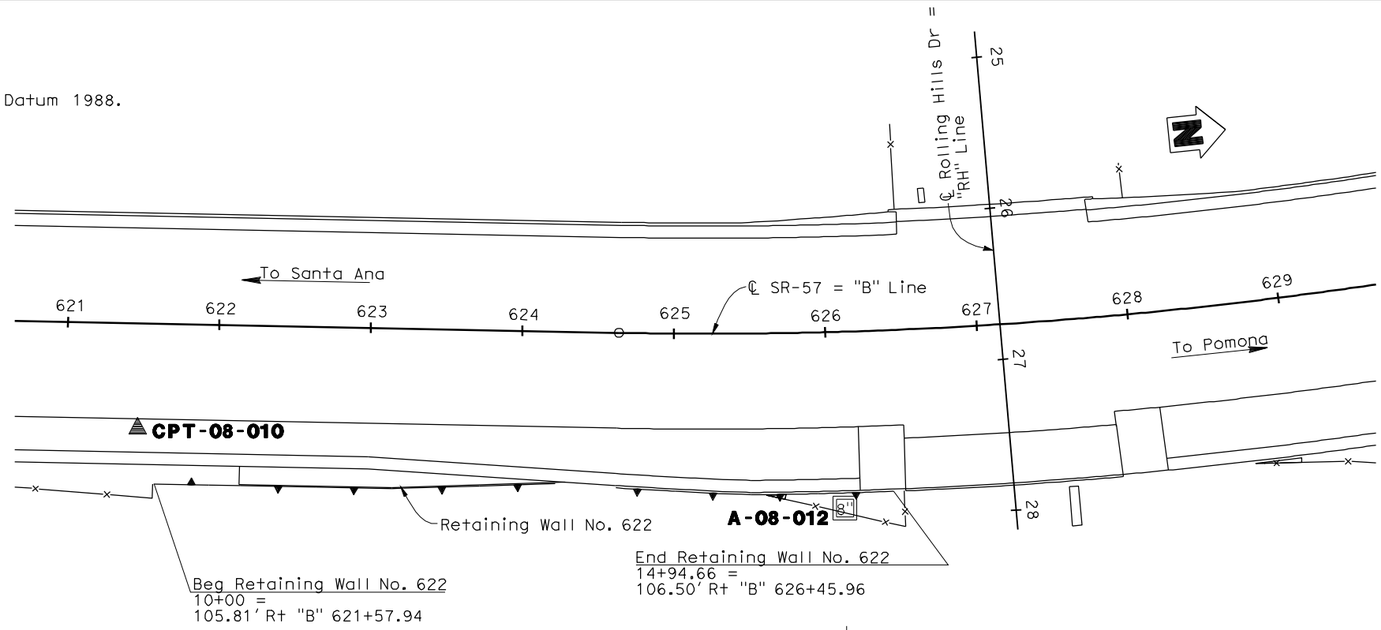
California modified ring sampler
standard penetration test sampler

HAMMER TYPE:

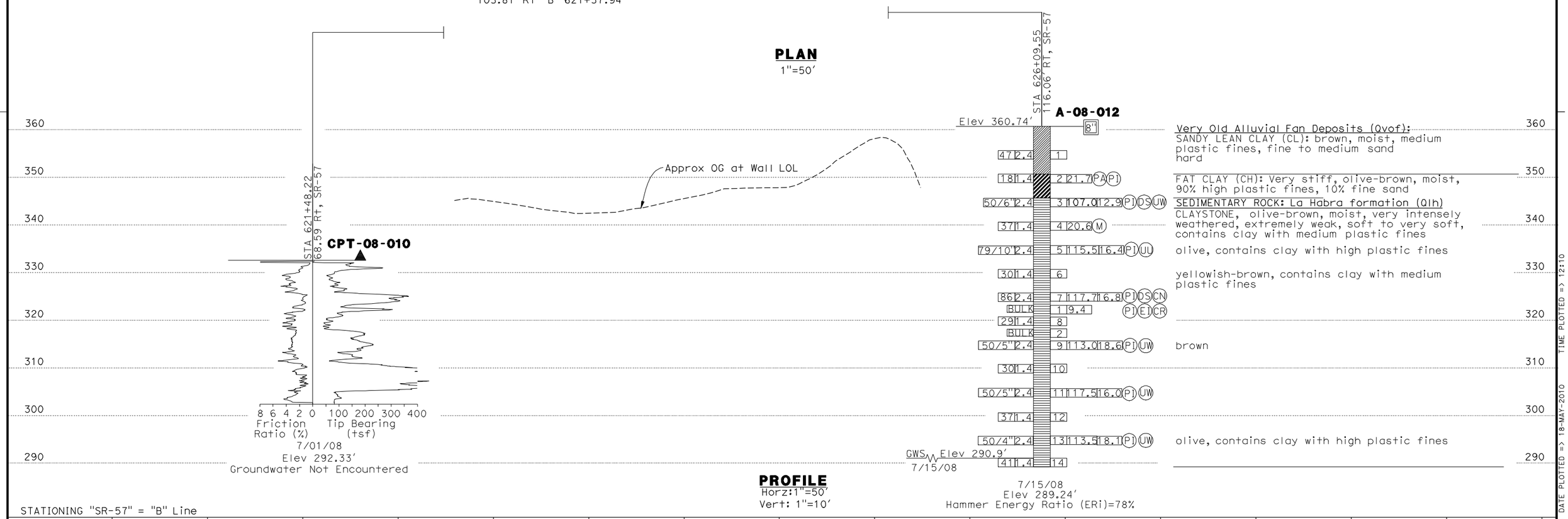
Automatic hammer

CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "SR-57" = "B" Line

618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. 55E0090 — POST MILES 19.24

RETAINING WALL No. 622
LOG OF TEST BORINGS SHEET 1 OF 4

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 14 OF 17

FILE => 55e0090-z-ltb01.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 12:10

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			

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

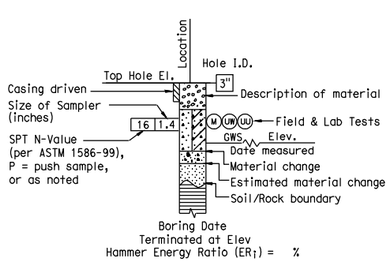
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

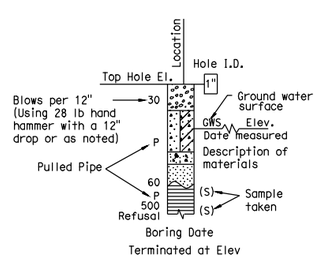
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

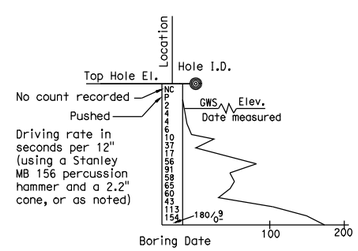
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



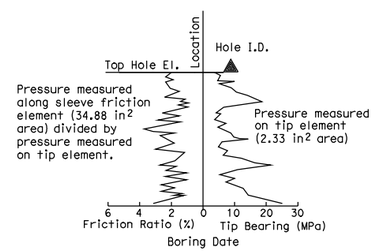
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

BOREHOLE IDENTIFICATION

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

Note: Size in inches.

RETAINING WALL No. 622

SOIL LEGEND

LOG OF TEST BORINGS SHEET 2 OF 4

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0090

POST MILES 19.24

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 15 OF 17

FILE => 55e0090-z-ltb02.dgn

USERNAME => jpowell9 DATE PLOTTED => 23-OCT-2009 TIME PLOTTED => 16:00

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			

Hisham Nofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

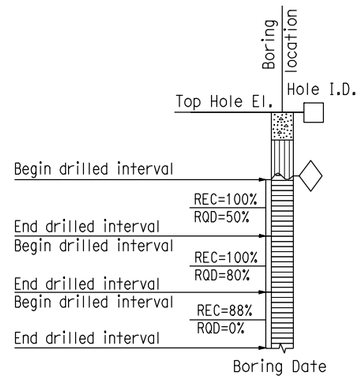
OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

PERCENT CORE RECOVERY (REC) & ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4''}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8" to 1 ft
Thinly bedded	1-1/4" to 3-5/8"
Very thinly bedded	3/8" to 1-1/4"
Laminated	Less than 3/8"

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features					General Characteristics
	Chemical Weathering-Discoloration and/or oxidation		Mechanical Weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Texture and Solutioning		
	Body of Rock	Fracture Surfaces		Texture	Solutioning	
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

RETAINING WALL No. 622
ROCK LEGEND
LOG OF TEST BORINGS SHEET 3 OF 4

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY K. Reyes
CHECKED BY H. Nofal
R. Bethapudi
FIELD INVESTIGATION BY:
DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0090
POST MILES 19.24

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES 02/18/09 04/07/09 04/17/09 06/08/09

REVISION DATES

SHEET 16 OF 17

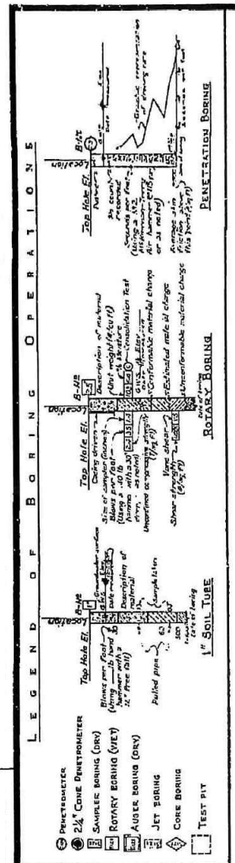
FILE => 55e0090-z-ltb03.dgn

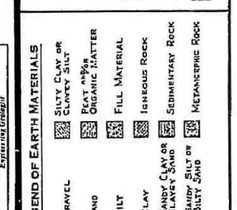
USERNAME => jpowell9 DATE PLOTTED => 23-OCT-2009 TIME PLOTTED => 16:00

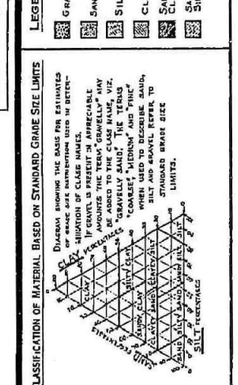
7	CALIF.			

Dist.	County	Route	Section	Sheet No.	Total Sheets
07	Ora.	57	7H/7H2	160	180

Date Approved September 30, 1968







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.

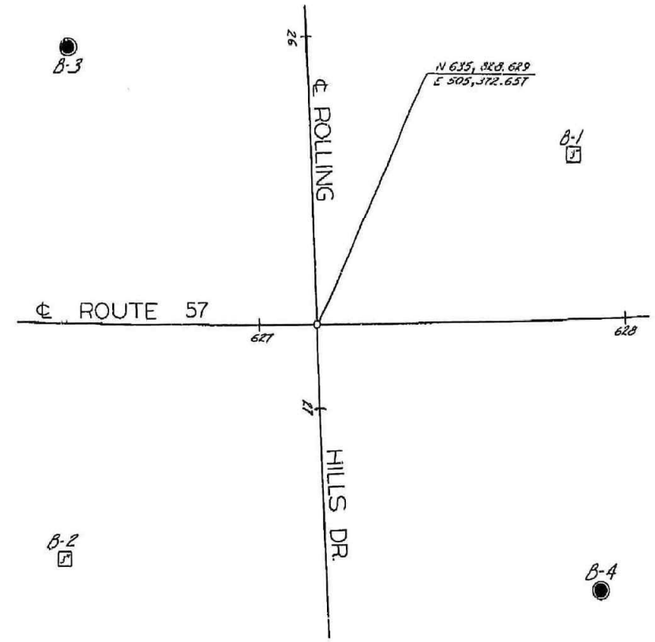
CHECKED
Approval Recommended
Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

160

BENCH MARK

B.M. # 629-D-66 Elev. 361.18
Fd. anchor bolt on top of northeast pedestal of Hathaway Oil Well No. 8



PLAN
Scale: 1" = 20'

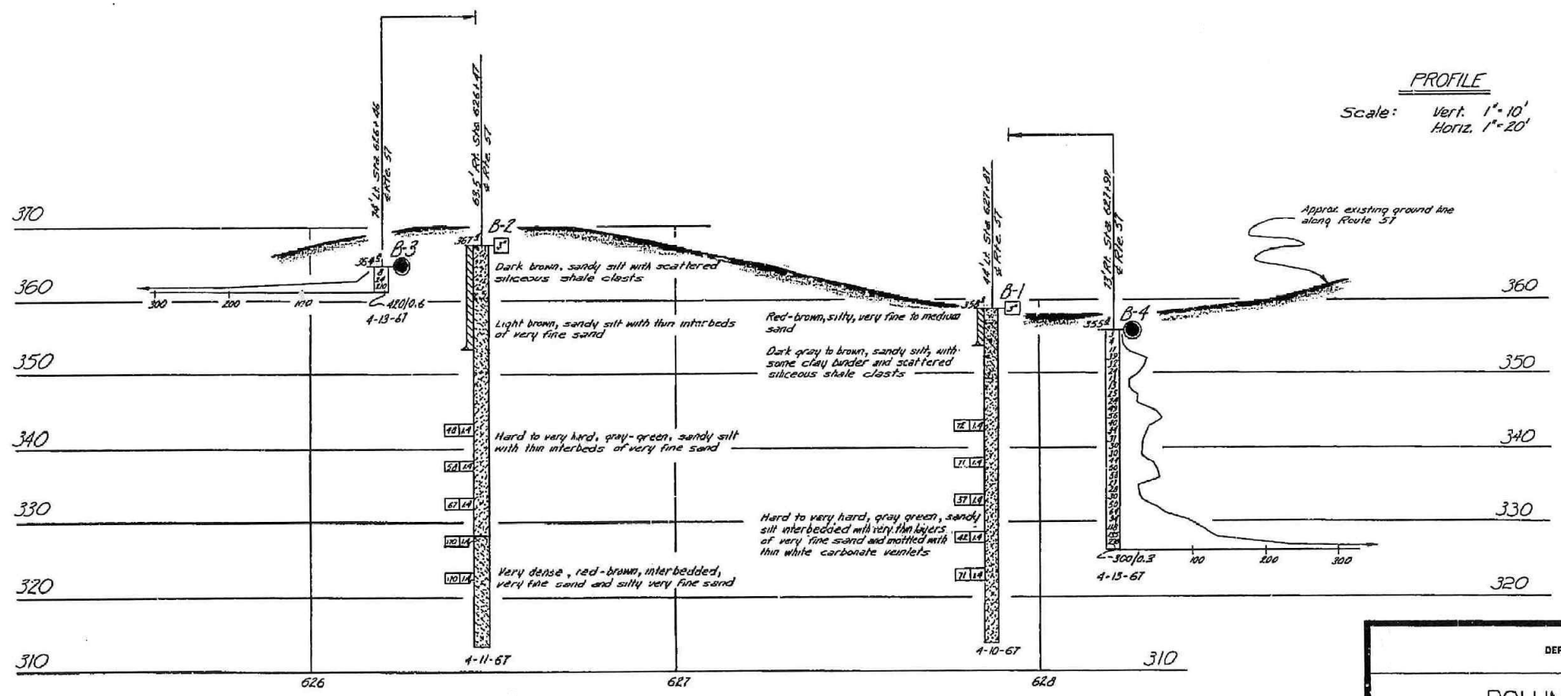
DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			
Hisham Nofal — REGISTERED CIVIL ENGINEER			06/08/09 DATE		
RETAINING WALL NO. 622					
LOG OF TEST BORINGS SHEET 4 OF 4					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA		CU: 12220 EA: 0F0321	BRIDGE No. 55E0090	Sheet 17	of 17

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION
BRIDGE DEPT. GEOLOGY SECTION
DATE April 1, 1967

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION

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



AS BUILT PLANS
Contract No. 07-032134
Date Completed
Document No. 70001578

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ROLLING HILLS DRIVE UNDERCROSSING

LOG OF TEST BORINGS

SHEET	OF	SCALE As Noted	BRIDGE 55-0083	FILE	DRAWING 55-0083-7
10	10				

Chg. 07200
W.A. 032131

Disregard prints bearing earlier numbers

PREL. DRAWING No. PR-

FILE => 55e0090-z-l1tb04.dgn

USERNAME => jpowell19 DATE PLOTTED => 23-OCT-2009 TIME PLOTTED => 16:01

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

GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS NAD-83, Zone 6.
vertical control based on North American Vertical Datum 1988.
Pt 1049: N2276409.426, E6066857.705, Elev 348.344

SAMPLER TYPES:

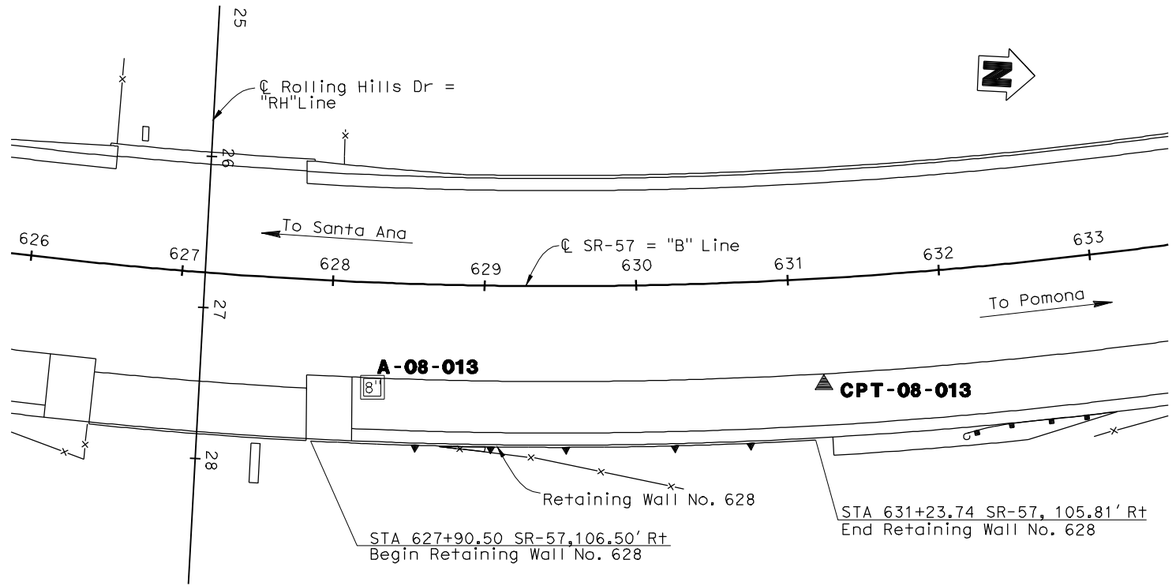
California modified ring sampler
standard penetration test sampler

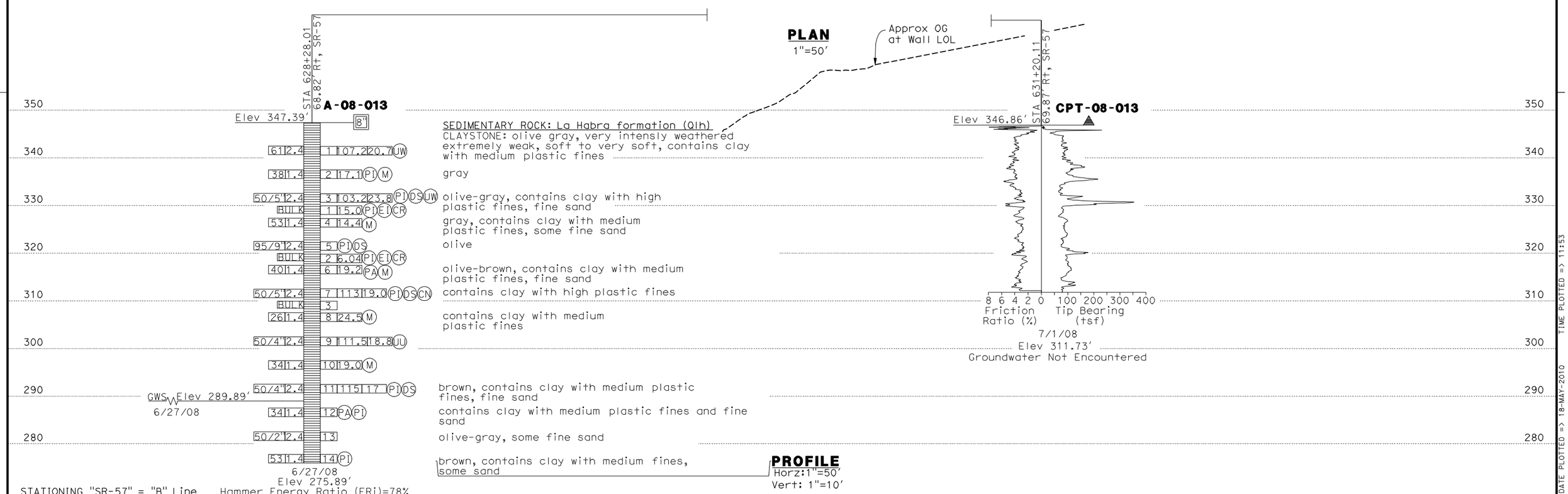
HAMMER TYPE:

Automatic hammer

CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.





DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. 55E0091
POST MILES 19.36

RETAINING WALL No. 628
LOG OF TEST BORINGS SHEET 1 OF 4

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/18/09 04/07/09 04/27/09 06/08/09

SHEET 12 OF 15

FILE => 55e0091-z-1tb01.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:53

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			

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

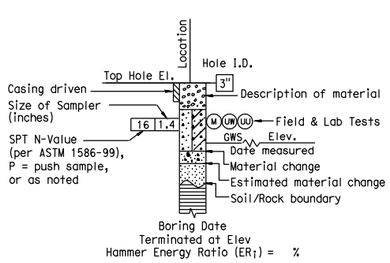
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

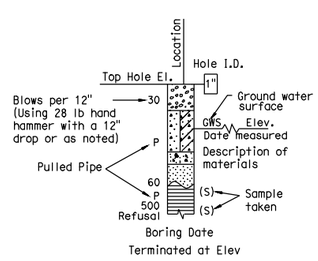
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

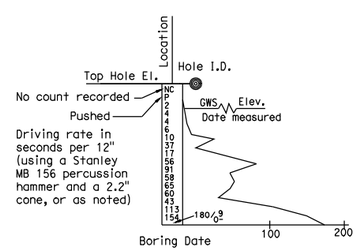
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



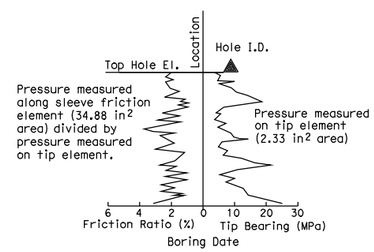
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

BOREHOLE IDENTIFICATION

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

Note: Size in inches.

RETAINING WALL No. 628

SOIL LEGEND

LOG OF TEST BORINGS SHEET 2 OF 4

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0091

POST MILES 19.36

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 13 OF 15

FILE => 55e0091-z-ltb02.dgn

USERNAME => jpowell9 DATE PLOTTED => 23-OCT-2009 TIME PLOTTED => 17:11

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			

Hisham Nofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

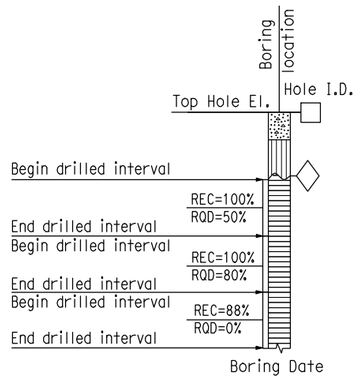
OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

PERCENT CORE RECOVERY (REC) & ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces} \geq 4''}{\text{Total length of core run (inches)}} \times 100\%$$



RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8" to 1 ft
Thinly bedded	1-1/4" to 3-5/8"
Very thinly bedded	3/8" to 1-1/4"
Laminated	Less than 3/8"

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions. Only two adjacent descriptors may be combined.

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features					General Characteristics
	Chemical Weathering-Discoloration and/or oxidation		Mechanical Weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Texture and Solutioning		
	Body of Rock	Fracture Surfaces		Texture	Solutioning	
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

RETAINING WALL No. 628
ROCK LEGEND
LOG OF TEST BORINGS SHEET 3 OF 4

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY K. Reyes
CHECKED BY H. Nofal
R. Bethapudi
FIELD INVESTIGATION BY:
DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0091
POST MILES 19.36

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 02/18/09 04/07/09 04/27/09 06/08/09

SHEET 14 OF 15

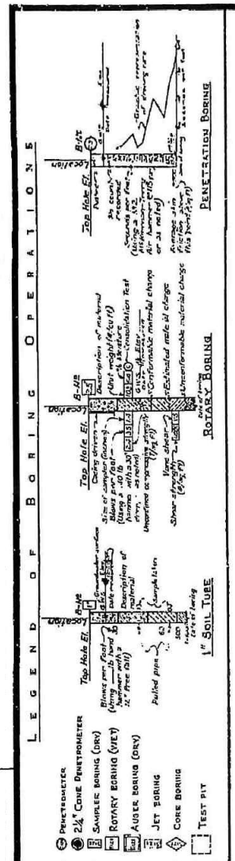
FILE => 55e0091-z-ltb03.dgn

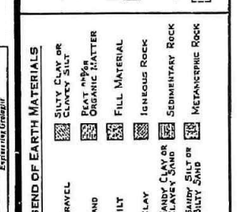
USERNAME => jpowell9 DATE PLOTTED => 27-OCT-2009 TIME PLOTTED => 08:54

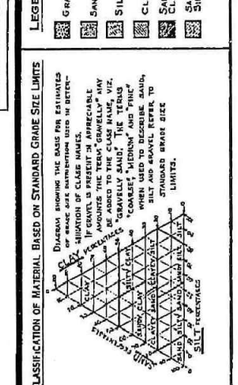
7	CALIF.			

Dist.	County	Route	Section	Sheet No.	Total Sheets
07	ORA.	57	7/1/02	160	180

Date Approved September 30, 1968







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.

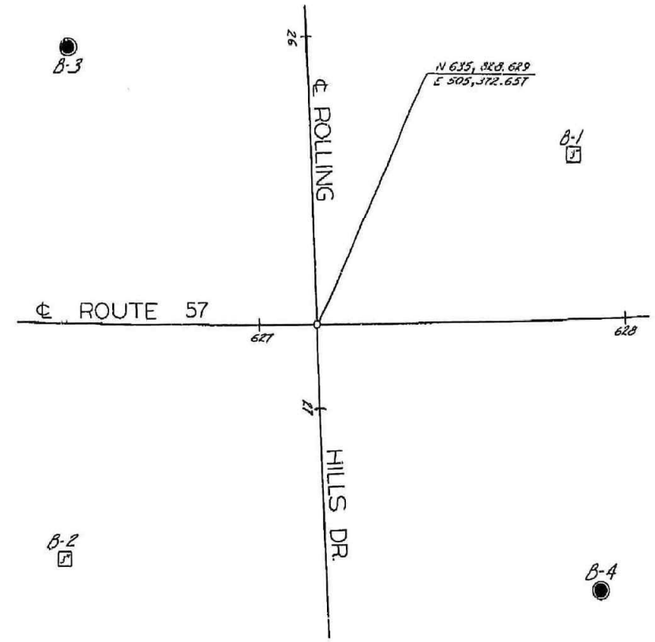
CHECKED
Approval Recommended
Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

160

BENCH MARK

B.M. # 629-D-66 Elev. 361.18
Fd. anchor bolt on top of northeast pedestal of Hathaway Oil Well No. 8



PLAN
Scale: 1" = 20'

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			

Hisham Nofal — 06/08/09
REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

RETAINING WALL NO. 628

LOG OF TEST BORINGS SHEET 4 OF 4

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 12220
EA: 0F0321

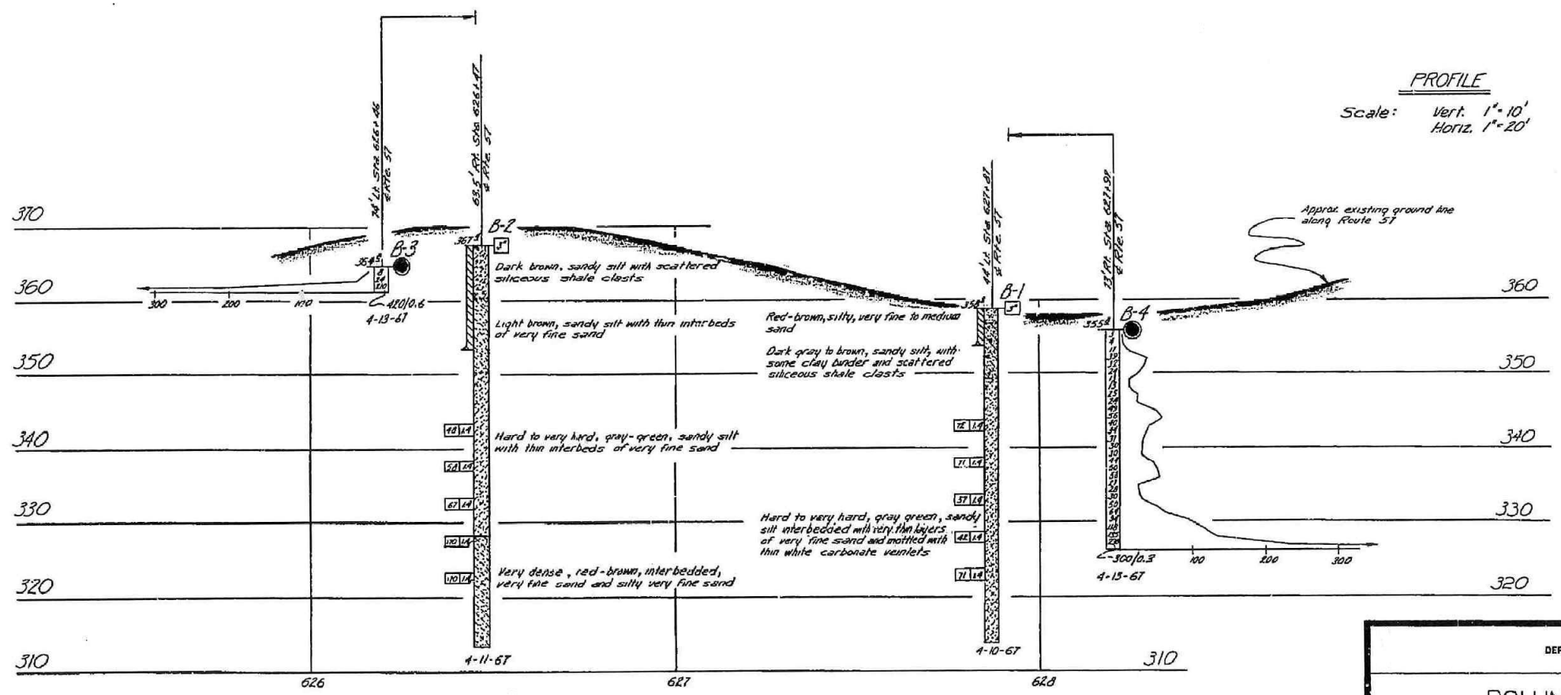
BRIDGE No. 55E0091

Sheet	of
15	15

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION
BRIDGE DEPT. GEOLOGY SECTION
DATE April 1, 1967

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION

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



AS BUILT PLANS
Contract No. 07-032134
Date Completed
Document No. 70001578

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ROLLING HILLS DRIVE UNDERCROSSING

LOG OF TEST BORINGS

SHEET	OF
10	10

Scale: As Noted | Bridge 55-0083 | File | Drawing 55E0183-7

Chg. 07200
W.A. 032131

Disregard prints bearing earlier numbers

PREL. DRAWING No. PR-

FILE => 55e0091-z-1tb04.dgn

USERNAME => jpowell19 DATE PLOTTED => 23-OCT-2009 TIME PLOTTED => 17:12

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

GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS NAD-83, Zone 6.
vertical control based on North American Vertical Datum 1988.
Pt 1150: N2277373.804, E6066685.179, Elev 331.888

SAMPLER TYPES:

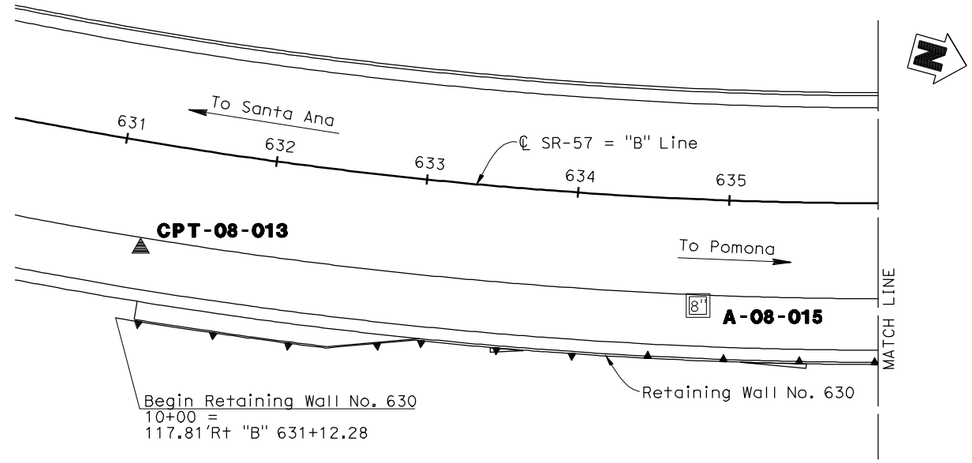
California modified ring sampler
standard penetration test sampler

HAMMER TYPE:

Automatic hammer

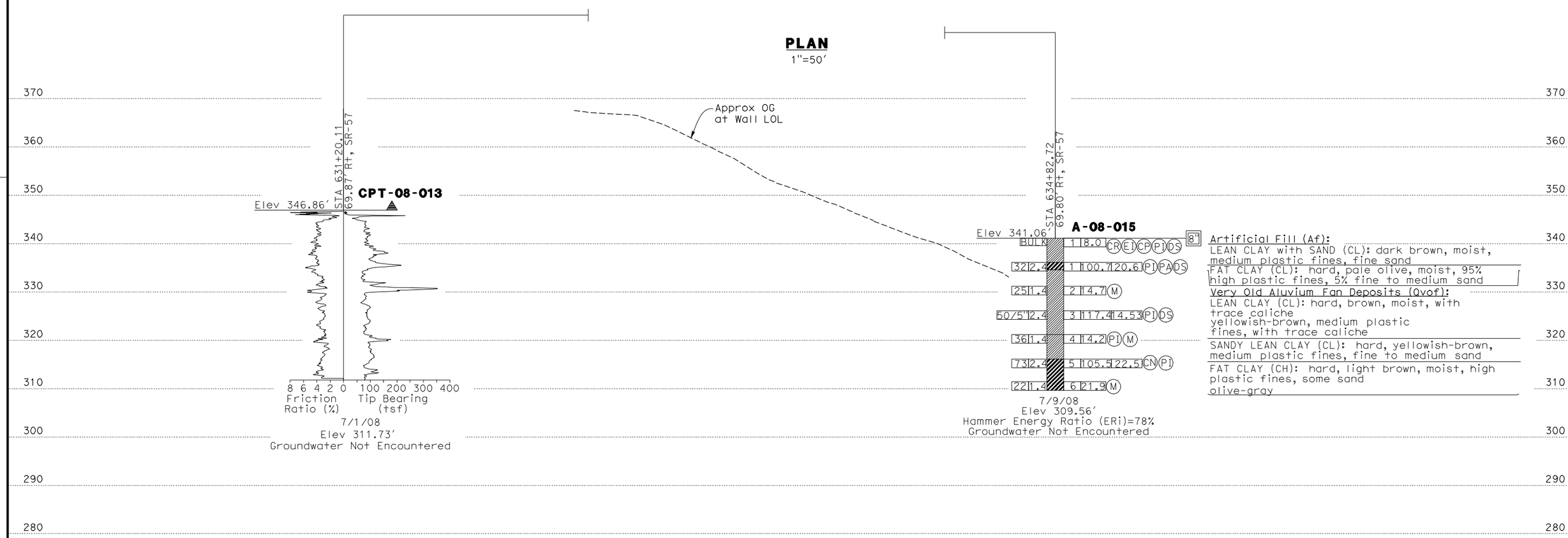
CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



PLAN

1"=50'



PROFILE

Horz:1"=50'
Vert: 1"=10'

STATIONING "SR-57" = "B" Line

626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. 55E0092
POST MILES 19.41

RETAINING WALL NO. 630

LOG OF TEST BORINGS SHEET 1 OF 4

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 23 OF 26

FILE => 55e0092-z-1tb01.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 12:01

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

Hisham Nofal
GEOTECHNICAL PROFESSIONAL — 06/08/09 DATE

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS NAD-83, Zone 6.
vertical control based on North American Vertical Datum 1988.
Pt 1150: N2277373.804, E6066685.179, Elev 331.888

SAMPLER TYPES:

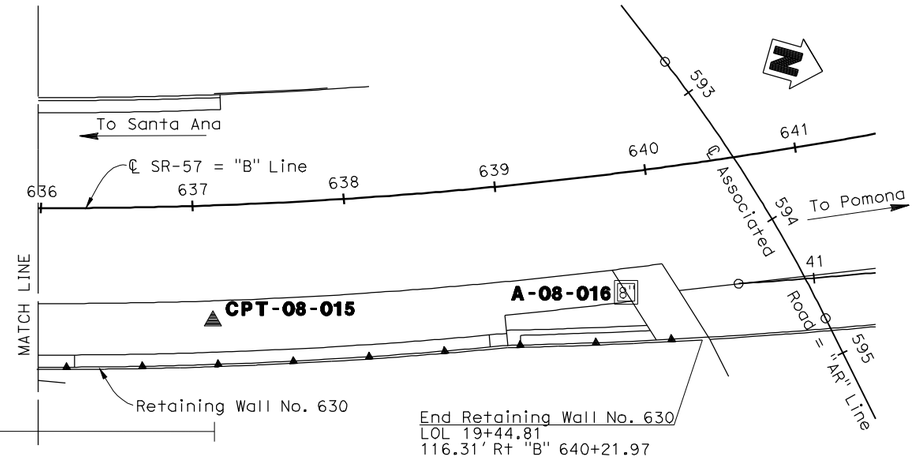
California modified ring sampler
standard penetration test sampler

HAMMER TYPE:

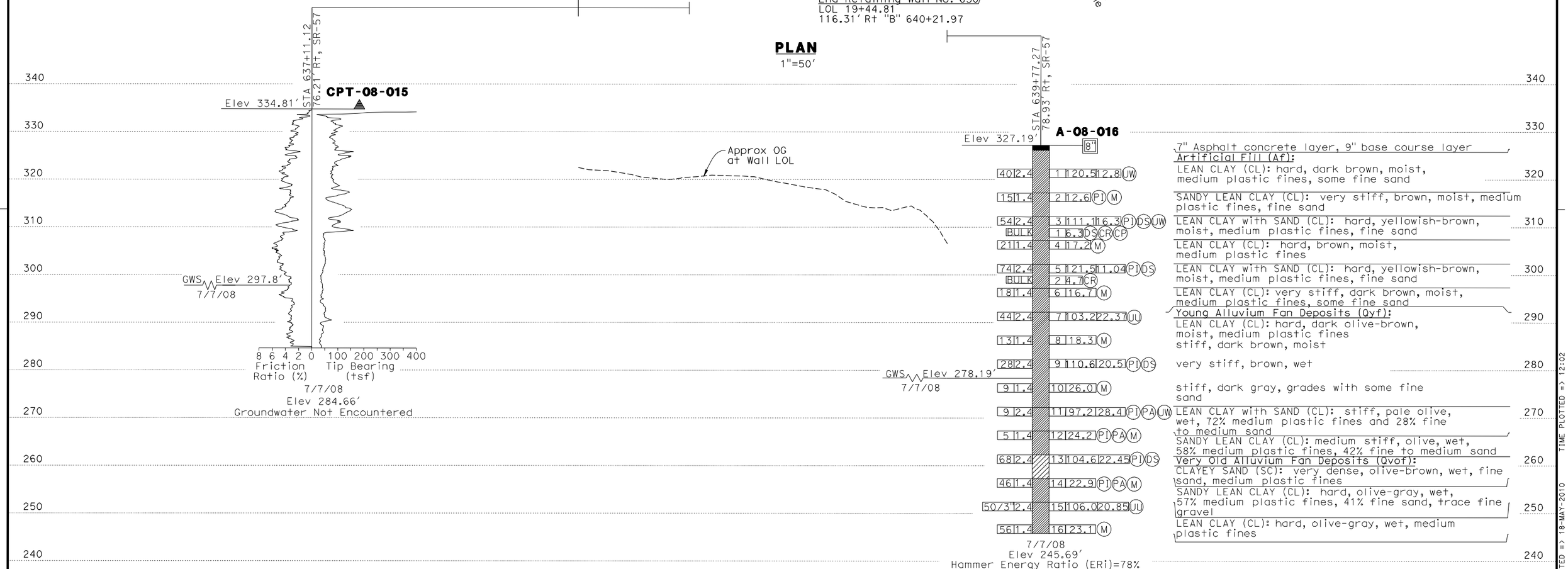
Automatic hammer

CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "SR-57" = "B" Line
631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. 55E0092
POST MILES 19.41

RETAINING WALL NO. 630
LOG OF TEST BORINGS SHEET 2 OF 4

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/18/09 04/07/09 04/27/09 06/08/09

SHEET 24 OF 26

FILE => 55e0092-z-ltb02.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 12:02

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			

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

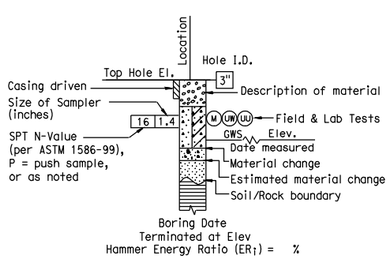
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

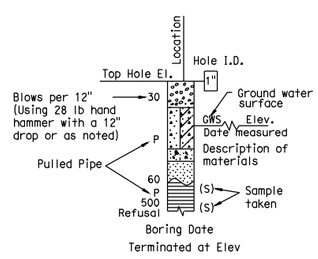
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

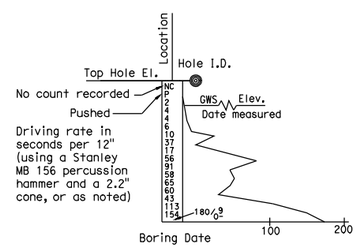
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



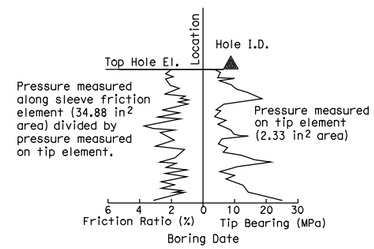
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

BOREHOLE IDENTIFICATION

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

Note: Size in inches.

RETAINING WALL No. 630

SOIL LEGEND

LOG OF TEST BORINGS SHEET 3 OF 4

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0092

POST MILES 19.41

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 04/17/09 06/08/09

SHEET 25 OF 26

FILE => 55e0092-z-ltb03.dgn

USERNAME => jpowell9 DATE PLOTTED => 27-OCT-2009 TIME PLOTTED => 08:55

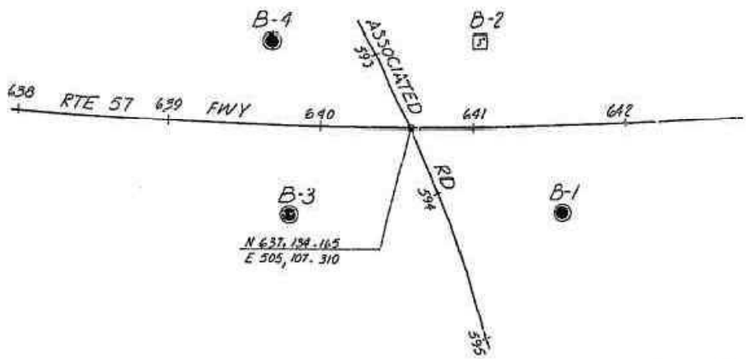
7	CALIF			

DIST.	COUNTY	ROUTE	POSTMILE	TOTAL PROJECT
07	ORA	57	17.4/20.2	171 / 180

Date approved September 30, 1968

BENCH MARK

BM "40-19A-56 Elev. 292.88
Set chiz. knob on top N.E. cor. of S.E. conc. pedestal of Hathaway Co. oil well, A.V. Nl. #10; +8' W. of ℄ of Associated Rd., 500' N. of Sta. 391+22 "P" Line

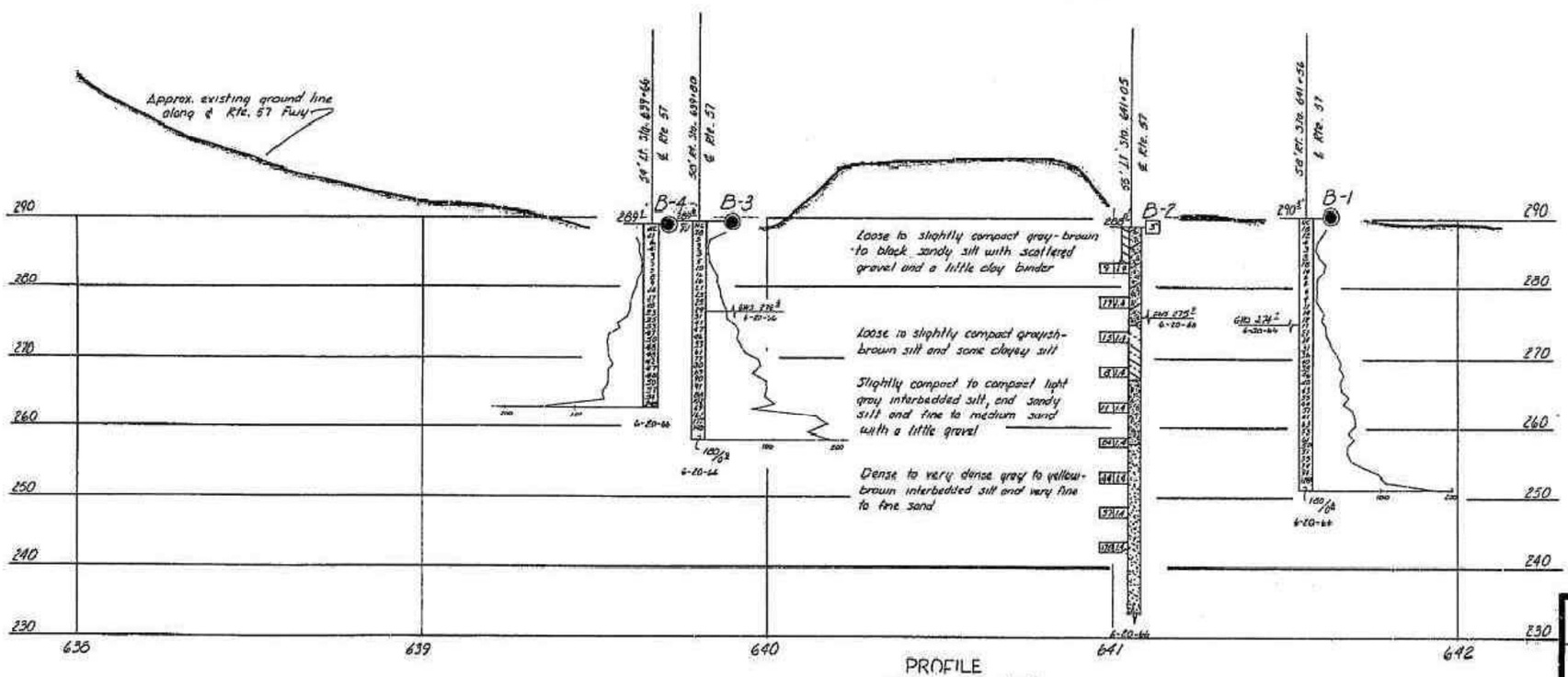


DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			
Hisham Nofal — REGISTERED CIVIL ENGINEER			06/08/09 — DATE		
RETAINING WALL NO. 630					
LOG OF TEST BORINGS SHEET 4 of 4					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU: 12220 EA: 0F0231	BRIDGE No. 55E0092	
				Sheet 26	of 26

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

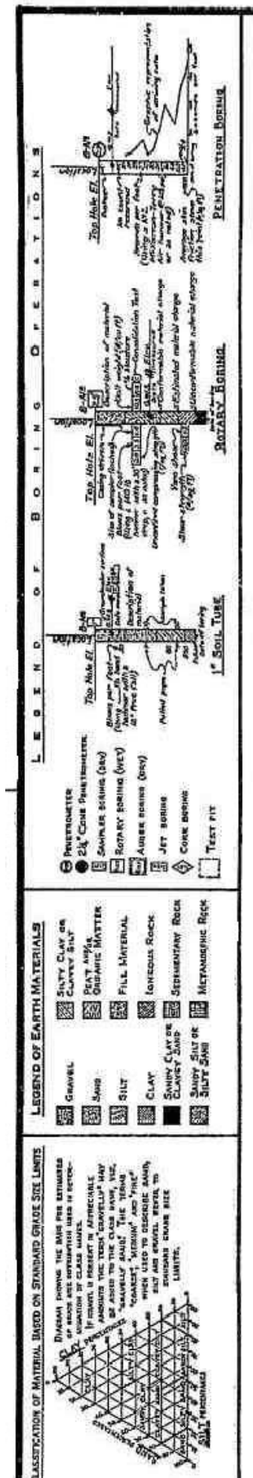
AS BUILT PLANS
Contract No. 07-032124
Date Completed
Document No. 70001578

PLAN
Scale 1" = 50'



PROFILE
Scale Vert. 1" = 10'
Horiz. 1" = 10'

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION



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.

SHEET	OF
1.1	2.1

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ASSOCIATED ROAD UNDERCROSSING

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE 55-466	FILE	DRAWING 55466-12

Charge 07208

PREL. DRAWING No. PR-

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

GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS NAD-83, Zone 6.
Vertical control based on North American Vertical Datum 1988.
Pt 1068: N2277999.248, E6066394.642, Elev 310.252
Pt 1069: N2278210.836, E6066285.157, Elev 305.442

SAMPLER TYPES:

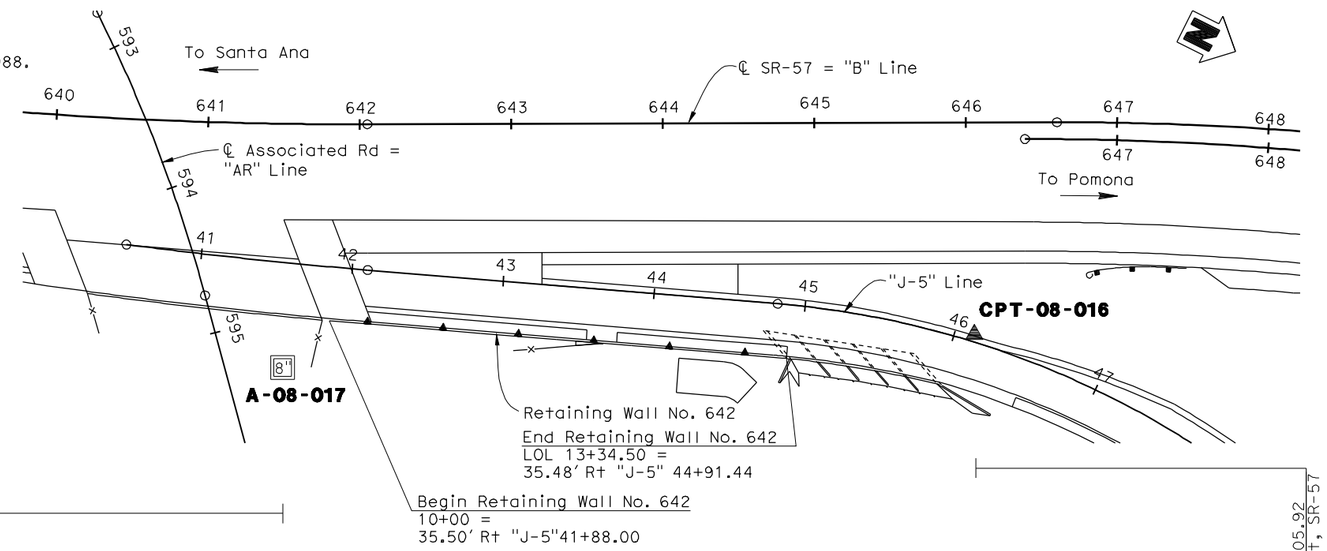
California modified ring sampler
standard penetration test sampler

HAMMER TYPE:

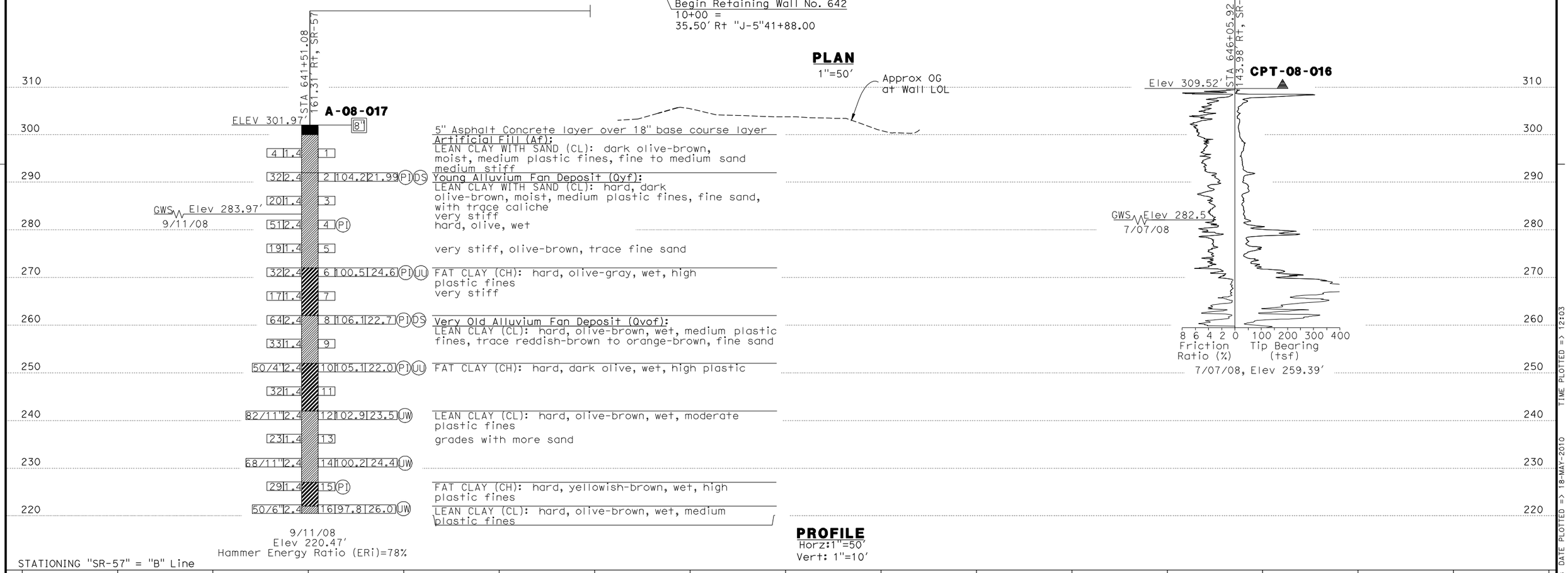
Automatic hammer

CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Ayman Salama PROJECT ENGINEER	BRIDGE NO. 55E0093	RETAINING WALL NO. 642
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE			POST MILES 19.62	LOG OF TEST BORINGS SHEET 1 OF 3

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 13 OF 15

FILE => 55e0093-z-1tb01.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 12:03

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			

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

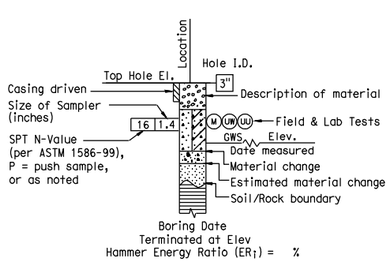
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

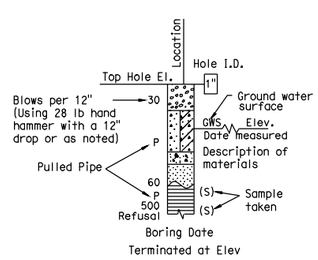
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

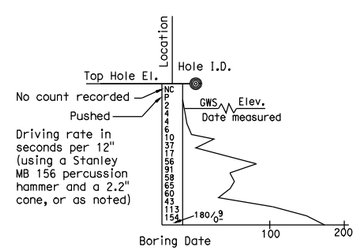
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



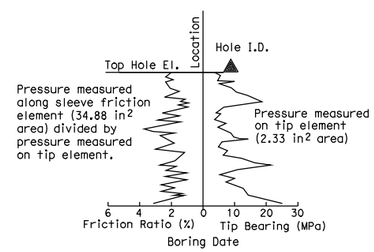
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

BOREHOLE IDENTIFICATION

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

Note: Size in inches.

RETAINING WALL NO. 642

SOIL LEGEND

LOG OF TEST BORINGS SHEET 2 OF 3

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0093

POST MILES 19.62

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 14 OF 15

FILE => 55e0093-z-ltb02.dgn

USERNAME => jpowell9 DATE PLOTTED => 26-OCT-2009 TIME PLOTTED => 07:53

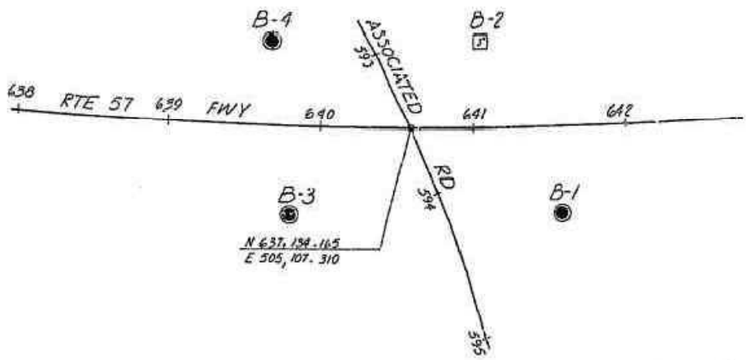
7	CALIF			

DIST.	COUNTY	ROUTE	POST MILES	TOTAL PROJECT
07	ORA	57	17.4/20.2	171 / 180

Date approved September 30, 1968

BENCH MARK

BM "40-19A-56" Elev. 292.88
Set chiz. knob on top N.E. cor. of S.E. conc. pedestal of Hathaway Co. oil well, A.V. Nº 10; +8' W. of ℄ of Associated Rd., 500' N. of Sta. 391+22 "P" Line

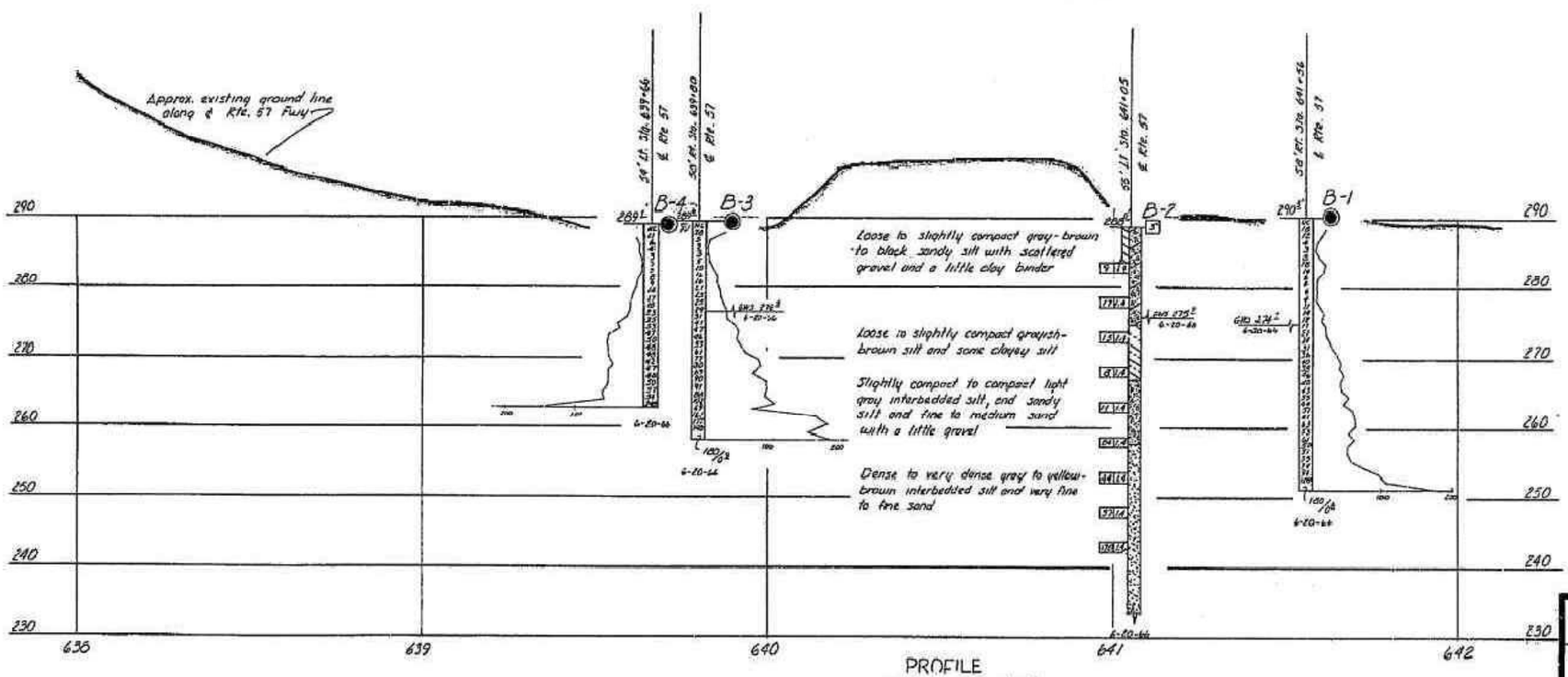


DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			
Hisham M. Nofal — REGISTERED CIVIL ENGINEER			06/08/09 — DATE		
RETAINING WALL NO. 642					
LOG OF TEST BORINGS SHEET 3 of 3					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU: 12220 EA: 0F0231	BRIDGE No. 55E0093	
				Sheet 15	of 15

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL — No. 2765 — Exp. 09/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

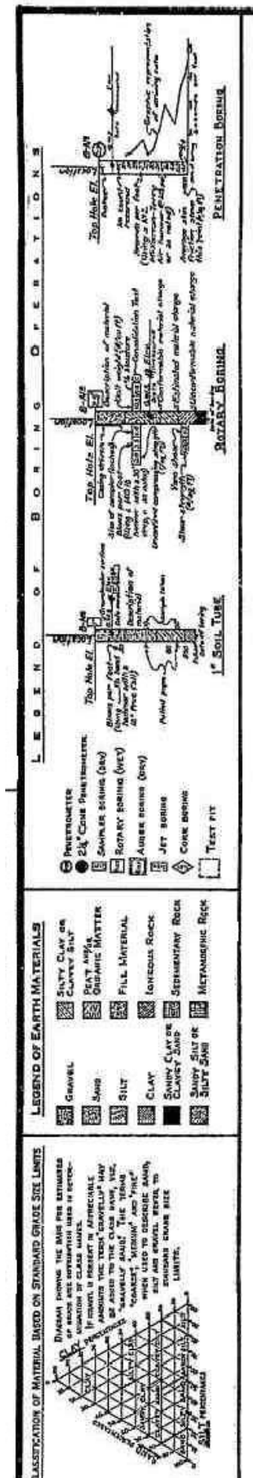
AS BUILT PLANS
Contract No. 07-032124
Date Completed
Document No. 70001578

PLAN
Scale 1" = 50'



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

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION



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.

SHEET	OF
11	21

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ASSOCIATED ROAD UNDERCROSSING

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE 55-466	FILE	DRAWING 55466-12

Charge 07208

PREL. DRAWING No. PR-

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

GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

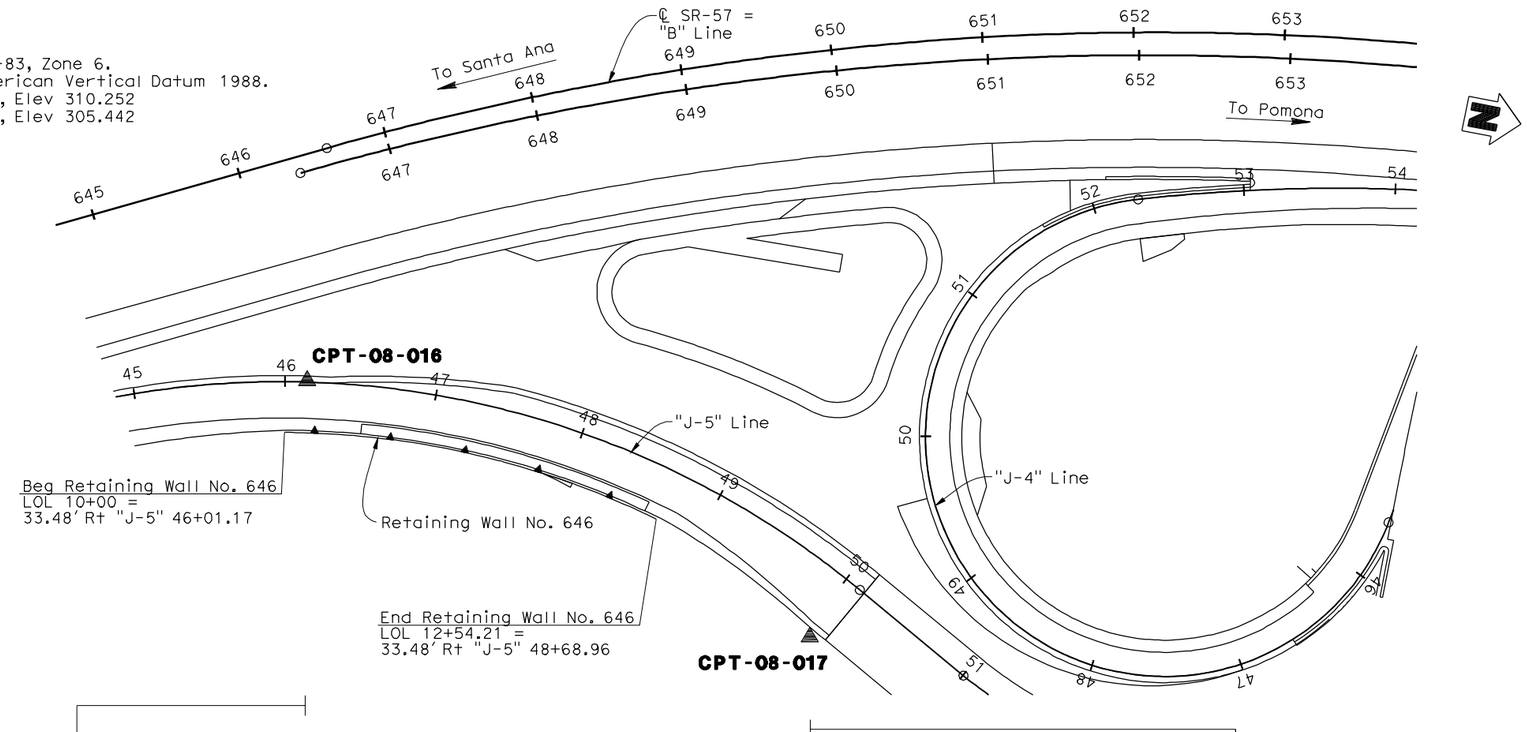
REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

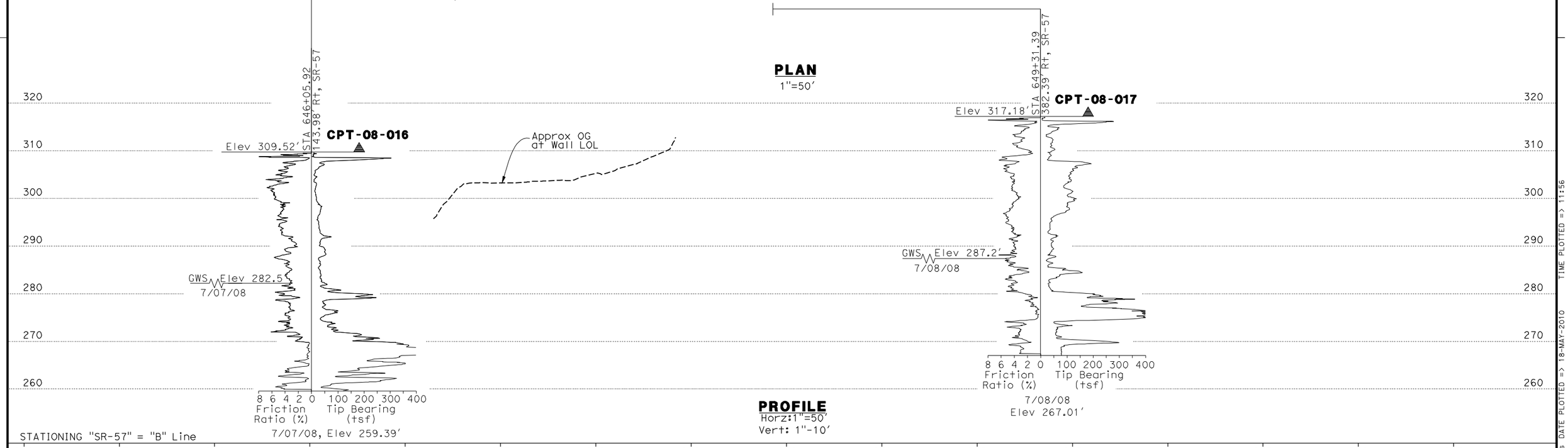
CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS NAD-83, Zone 6.
Vertical control based on North American Vertical Datum 1988.
Pt 1068: N2277999.248, E6066394.642, Elev 310.252
Pt 1069: N2278210.836, E6066285.157, Elev 305.442



PLAN
1"=50′



PROFILE
Horz:1"=50′
Vert: 1"-10′

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Ayman Salama PROJECT ENGINEER	BRIDGE NO. 55E0094	RETAINING WALL No. 646
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE			POST MILES 19.70	LOG OF TEST BORINGS SHEET 1 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 9 OF 10

FILE => 55e0094-z-1tb01.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:56

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			

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

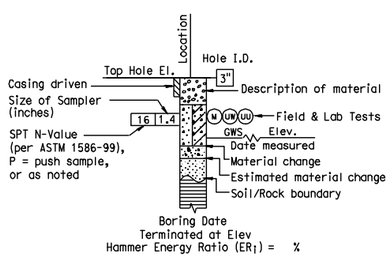
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

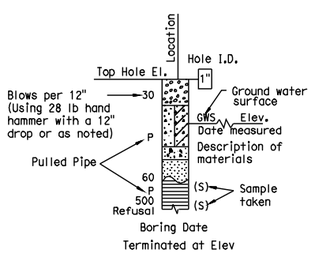
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

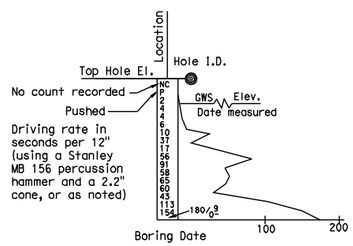
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



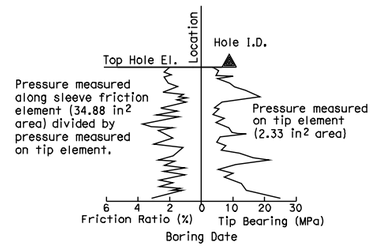
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0094

POST MILES 19.70

RETAINING WALL NO. 646

SOIL LEGEND

LOG OF TEST BORINGS SHEET 2 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 04/17/09 06/08/09

SHEET 10 OF 10

FILE => 55e0094-z-1tb02.dgn

USERNAME => nmorales DATE PLOTTED => 06-JUN-2009 TIME PLOTTED => 12:26

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1050: N2279503.786, E6066168.912, Elev 326.908

SAMPLER TYPES:

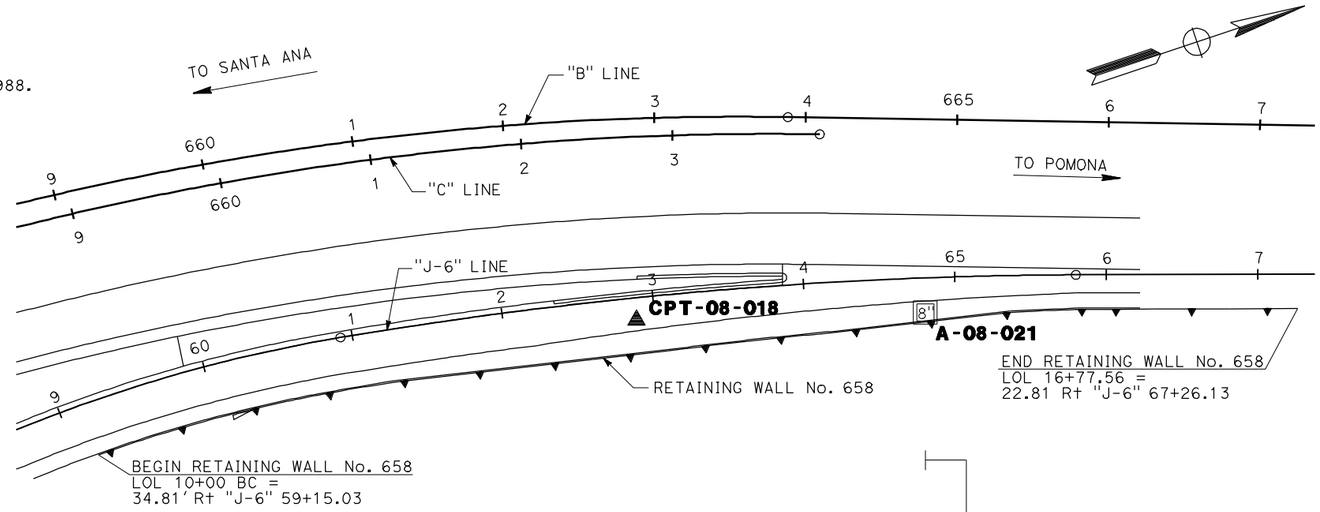
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

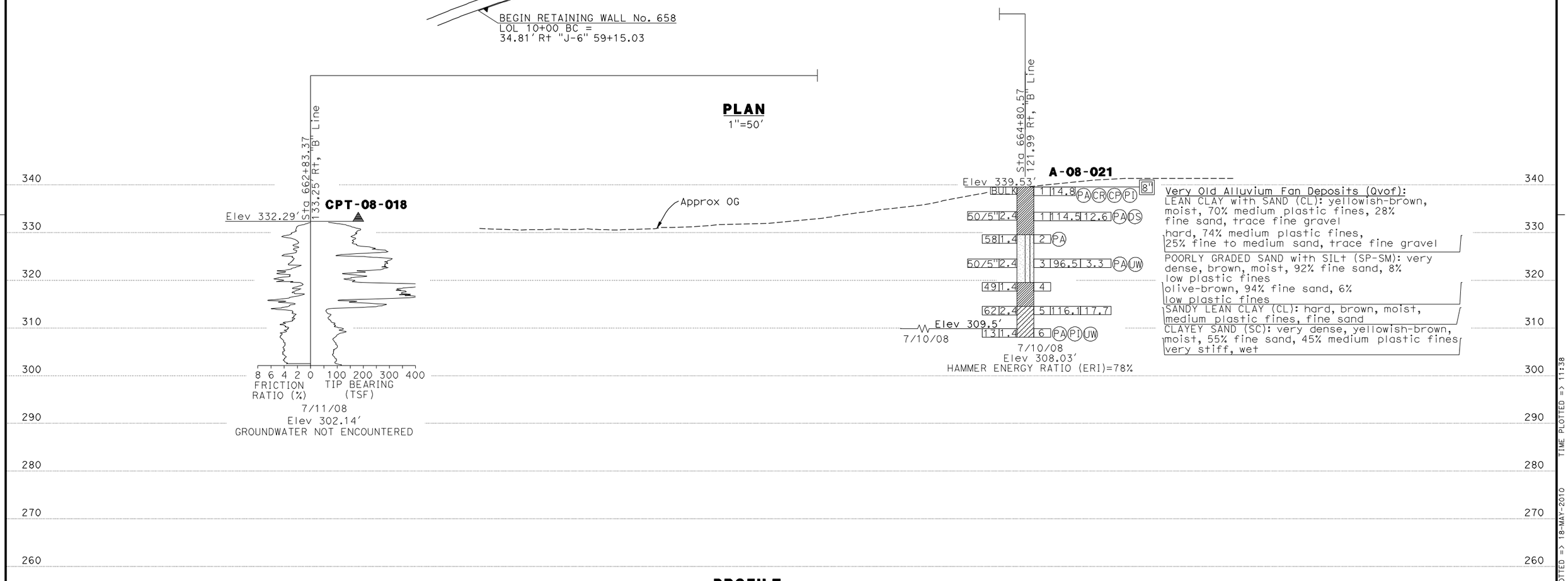
AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "B" LINE

5 6 7 8 9 660 1 2 3 4 665 6 7 8 9 670

DESIGN OVERSIGHT	DRAWN BY K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED BY H. Nofal	DATE	Ayman Salama PROJECT ENGINEER

BRIDGE NO.
POST MILES

RETAINING WALL No. 658
LOG OF TEST BORINGS SHEET 1 OF 2 R-24

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032ad006.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:38

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/11 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

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

CEMENTATION

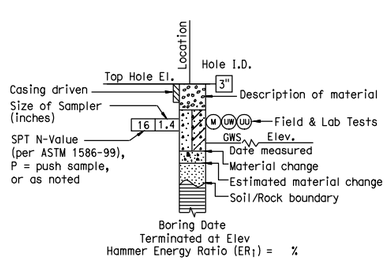
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

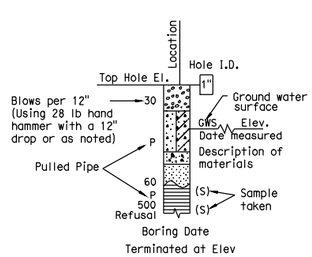
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

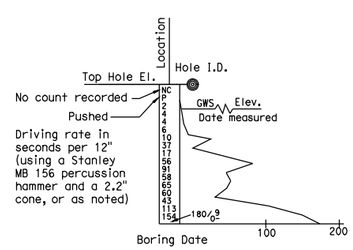
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



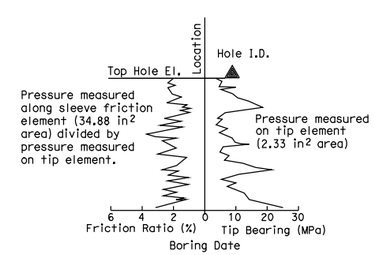
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

RETAINING WALL No. 658

LOG OF TEST BORINGS SHEET 2 OF 2 R-25

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032qd007.dgn

USERNAME => rmitry DATE PLOTTED => 06-NOV-2009 TIME PLOTTED => 09:58

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are cCCS NAD-83, Zone 6.
vertical control based on North American Vertical Datum 1988.
Pt 1050: N2279503.786, E6066168.912, Elev 326.908
Pt 1160: N2281521.621, E6067030.125, Elev 356.584

SAMPLER TYPES:

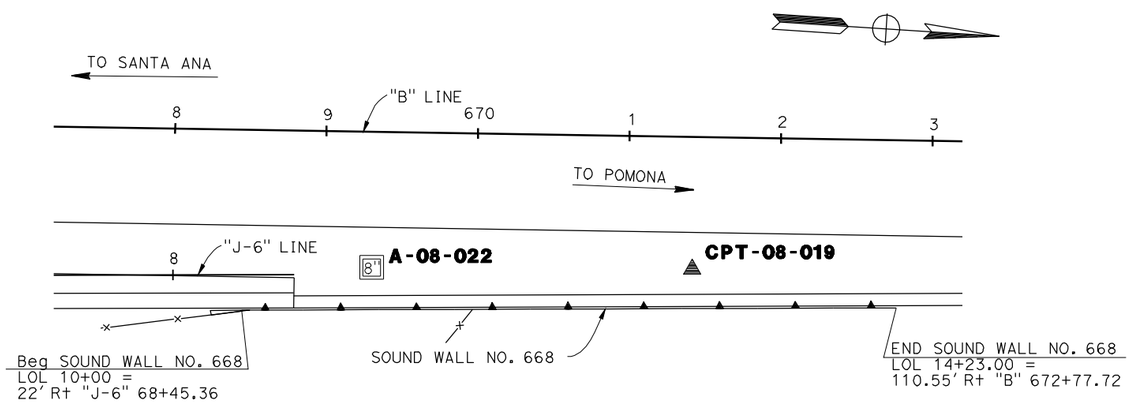
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

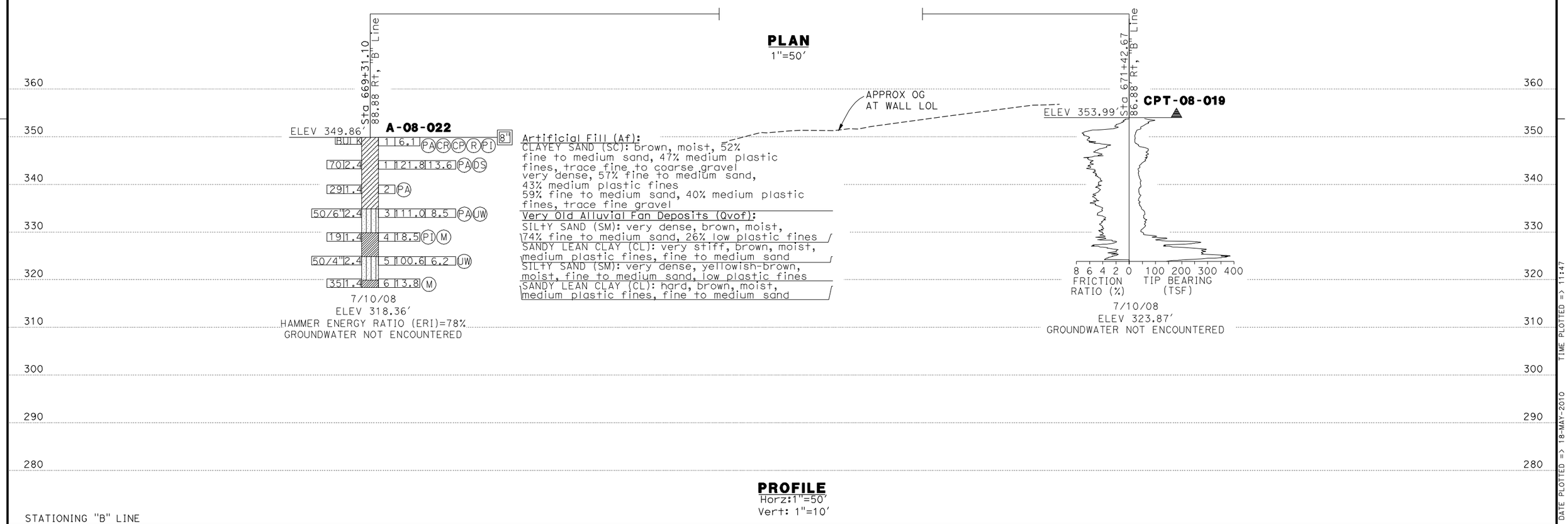
AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'



PROFILE
Horz: 1"=50'
Vert: 1"=10'

STATIONING "B" LINE

3 4 665 6 7 8 9 670 1 2 3 4 675 6 7 8

DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Ayman Salama PROJECT ENGINEER	BRIDGE NO. / POST MILES
	CHECKED BY H. Nofal	DATE			

SOUND WALL NO. 668
LOG OF TEST BORINGS SHEET 1 OF 2 SW-45

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 06/15/09 SHEET OF

FILE => c0F032re003.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:47

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/11 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

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

CEMENTATION

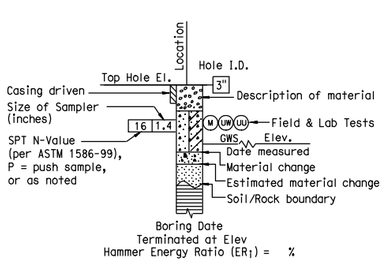
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

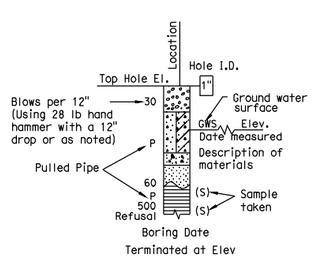
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

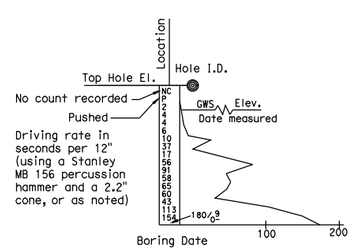
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



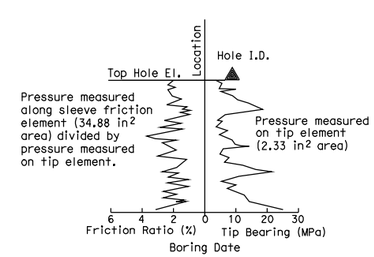
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

SOUND WALL No. 668

LOG OF TEST BORINGS SHEET 2 OF 2

SW-46

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032re004.dgn

USERNAME => rmitry DATE PLOTTED => 06-NOV-2009 TIME PLOTTED => 09:59

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

Hisham Nofal
GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

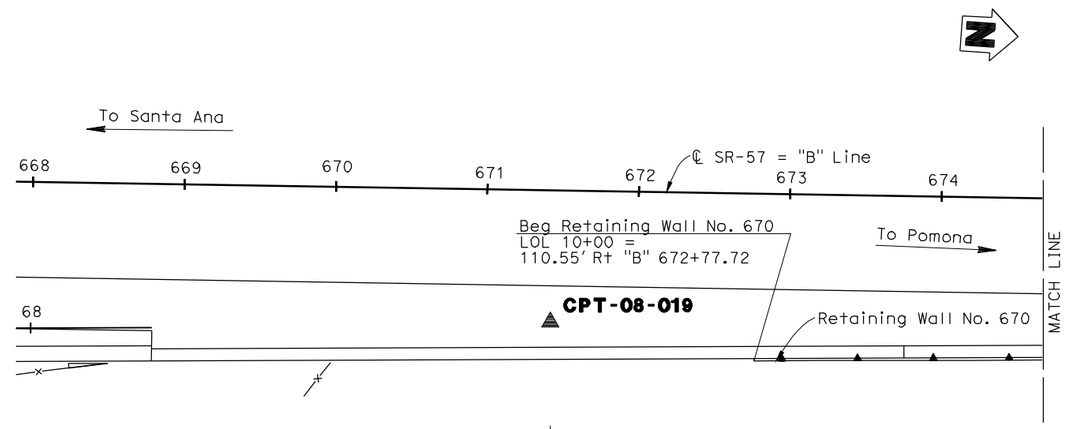
REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

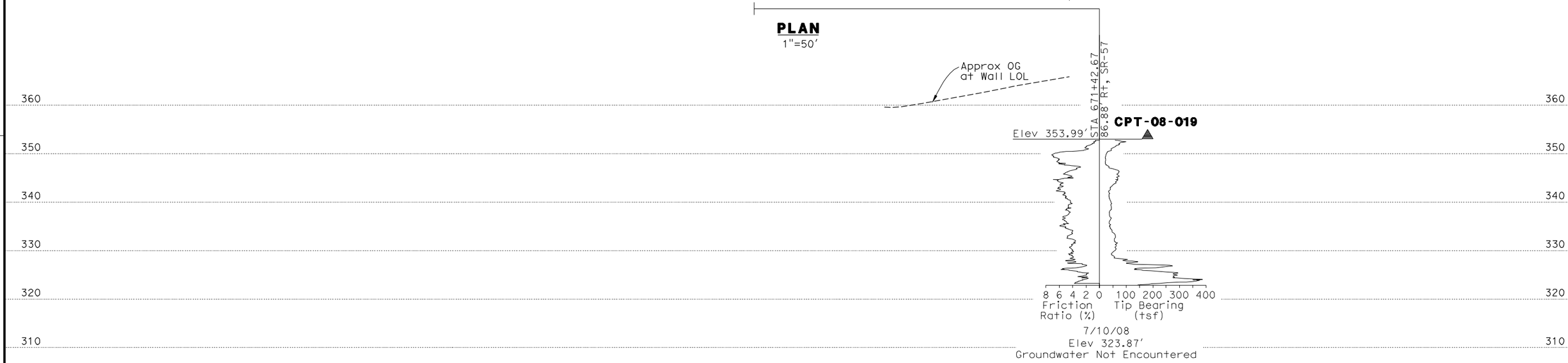
OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:
Horizontal coordinates are cCCS NAD-83, Zone 6.
vertical control based on North American Vertical Datum 1988.
Pt 1050: N2279503.786, E6066168.912, Elev 326.908
Pt 1160: N2281521.621, E6067030.125, Elev 356.584



PLAN
1"=50'



PROFILE
Horz: 1"=50'
Vert: 1"=10'

STATIONING "SR-57" = "B" Line
665 666 667 668 669 670 671 672 673 674 675 676 677 678 679

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. 55E0095
POST MILES 20.21

RETAINING WALL NO. 670
LOG OF TEST BORINGS SHEET 1 OF 4

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 18 OF 21

FILE => 55e0095-z-l1tb01.dgn

USERNAME => rmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 12:04

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

GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

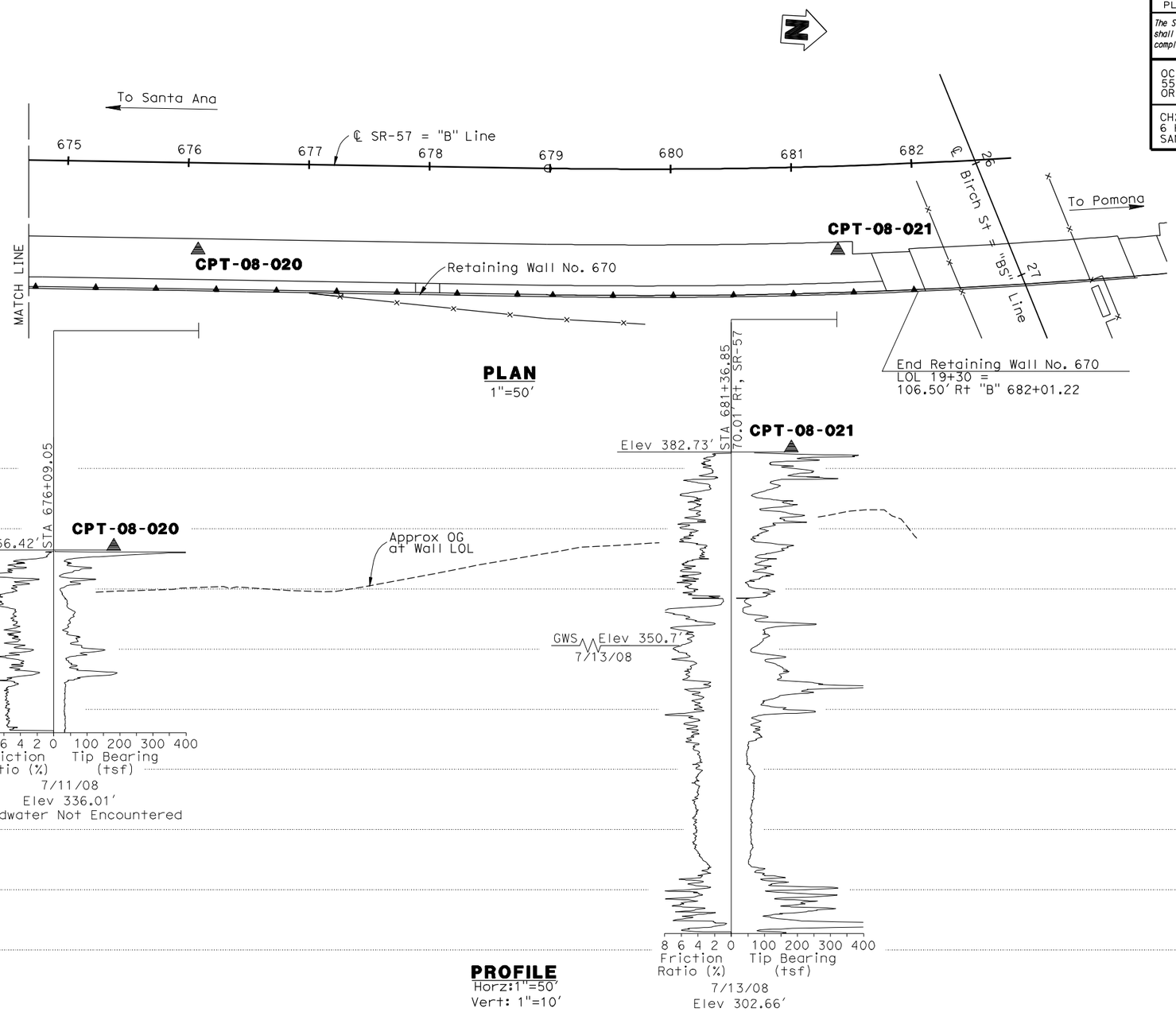
REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS Nad-83, Zone 6.
Vertical control based on North American Vertical Datum 1988.
Pt 1050: N2279503.786, E6066168.912, Elev 326.908



DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Ayman Salama PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE		

BRIDGE NO. 55E0095 — POST MILES 20.21

RETAINING WALL NO. 670

LOG OF TEST BORINGS SHEET 2 OF 4

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 19 OF 21

FILE => 55e0095-z-1tb02.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 12:04

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			

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

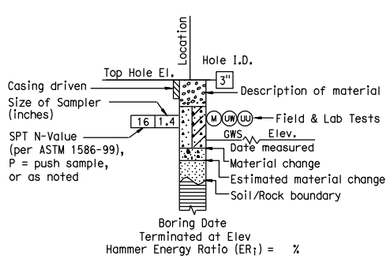
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

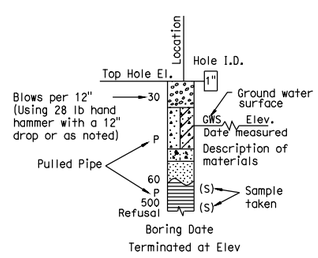
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

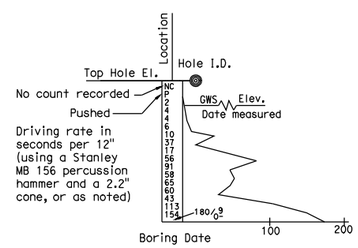
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



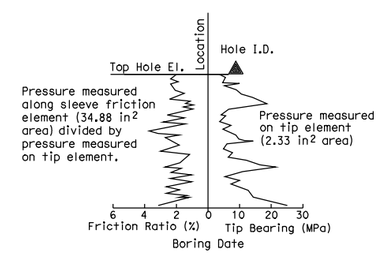
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

BOREHOLE IDENTIFICATION

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

Note: Size in inches.

RETAINING WALL NO. 670

SOIL LEGEND

LOG OF TEST BORINGS SHEET 3 OF 4

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0095

POST MILES 20.21

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 20 OF 21

FILE => 55e0095-z-ltb03.dgn

USERNAME => jpowell9 DATE PLOTTED => 26-OCT-2009 TIME PLOTTED => 08:07

7	CALIF.		

Dist.	County	Route	Section	Sheet No.	Total Sheets
07	Ora.	57	19.3/R.6	149	197

Registered Civil Engineer R.C.E. 23

Date approved March 24, 1969

LEGEND OF BORING OPERATIONS

Penetrometer
2½" Cone 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
Silty
Clay
Sandy Clay or Clayey Sand
Sandy Silt or Silty Sand
Silty Clay or Clayey Silt
Peat and Organic Matter
Fill Material
Igneous Rock
Sedimentary Rock
Metamorphic Rock

Classification of Material Based on Standard Grain 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 D. Mart 11-3-67
Drawn	By A. Allen 11-9-67
Checked	By A. D. Schrock 11-13-67

Supervising Engineer Geologist

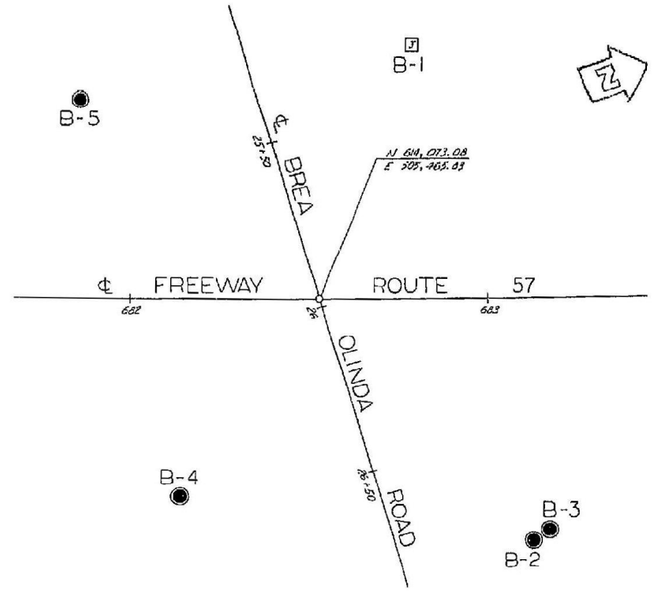
BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

14

BENCH MARK

B.M. # 684-E-66 Elev. 357.46
Pd. Union Oil Co Mon. stamped G and L No. 16, 1.5 196B, 0.5' deep 582' west of Stat. 633 + 39 'P' Line.

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE Nov. 1967



PLAN

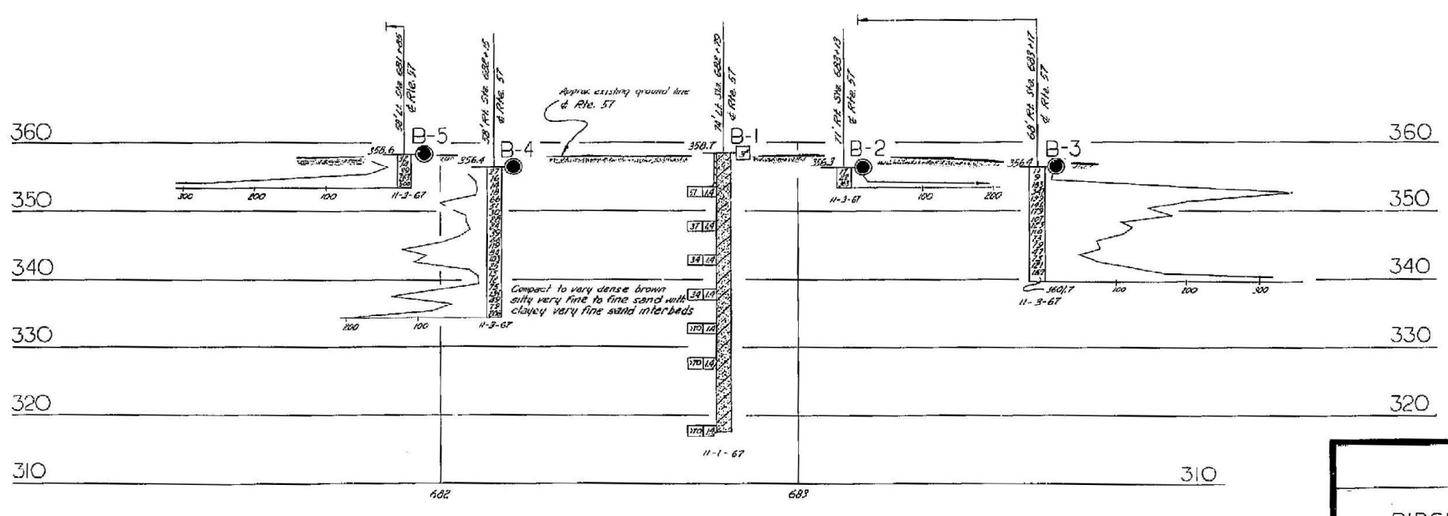
Scale: 1" = 20'

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			
Hisham Nofal — REGISTERED CIVIL ENGINEER			06/08/09 — DATE		
RETAINING WALL NO. 670					
LOG OF TEST BORINGS SHEET 4 of 4					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA		CU:12220 EA:0F0321	BRIDGE No. 55E0095		
				Sheet 21	of 21

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PROFILE

Scale: Vert. 1" = 10'
Horiz. 1" = 30'



AS BUILT
Contractor W. Hansen
Contract No. 07-032204
Date 8-31-71
WP 11-3-71

Sheet	of
13	13

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BIRCH STREET UNDERCROSSING

LOG OF TEST BORINGS

Scale As Noted	Bridge 55-485	File	Drawing 55 485-7

Charge 01208
W.A. 032201

Disregard prints bearing earlier numbers → PREL. DRAWING No. PR-

AS BUILT PLANS
Contract No. 07-032204
Date Completed
Document No. 2000 5907

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 PUBLIC WORKS.

DATE 15 Feb 73 SIGNATURE James E. Court TITLE Sr. Rmo

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

GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS Nad-83, Zone 6.
vertical control based on North American Vertical Datum 1988.
Pt 1079: N2282339.808, E6067144.835, Elev 407.210
Pt 1160: N2281521.621, E6067030.125, Elev 356.584

SAMPLER TYPES:

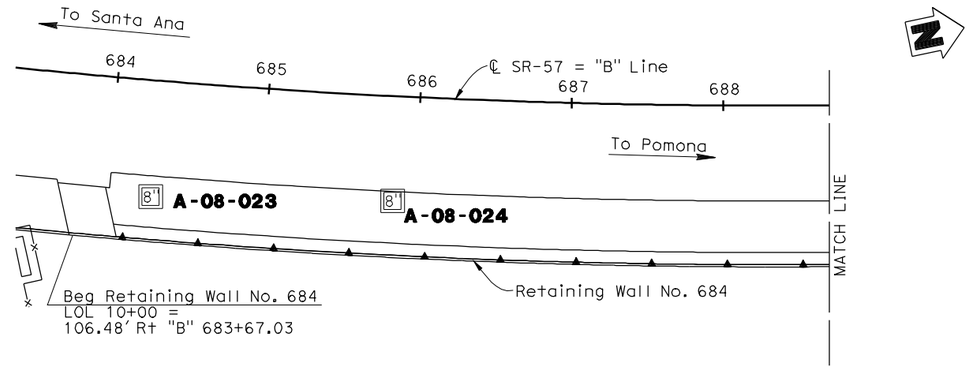
California modified ring sampler
standard penetration test sampler

HAMMER TYPE:

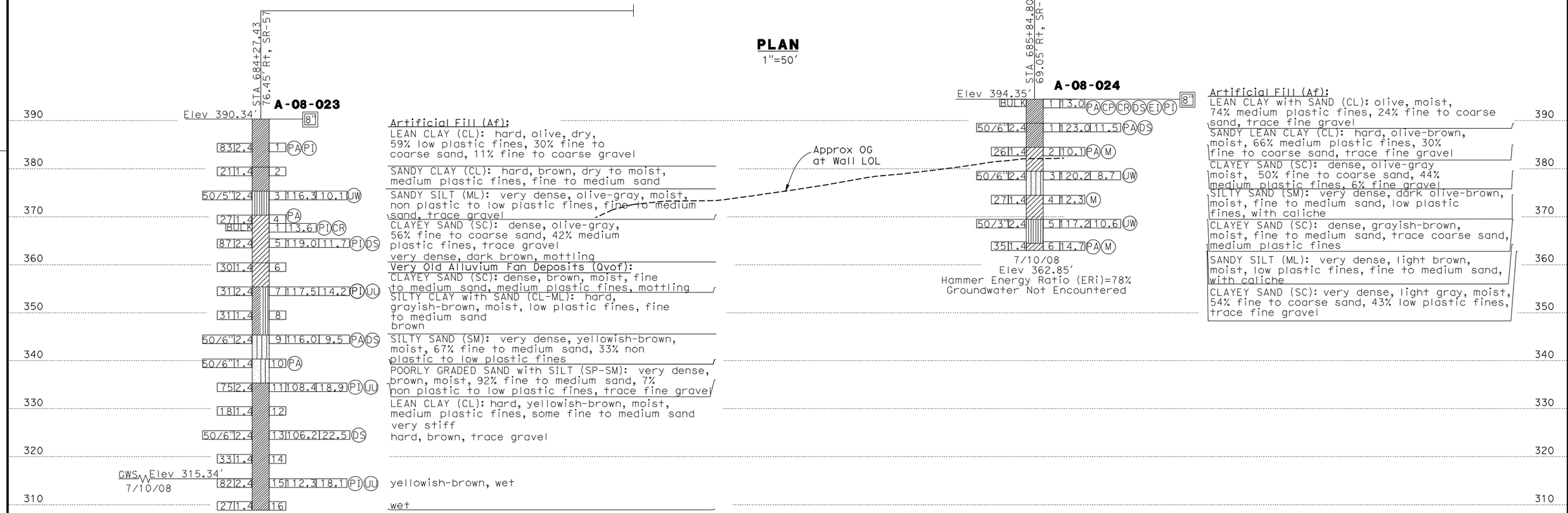
Automatic hammer

CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



PLAN
1"=50'



STATIONING "SR-57" = "B" Line

PROFILE
Horz:1"=50'
Vert: 1"=10'

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. 55E0096
POST MILES 20.42

RETAINING WALL No. 684

LOG OF TEST BORINGS SHEET 1 OF 5

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/27/09 06/08/09

SHEET 12 OF 16

FILE => 55e0096-z-ltb01.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 12:06

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

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS NAD-83, Zone 6.
vertical control based on North American Vertical Datum 1988.
Pt 1079: N2282339.808, E6067144.835, Elev 407.210
Pt 1160: N2281521.621, E6067030.125, Elev 356.584

SAMPLER TYPES:

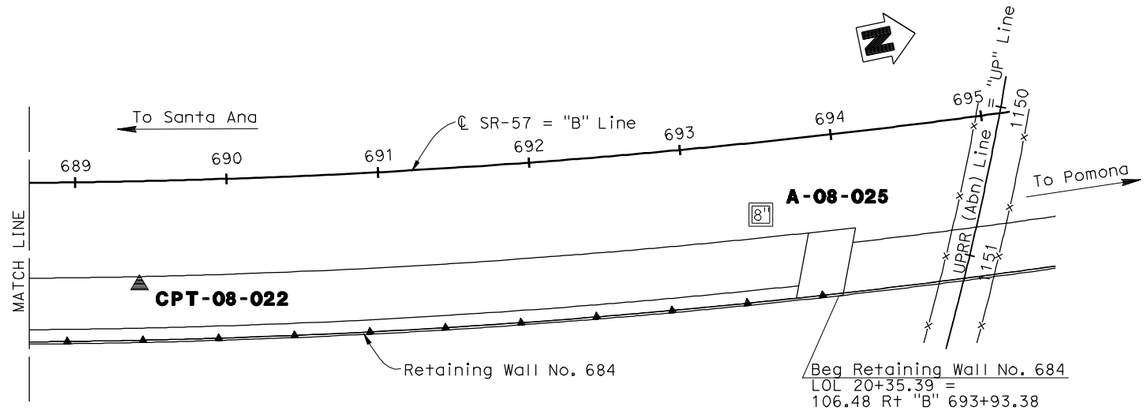
California modified ring sampler
standard penetration test sampler

HAMMER TYPE:

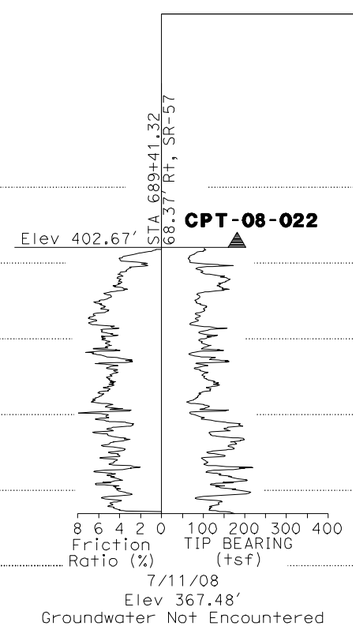
Automatic hammer

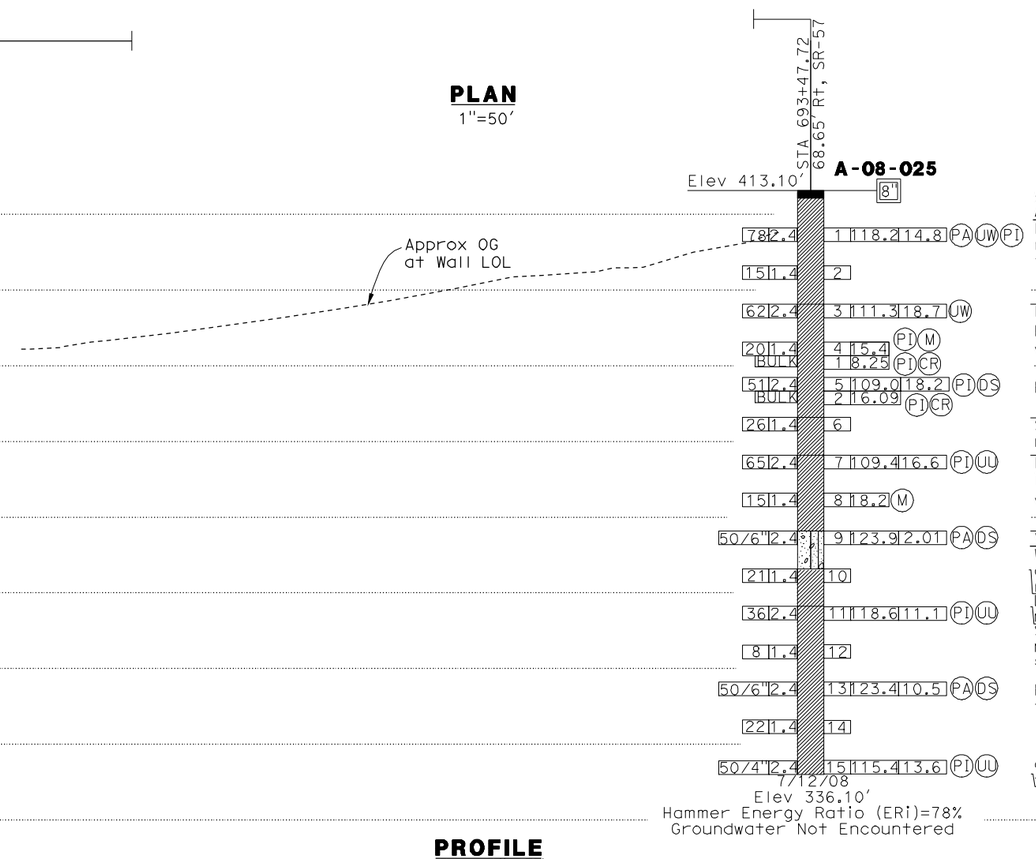
CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



PLAN
1"=50'





Blows	Tsf	Sample	Depth	Moisture	Dry Density	Tests	Description
78	2.4	1	18.2	14.8		PA UW PI	5" Asphalt concrete layer over 9" base course layer Artificial Fill (Af): LEAN CLAY with SAND (CL): hard, olive, moist, 78% medium plastic fines, 21% fine to coarse sand, trace fine gravel
15	1.4	2					very stiff
62	2.4	3	11.3	18.7		UW	LEAN CLAY (CL): hard, olive-gray, moist, medium plastic fines, some fine to medium sand
20	1.4	4	15.4			PI M	very stiff, olive-brown, trace gravel
BULK		1	8.25			PI CR	
51	2.4	5	09.0	18.2		PI DS	hard, olive
BULK		2	6.09			PI CR	
26	1.4	6					SANDY LEAN CLAY (CL): hard, dark brown, moist, medium plastic fines, fine sand
65	2.4	7	09.4	16.6		PI UL	LEAN CLAY (CL): hard, olive-brown, moist, silty sand interbeds, some mottling, medium plastic fines, fine sand
15	1.4	8	18.2			M	very stiff, dark brown, mottling
50/6"	2.4	9	23.9	2.01		PA DS	Very Old Alluvium Fan Deposits (Qvof): WELL GRADED SAND with SILT and GRAVEL (SW-SM): very dense, gray, moist, 49% fine to coarse sand, 7% non-plastic fines, 44% fine gravel
21	1.4	10					LEAN CLAY with SAND (CL): hard, moist, brown, medium plastic fines, fine sand
36	2.4	11	18.6	11.1		PI UL	SANDY LEAN CLAY (CL): hard, dark olive, moist, medium plastic fines, fine sand
8	1.4	12					stiff
50/6"	2.4	13	23.4	10.5		PA DS	hard, brown, 53% medium plastic fines 44% fine to coarse sand, trace fine gravel
22	1.4	14					
50/4"	2.4	15	15.4	13.6		PI UL	dark brown, moist, medium plastic fines, fine sand

PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "SR-57" = "B" Line

685 686 687 688 689 690 691 692 693 694 695 696 697 698 699

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0096
POST MILES 20.42

RETAINING WALL No. 684
LOG OF TEST BORINGS SHEET 2 OF 5

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 13 OF 16

FILE => 55e0096-z-1tb02.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 12:07

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			

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

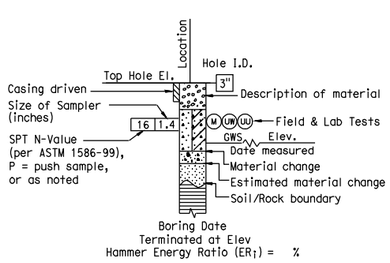
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

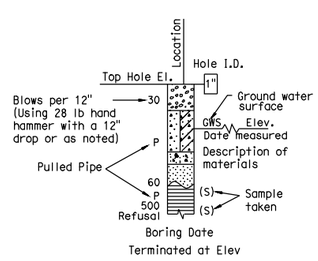
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

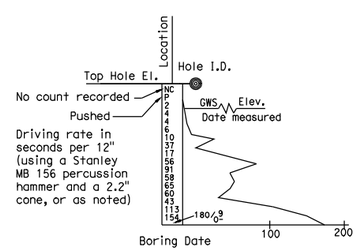
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



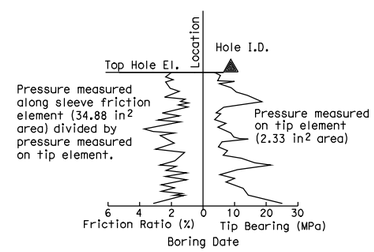
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

BOREHOLE IDENTIFICATION

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

Note: Size in inches.

RETAINING WALL NO. 684

SOIL LEGEND

LOG OF TEST BORINGS SHEET 3 OF 5

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0096

POST MILES 20.42

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 04/17/09 06/08/09

SHEET 14 OF 16

FILE => 55e0096-z-ltb03.dgn

USERNAME => jpowell9 DATE PLOTTED => 26-OCT-2009 TIME PLOTTED => 10:33

Dist.	County	Route	Section	Sheet No.	Total Sheets
07	Ora.	57	195 Bre.	149	197

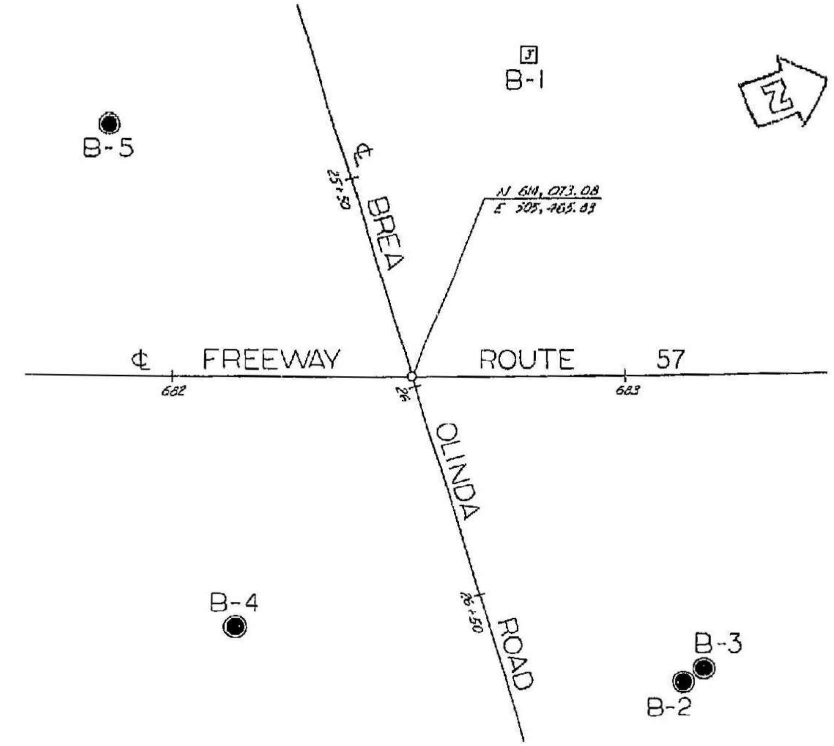
REGISTERED CIVIL ENGINEER
DATE APPROVED March 24, 1969

BENCH MARK

B.M. # 684-E-66 Elev. 357.46
Fd. Union Oil Co. Mon. stamped G and L No. 16, L.S 1968, 0.5' deep 582' west of Stat. 633+39 "P" Line.

PLAN

Scale: 1" = 20'



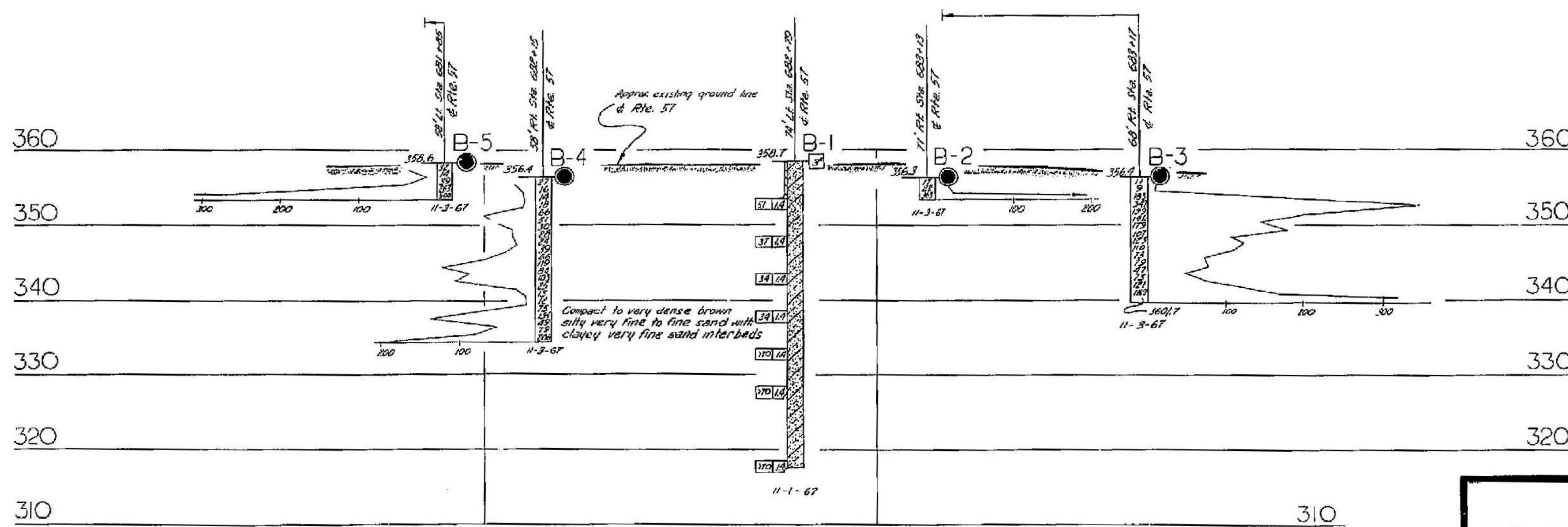
NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE Nov., 1967

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			
REGISTERED CIVIL ENGINEER				DATE 06/08/09	
RETAINING WALL NO. 684					
LOG OF TEST BORINGS SHEET 4 of 5					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE ANDINVESTIGATIONS, SACRAMENTO, CALIFORNIA			CU:12220 EA:OF0321	BRIDGE No. 55E0096	
				Sheet 15	of 16

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

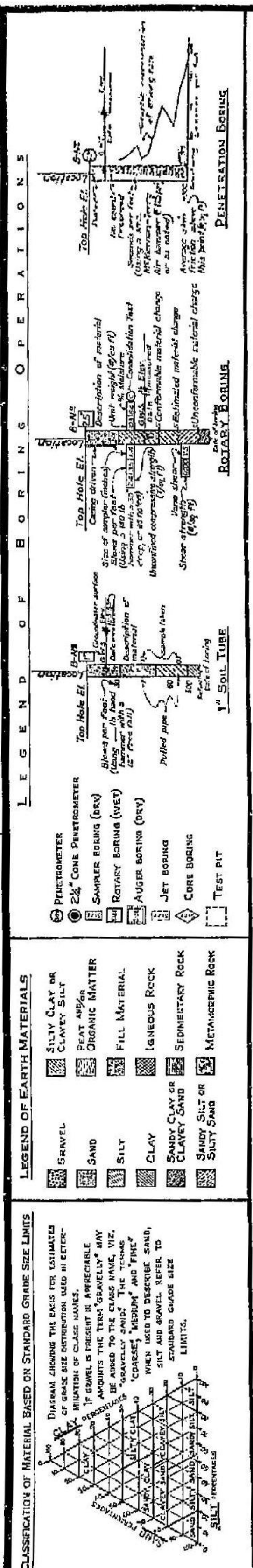
PROFILE

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



AS BUILT
CONTRACTOR W. Hansen
CONTRACT NO. 07-032204
DATE 8-31-71
WP 11-3-71

SHEET 13 OF 13



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 O. Mikes 11-3-67
DRAWN	By B. Allen 11-9-67
CHECKED	By C.D. Schenk 11-14-67

Approval Recommended — Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

14

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BIRCH STREET UNDERCROSSING

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE 55-485	FILE	DRAWING 55485-7

Charge 01208
W.A. 032E01

Disregard prints bearing earlier numbers → PREL. DRAWING No. PR–

AS BUILT PLANS
Contract No. 07-032204
Date Completed
Document No. 7C005907

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 PUBLIC WORKS.
DATE 15 Feb. 73 SIGNATURE James E. Court TITLE SR. RMO

DIST.	COUNTY	ROUTE	EXCESS	PARCEL NO.	REV. DATE
12	ORA	57	1855 / 1929.6	164	147

DIST. ENGINEER — FOUNDATION ENGR.

DATE APPROVED: March 24, 1969

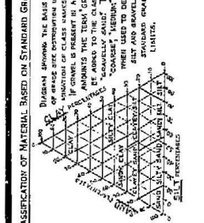
LEGEND OF BORING OPERATIONS

- Penetrometer
- 2½" Cone Penetrometer
- Sampler Boring (Dev)
- Rotary Borings (Dev)
- Auger Boring (Dev)
- Jet Boring
- Core Boring
- Test Pit
- Deep Traction Boring
- Rotary Boring
- 1" Soil Tube

LEGEND OF EARTH MATERIALS

- Gravel
- Silty Clay or Clayey Silt
- Sand
- 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 D. Nikes	11-16-67
DRAWN	by J. Lynn	11-29-67
CHECKED	by J. Alexander	1-2-68

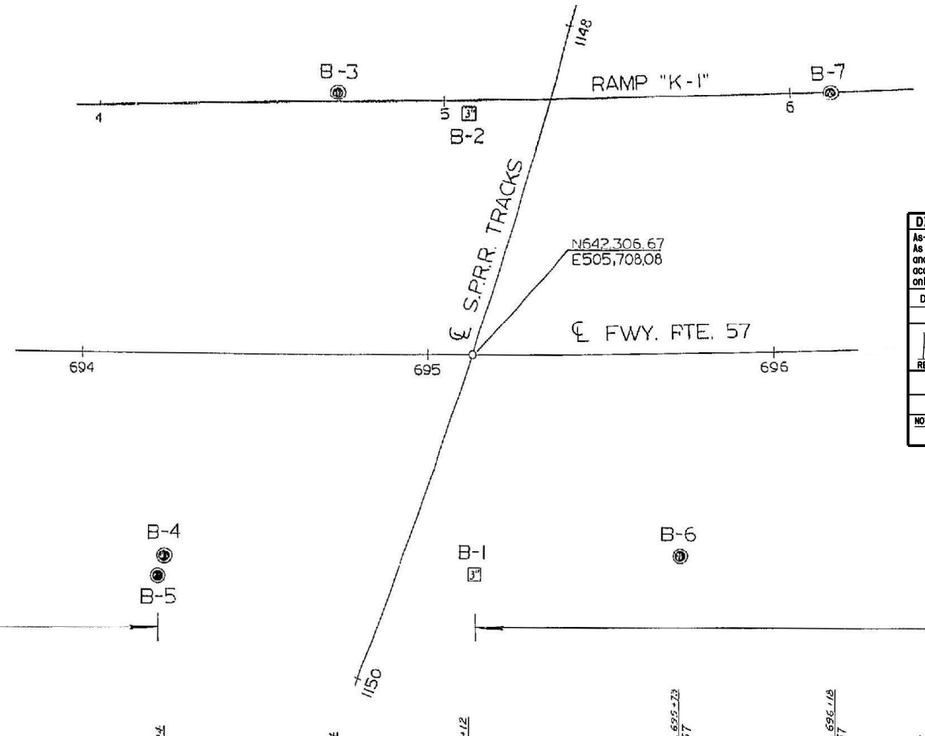
Approval Recommended by: Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

164

BENCH MARK

BM 964-E-66 Elev 368.47
Pd Tack in conc. filled 8" I.F. marked Sta. 643+42.76 "P" P.O.T., in CTR of tracks, 79' west of rails of S.P.R.Y. spur line and steardlease. Union Oil Co. pvt. road.



DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			
Hisham M. Nofal — REGISTERED CIVIL ENGINEER			06/08/09 — DATE		
RETAINING WALL NO. 684					
LOG OF TEST BORINGS SHEET 5 OF 5					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA	CU: 12220 EA: 0F0321		BRIDGE No. 55E0096	Sheet 16	of 16

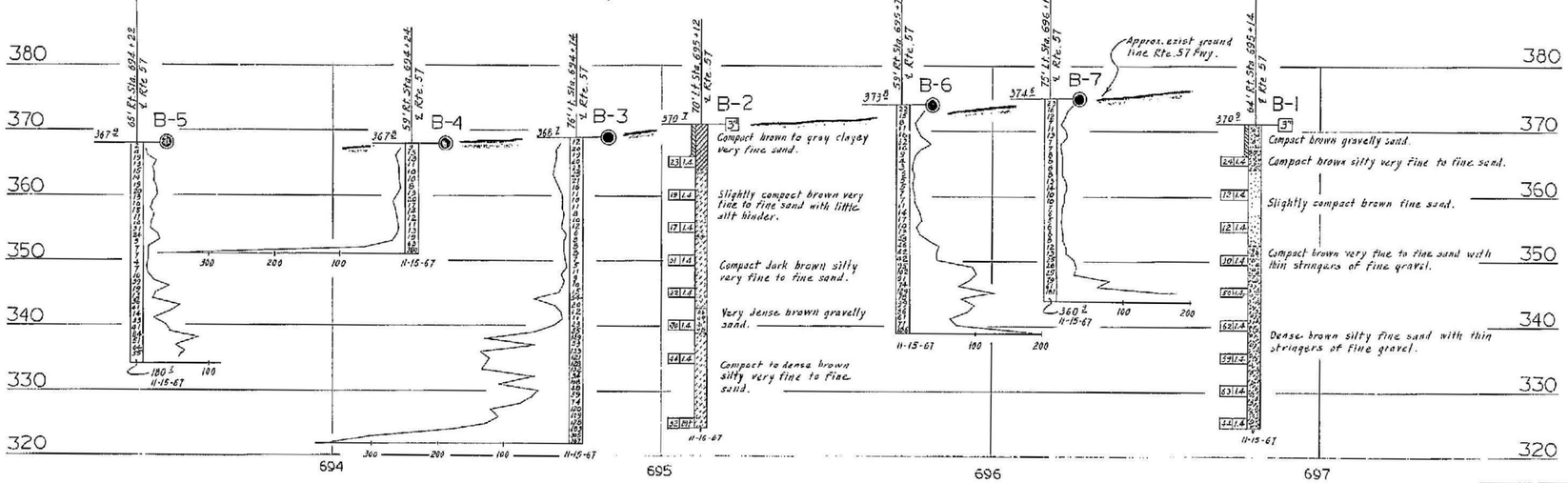
REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL — No. 2765 — Exp. 09/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLAN

Scale: 1" = 20'

PROFILE

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



BRIDGE DEPT. GEOLOGY SECTION
DATE November 1967

AS BUILT
CONTRACTOR J. W. Hansen
CONTRACT NO. 07-032204
DATE 8-31-71
WP 11-3-71

15 OF 15

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BREA OVERHEAD

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE # 55-162	FILE	DRAWING S-F 952-9

Chg 07206
W.A. 032201

Disregard prints bearing earlier revisions.

PREL. DRAWING NO. PR-

AS BUILT PLANS
Contract No. 07-032204
Date Completed
Document No. 7000 5907

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 PUBLIC WORKS.

DATE 15 Feb. 73 SIGNATURE James E. Court TITLE Sr. Rmo

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1079: N2282339.808, E6067144.835, Elev 407.210
Pt 1081: N2282931.290, E6067198.604, Elev 422.355

SAMPLER TYPES:

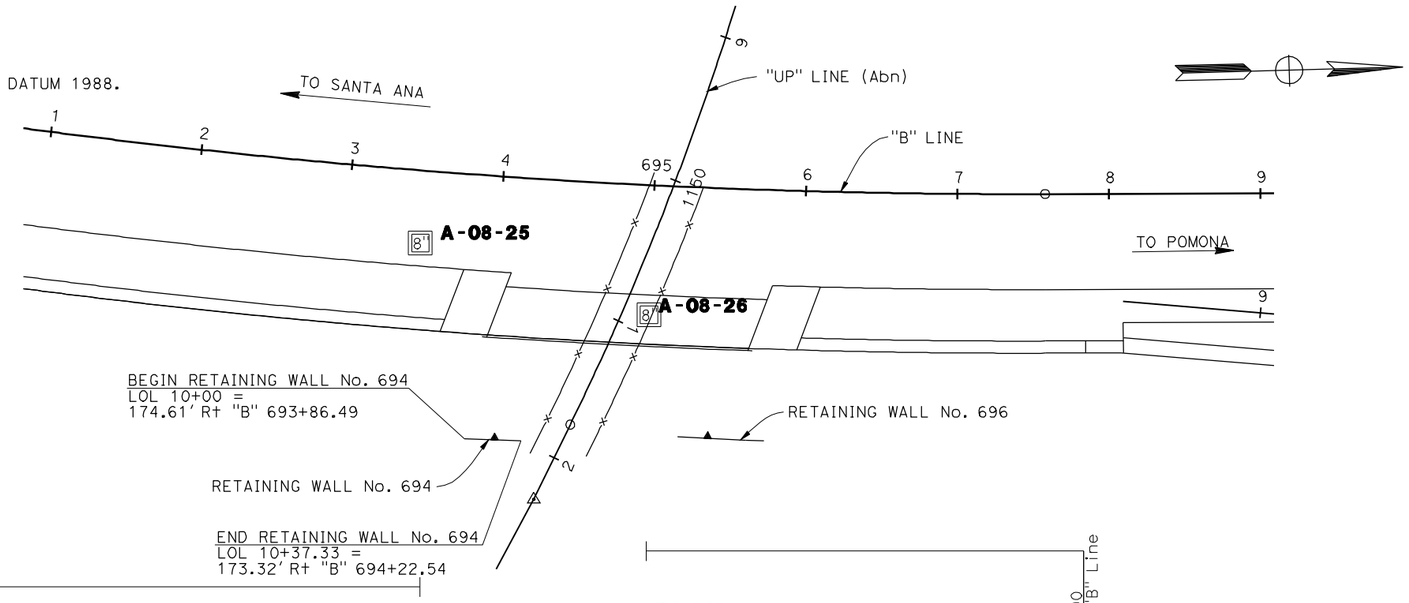
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

AUTOMATIC HAMMER

CORRECTION FACTOR:

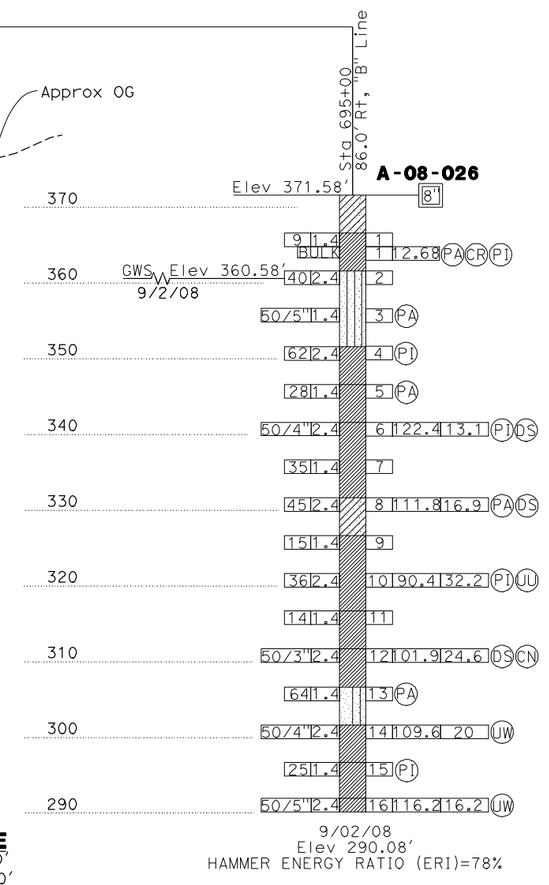
TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'

5" Asphalt concrete layer over 9" base course layer
Artificial Fill (Af):
LEAN CLAY with SAND (CL): hard, olive, moist, 78% medium plastic fines, 21% fine to coarse sand, trace fine gravel very stiff
LEAN CLAY (CL): hard, olive-gray, moist, medium plastic fines, some fine to medium sand very stiff, olive-brown, trace gravel
hard, olive
SANDY LEAN CLAY (CL): hard, dark brown, moist, medium plastic fines, fine sand
LEAN CLAY (CL): hard, olive-brown, moist, silty sand interbeds, some mottling, medium plastic fines, fine sand very stiff, dark brown, mottling
Very Old Alluvium Fan Deposits (Qvof):
WELL GRADED SAND with SILt and GRAVEL (SW-SM): very dense, gray, moist, 49% fine to coarse sand, 7% non-plastic fines, 44% fine gravel
LEAN CLAY with SAND (CL): hard, moist, brown, medium plastic fines, fine sand
SANDY LEAN CLAY (CL): hard, dark olive, moist, medium plastic fines, fine sand stiff
hard, brown, 53% medium plastic fines 44% fine to coarse sand, trace fine gravel
dark brown, moist, medium plastic fines, fine sand

PROFILE
Horz:1"=50'
Vert: 1"=10'



Very Old Alluvium Fan Deposits (Qvof):
CLAYEY SAND (SC): gray, moist, fine to coarse sand, medium plastic fines
SANDY LEAN CLAY (CL): stiff, yellowish-brown, moist, 67% medium plastic fines, 31% fine to coarse sand and trace fine gravel
SILtY SAND with GRAVEL (SM): dense, light olive-brown, moist, 51% fine to coarse sand 22% low plastic fines, 27% fine to coarse gravel very dense, wet
LEAN CLAY (CL): hard, dark brown, wet, medium plastic fines, trace fine sand
SANDY LEAN CLAY (CL): hard, light olive-brown,wet, 55% medium plastic fines, 45% fine to coarse sand
LEAN CLAY (CL): hard, yellowish-brown, wet, medium plastic fines, some fine sand, trace fine gravel
CLAYEY SAND (SC): dense, yellowish-brown, wet, 54% fine sand, 42% medium plastic fines, trace fine gravel
LEAN CLAY (CL): very stiff, light brown, wet, medium plastic fines, some fine sand
hard, yellowish-brown
LEAN CLAY with SAND (CL): very stiff, brown, wet, medium plastic fines, fine sand
LEAN CLAY (CL): hard, brown, wet, medium plastic fines, some fine sand
POORLY GRADED SAND with SILt (SP-SM): very dense, yellowish-brown, wet, 89% medium to fine, 11% non plastic fines
LEAN CLAY (CL): hard, brown, wet, medium plastic fines, trace fine to medium sand
LEAN CLAY with SAND (CL): hard, brown, wet, medium plastic fines, fine sand
LEAN CLAY (CL): hard, light brown, wet, medium plastic fines

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. / POST MILES

RETAINING WALL No. 694

LOG OF TEST BORINGS SHEET 1 OF 2 — R-28

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 06/15/09 — SHEET OF

FILE => c0f032ge003.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:39

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/11 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

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

CEMENTATION

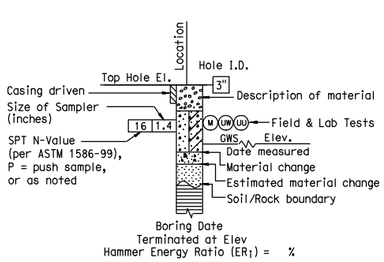
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

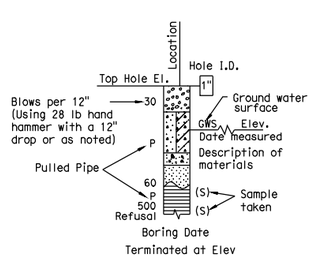
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

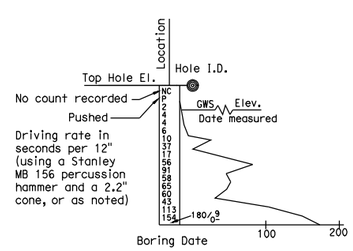
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



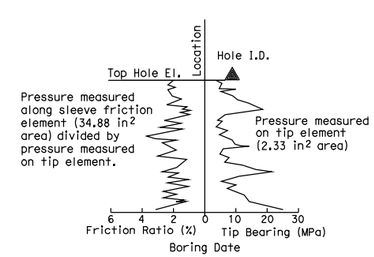
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

RETAINING WALL No. 694

LOG OF TEST BORINGS SHEET 2 OF 2

R-29

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

FILE => c0F032qe004.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 06/15/09

SHEET OF

USERNAME => rmitry DATE PLOTTED => 06-NOV-2009 TIME PLOTTED => 09:58

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1079: N2282339.808, E6067144.835, Elev 407.210
Pt 1081: N2282931.290, E6067198.604, Elev 422.355

SAMPLER TYPES:

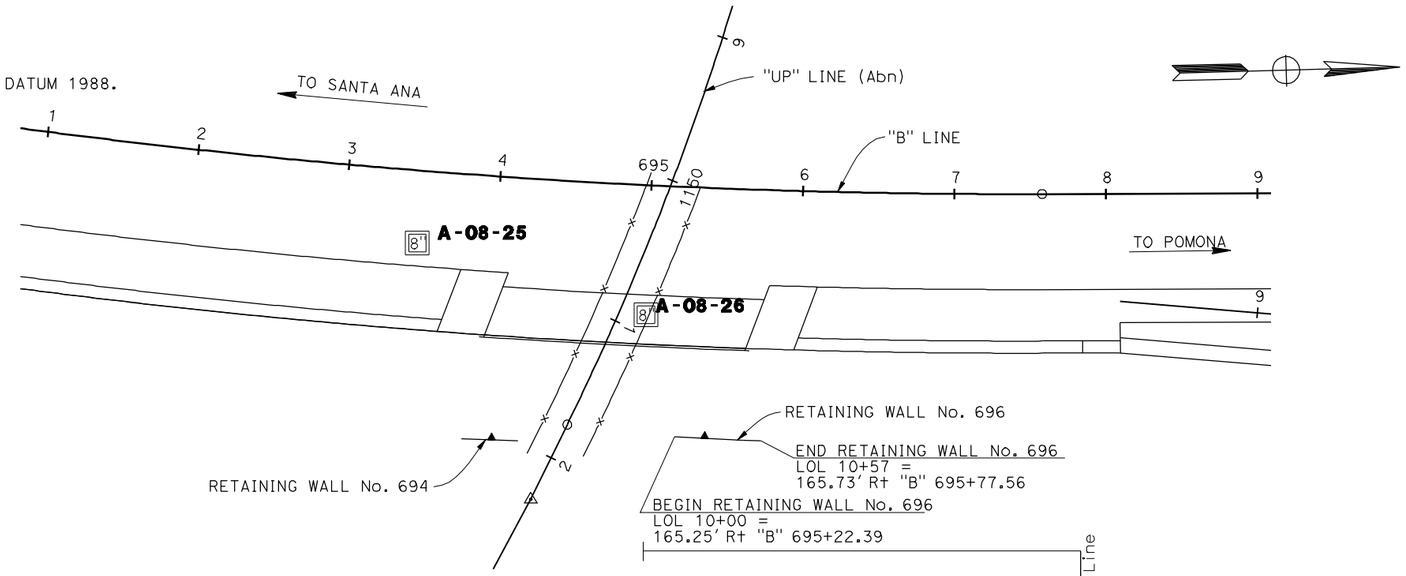
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

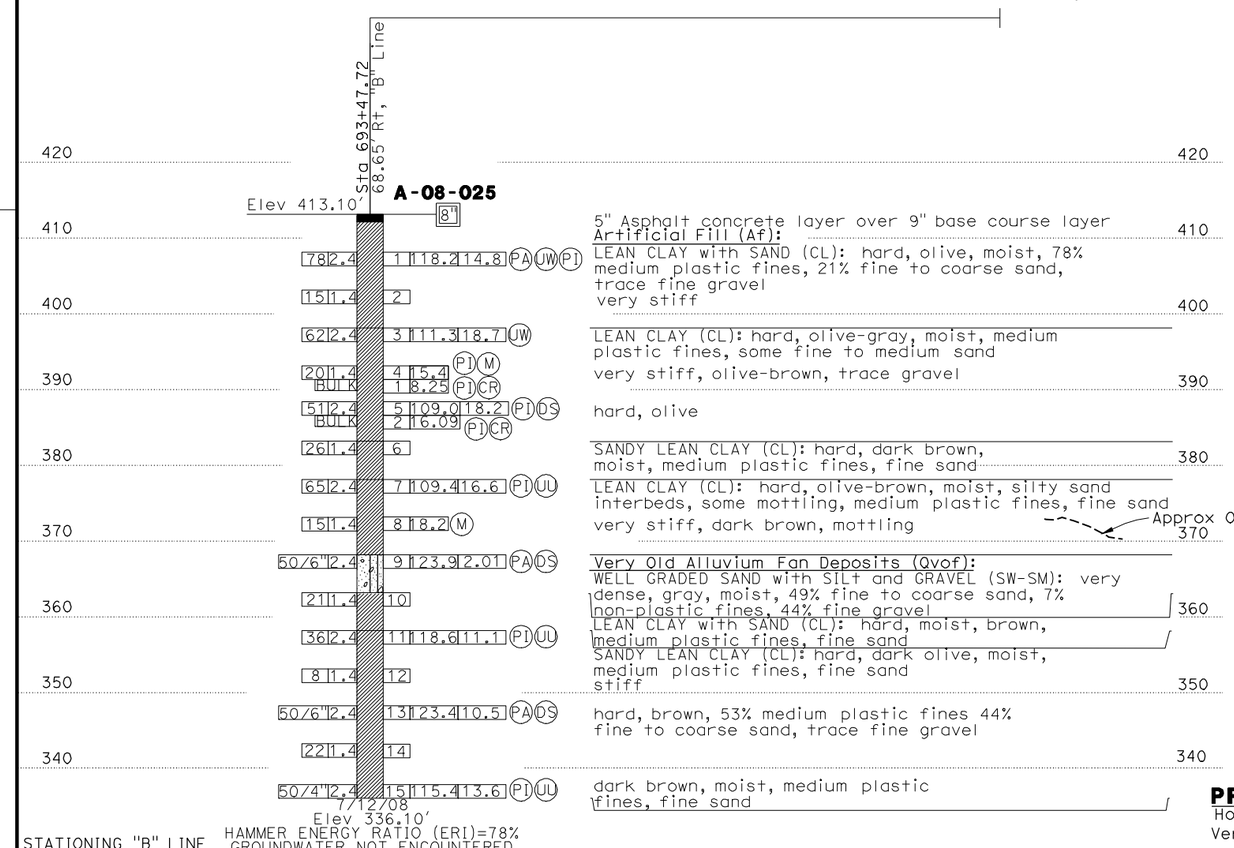
AUTOMATIC HAMMER

CORRECTION FACTOR:

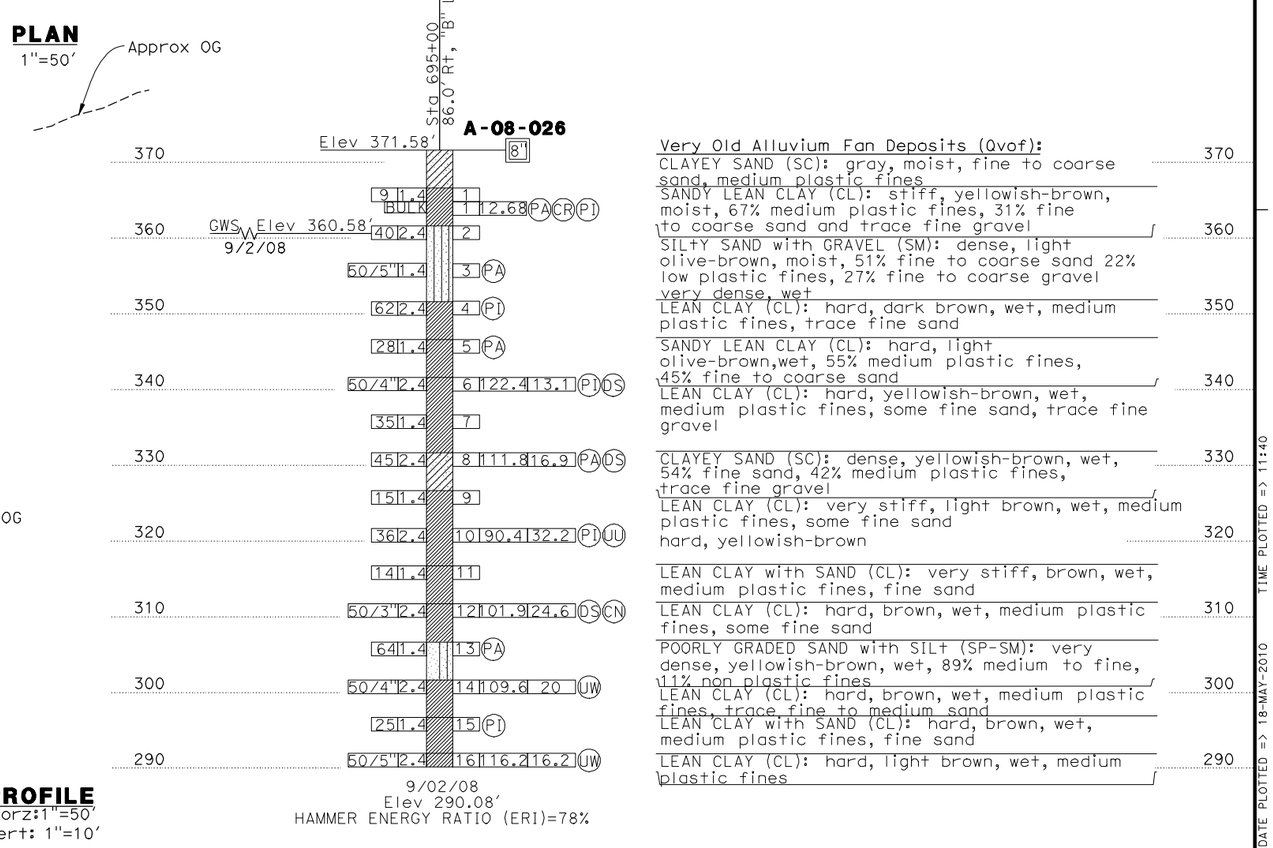
TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'



DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Ayman Salama PROJECT ENGINEER	BRIDGE NO.	RETAINING WALL No. 696
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE			POST MILES	LOG OF TEST BORINGS SHEET 1 OF 2 — R-32

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 06/15/09 — SHEET OF

FILE => c0f032af003.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:40

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/11 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

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

CEMENTATION

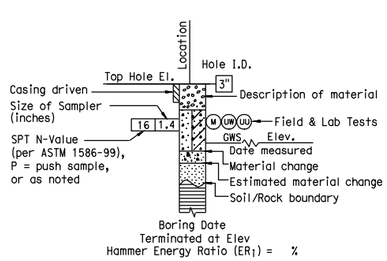
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

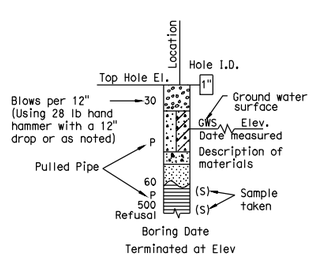
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

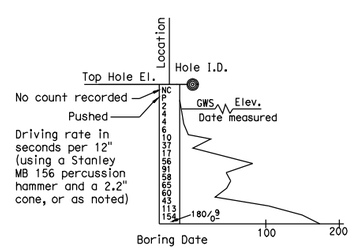
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



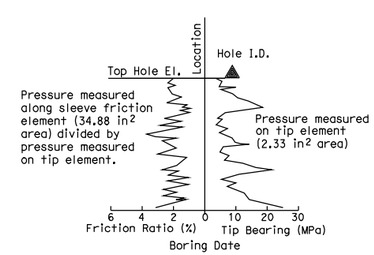
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

RETAINING WALL No. 696

LOG OF TEST BORINGS SHEET 2 OF 2

R-33

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032qf004.dgn

USERNAME => rmitry DATE PLOTTED => 06-NOV-2009 TIME PLOTTED => 09:58

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

Hisham Nofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal coordinates are CCS NAD-83, Zone 6.
vertical control based on North American Vertical Datum 1988.
Pt 1079: N2282339.808, E6067144.835, Elev 407.210
Pt 1081: N2282931.290, E6067198.604, Elev 422.355
Pt 1152: N2283540.401, E6067209.856, Elev 435.405

SAMPLER TYPES:

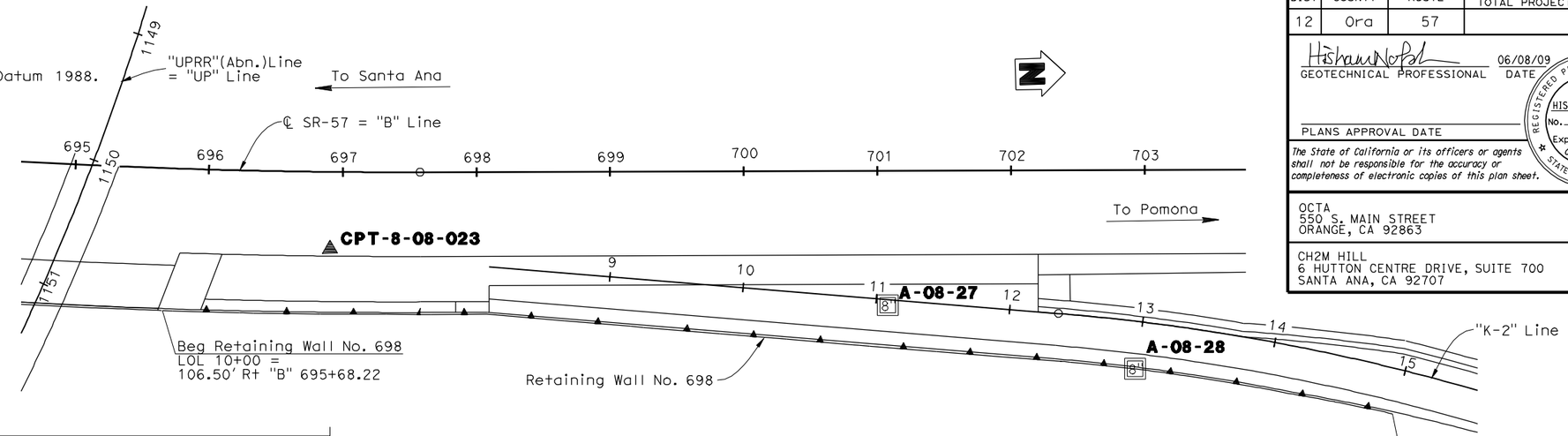
California modified ring sampler
standard penetration test sampler

HAMMER TYPE:

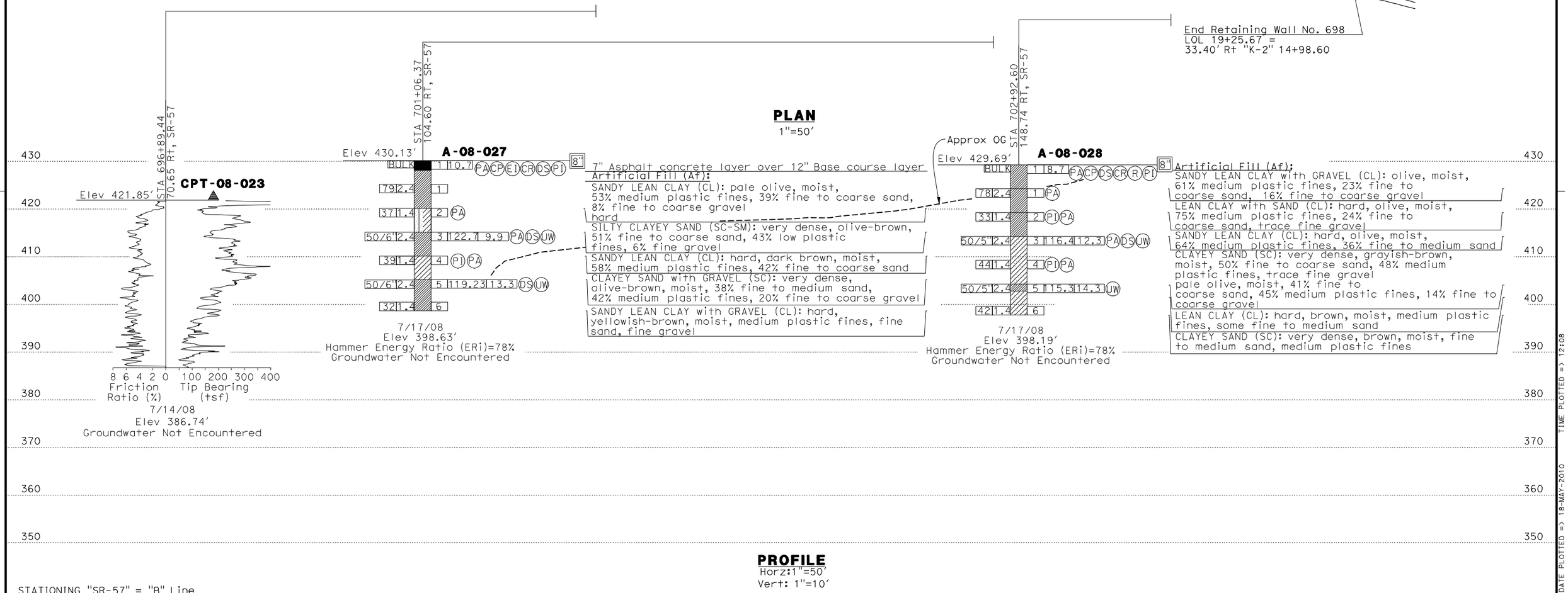
Automatic hammer

CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



PLAN
1"=50'



PROFILE
Horz: 1"=50'
Vert: 1"=10'

STATIONING "SR-57" = "B" Line
691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0097
POST MILES 20.64

RETAINING WALL NO. 698
LOG OF TEST BORINGS SHEET 1 OF 3

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 18 OF 20

FILE => 55e0097-z-ltb01.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 12:08

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			

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

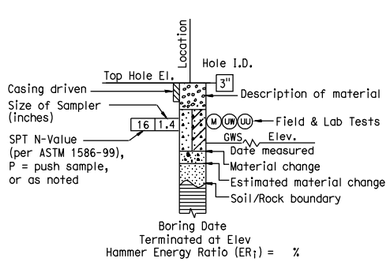
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

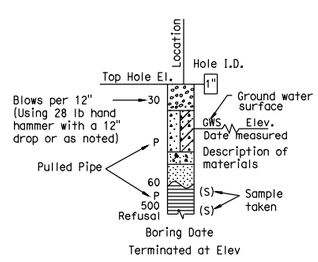
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

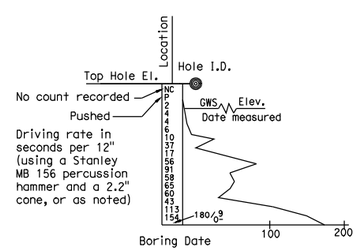
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



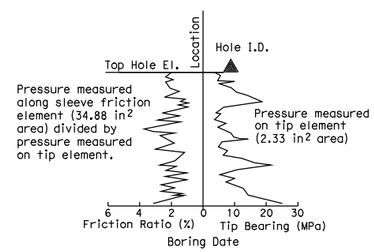
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

BOREHOLE IDENTIFICATION

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

Note: Size in inches.

RETAINING WALL NO. 698

SOIL LEGEND

LOG OF TEST BORINGS SHEET 2 OF 3

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0097

POST MILES 20.64

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 04/17/09 06/08/09

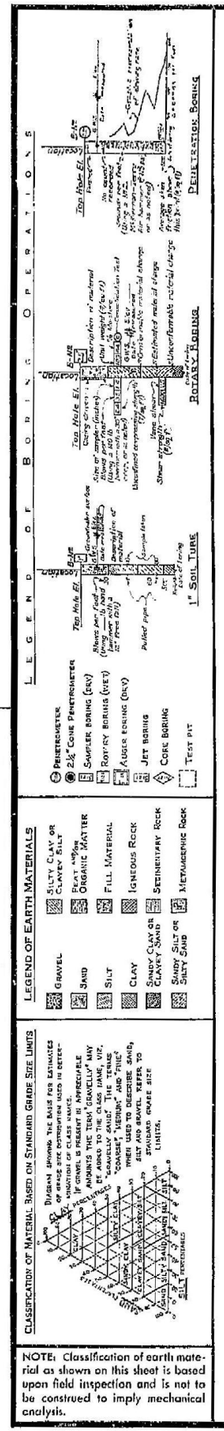
SHEET 19 OF 20

FILE => 55e0097-z-ltb02.dgn

USERNAME => jpowell9 DATE PLOTTED => 26-OCT-2009 TIME PLOTTED => 11:31

DIST.	COUNTY	ROUTE	KILOMETER POST	SHEET NO.	TOTAL SHEETS
12	ORA	57	18.5/19.6	164	147

Date approved: March 24, 1969



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 D. Nikes	11-16-67
DRAWN	by J. Lynn	11-29-67
CHECKED	by J. Alexander	1-2-68

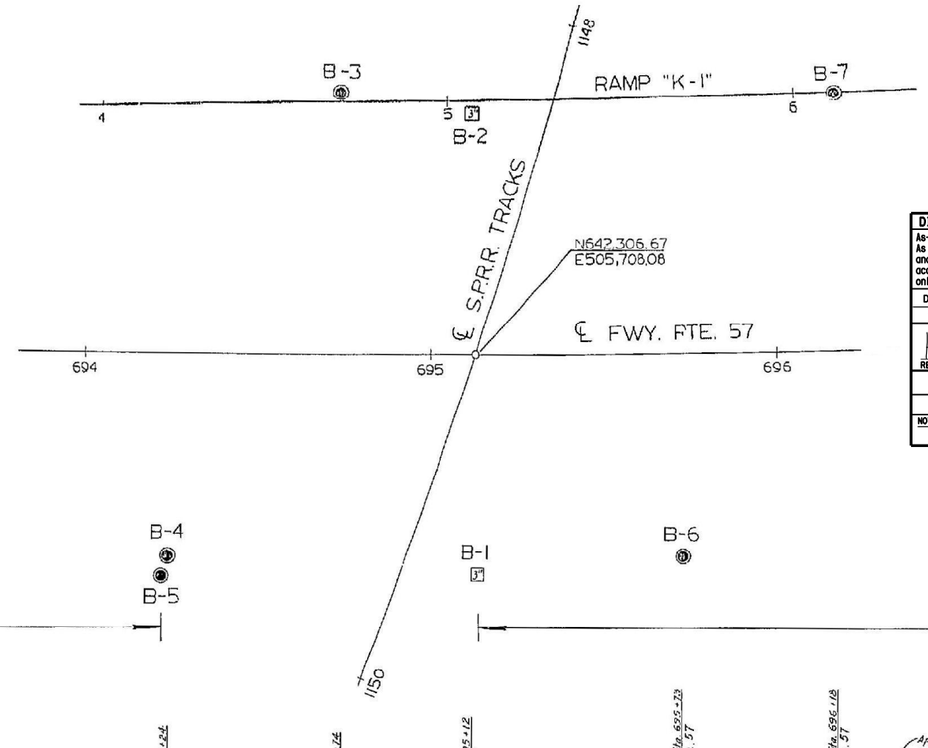
Approval Recommended by: Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

164

BENCH MARK

BM 964-E-66 Elev 368.47
Fd Tack in conc. filled 8" I.F. marked Sta. 643+42.76 "P" P.O.T., in CTR of tracks, 79' west of rails of S.P.R.Y. spur line and steardlease. Union Oil Co. pvt. road.

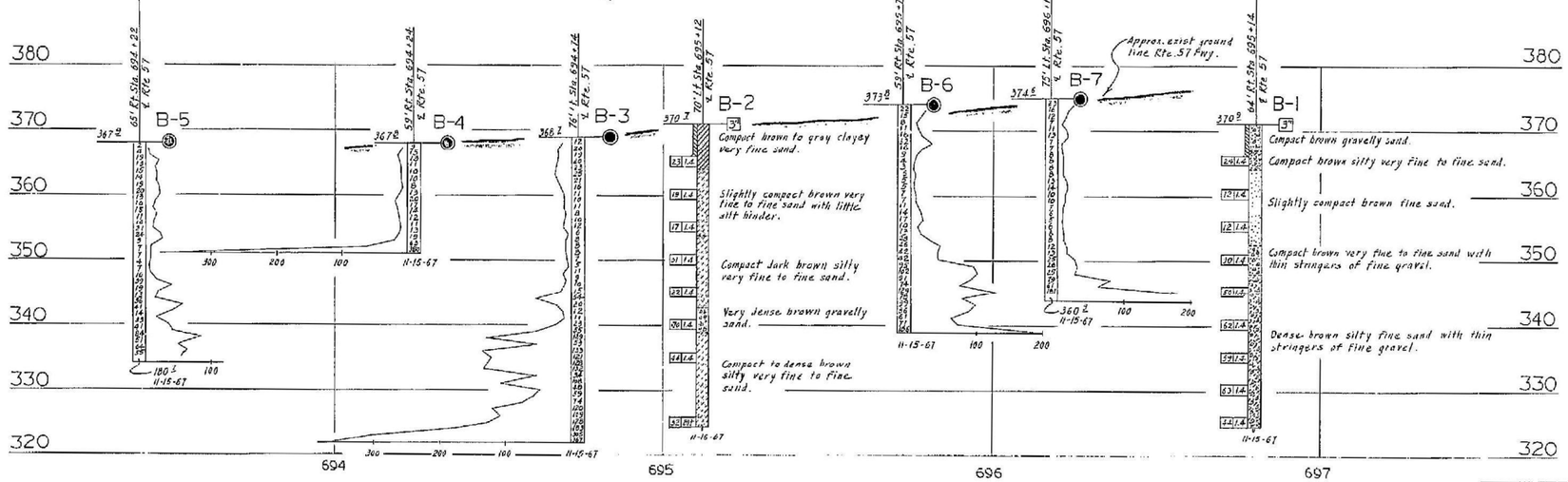


DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			
Hisham M. Nofal REGISTERED CIVIL ENGINEER			06/08/09 DATE		
RETAINING WALL NO. 698					
LOG OF TEST BORINGS SHEET 3 OF 3					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA	CU: 12220 EA: 0F0321		BRIDGE No. 55E0097	Sheet 20	of 20

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLAN
Scale: 1" = 20'

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



BRIDGE DEPT. GEOLOGY SECTION
DATE November 1967

AS BUILT
CONTRACTOR J. W. Hansen
CONTRACT NO. 07-032204
DATE 8-31-71
WP 11-3-71

15 OF 15

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BREA OVERHEAD

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE # 55-162	FILE	DRAWING S-F 952-9

Clg 07206
W.A. 032201

Disregard prints bearing earlier revisions.

PREL. DRAWING NO. PR-

AS BUILT PLANS
Contract No. 07-032204
Date Completed
Document No. 7000 5907

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 PUBLIC WORKS.

DATE 15 Feb. 73 SIGNATURE James E. Court TITLE Sr. Rmo

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

GEOTECHNICAL PROFESSIONAL — DATE 06/08/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

Horizontal Coordinates are CCS NAD-83, Zone 6.
Vertical control based on North American Vertical Datum 1988.
Pt 1057: N2273578.007, E6066831.271, Elev 294.844

SAMPLER TYPES:

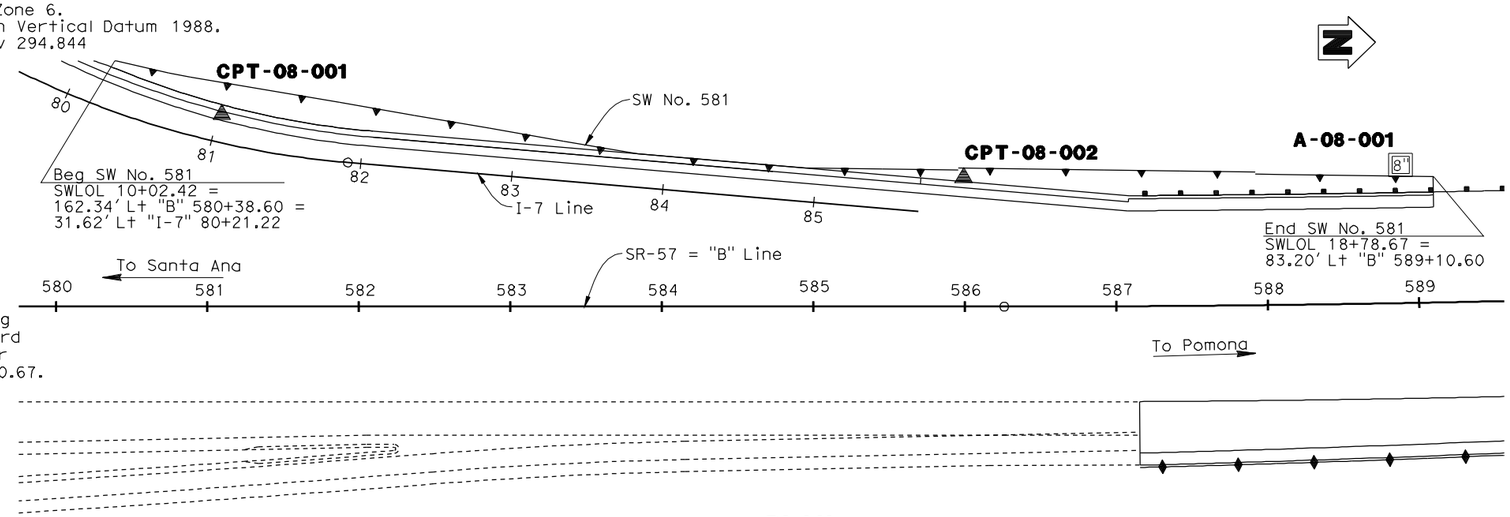
California modified ring sampler
standard penetration test sampler

HAMMER TYPE:

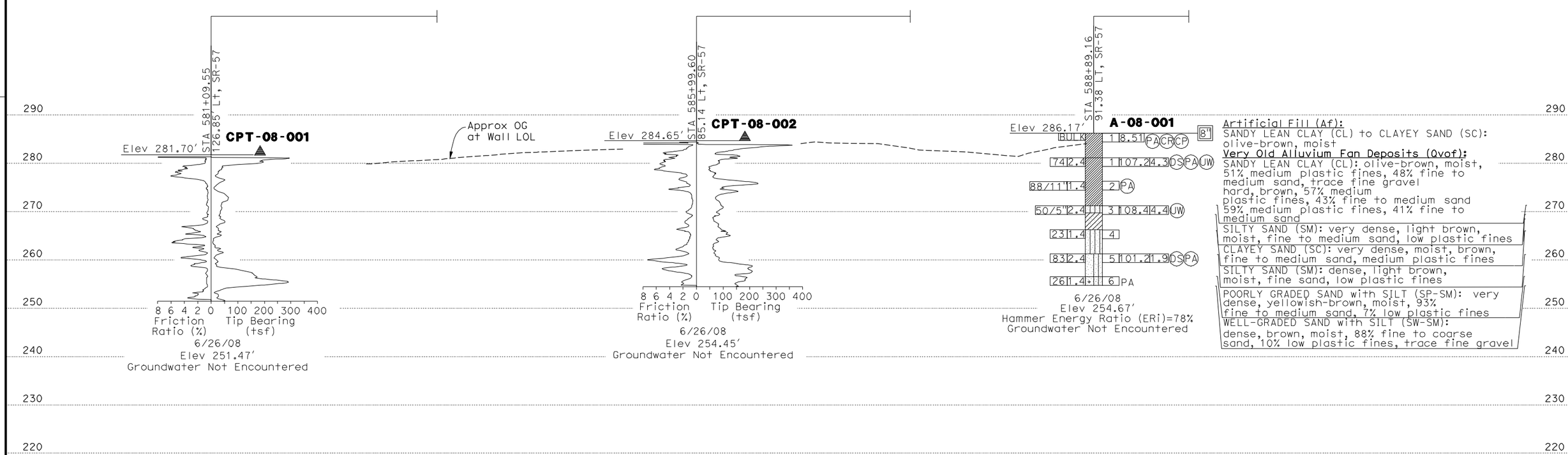
Automatic hammer

CORRECTION FACTOR:

To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



PLAN
1"=50′



PROFILE
Horz:1"=50′
Vert: 1"=10′

STATIONING ℄ SR-57 = "B" Line
576 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. 55E0088
POST MILES 18.46

SOUND WALL No. 581
LOG OF TEST BORINGS SHEET 1 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/18/09 04/07/09 04/17/09 06/08/09

SHEET 11 OF 12

FILE => 55e0088-z-1tb01.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:52

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			

HishamNofal 06/08/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

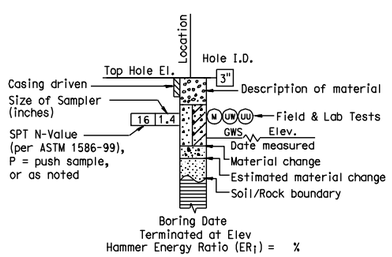
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

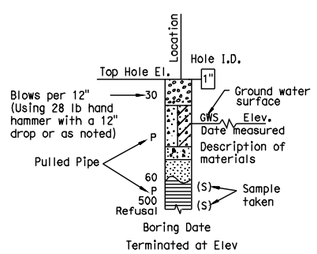
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

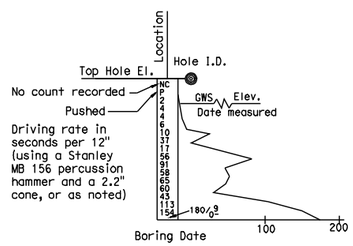
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



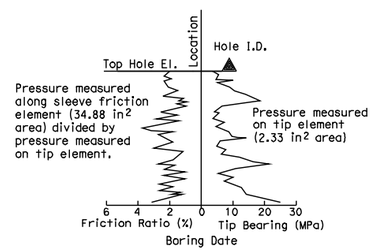
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO. 55E0088

POST MILES 18.46

SOUND WALL NO. 581

SOIL LEGEND

LOG OF TEST BORINGS SHEET 2 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 04/17/09 06/08/09

SHEET 12 OF 12

FILE => 55e0088-z-1tb02.dgn

USERNAME => nmorales DATE PLOTTED => 06-JUN-2009 TIME PLOTTED => 11:42

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1057: N2273578.007, E6066831.271, Elev 294.844

SAMPLER TYPES:

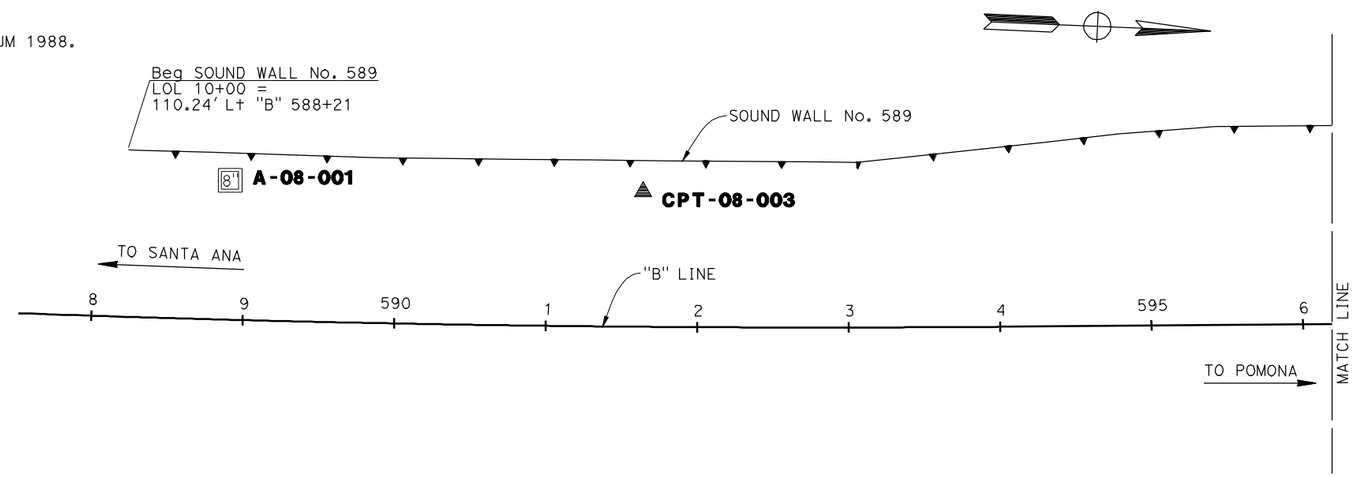
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

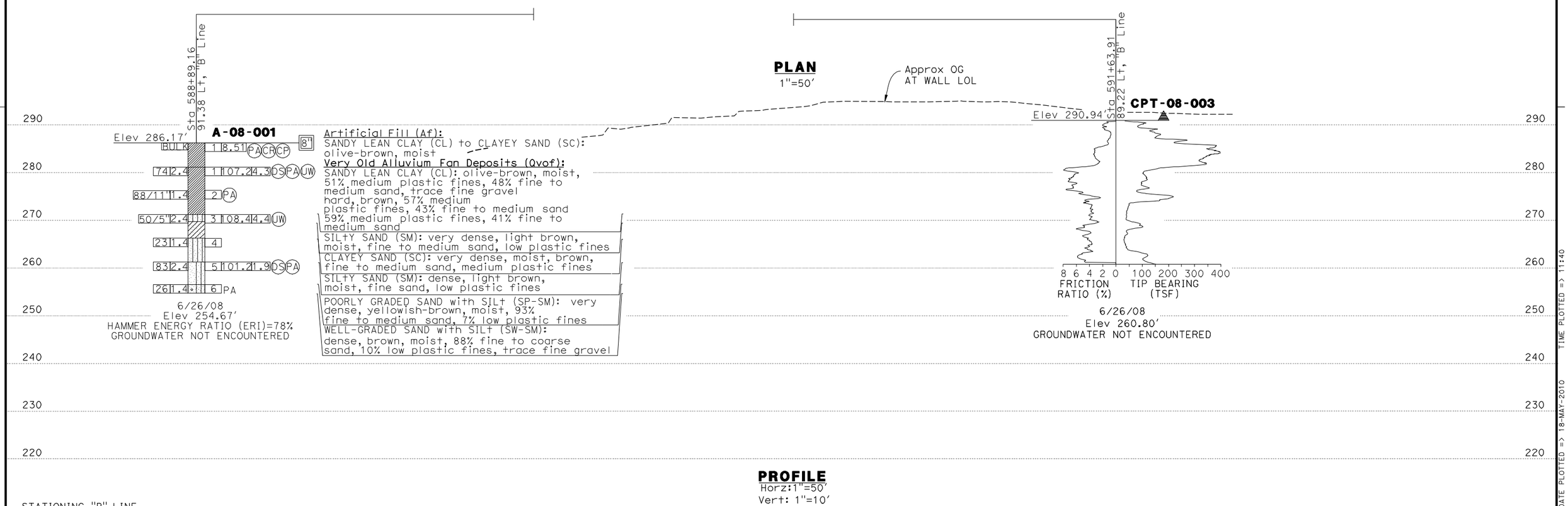
HAMMER TYPE:

AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.





DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R Bethapudi FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.
POST MILES

SOUND WALL NO. 589

LOG OF TEST BORINGS SHEET 1 OF 3 SW-5

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032ra005.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:40

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1057: N2273578.007, E6066831.271, Elev 294.844

SAMPLER TYPES:

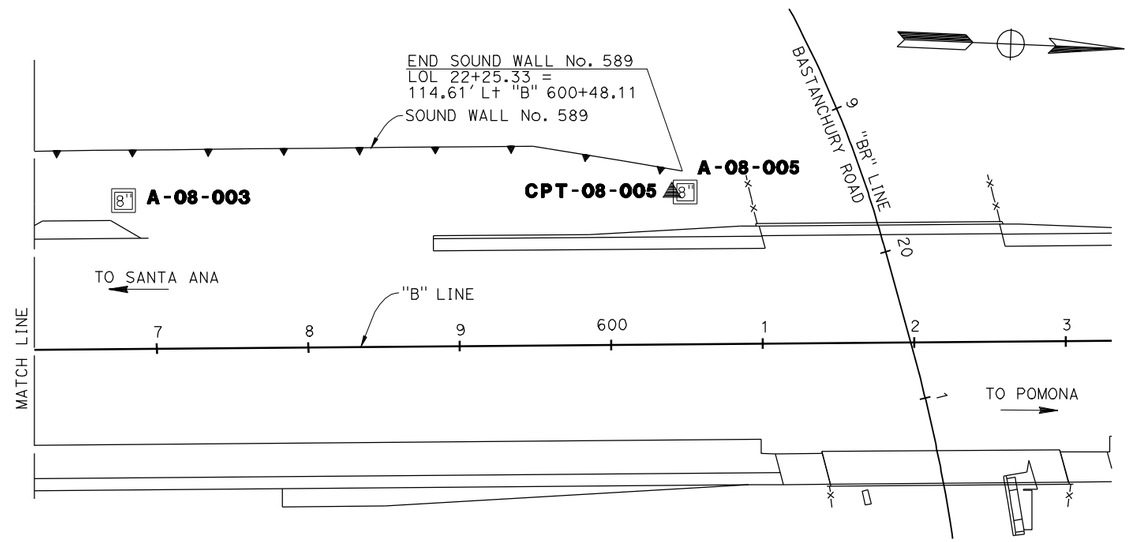
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

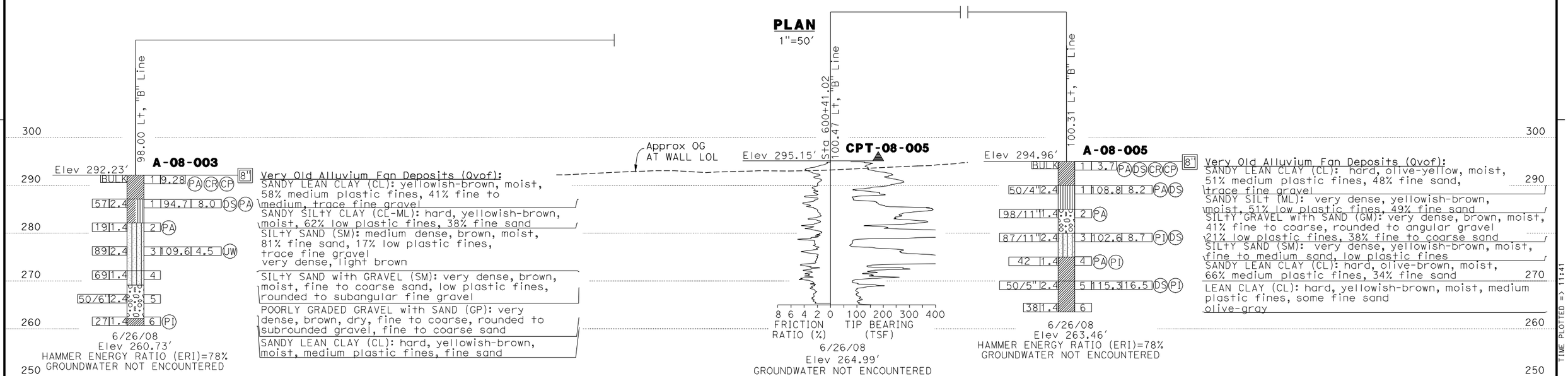
AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "B" LINE
1 2 3 4 595 6 7 8 9 600 1 2 3 4 605 6

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. / POST MILES

SOUND WALL NO. 589

LOG OF TEST BORINGS SHEET 2 OF 3 — SW-6

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/17/09 04/07/09 06/18/09 05/06/10

SHEET OF

FILE => c0F032ra006.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:41

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	18.4/20.9		

HishamNofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

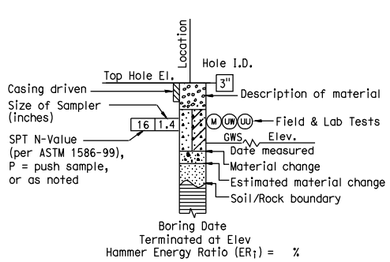
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

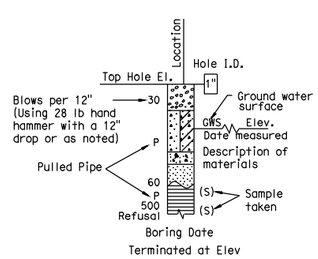
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

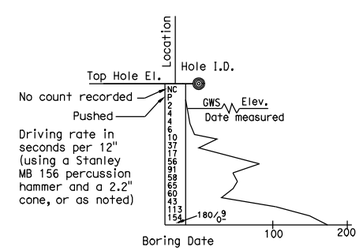
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



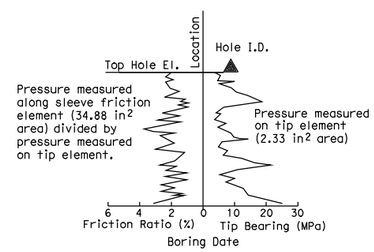
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

SOUND WALL No. 589

LOG OF TEST BORINGS SHEET 3 OF 3

SW-7

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

FILE => c0F032ra007.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 06/15/09

SHEET OF

USERNAME => jellis5 DATE PLOTTED => 15-JUN-2009 TIME PLOTTED => 12:17

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1057: N2273578.007, E6066831.271, Elev 294.844

SAMPLER TYPES:

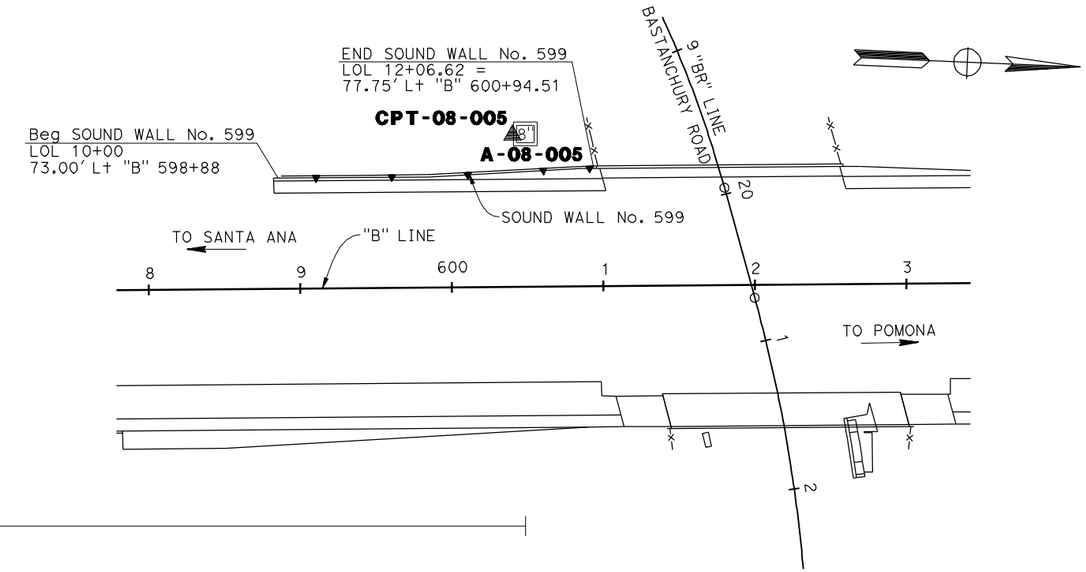
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

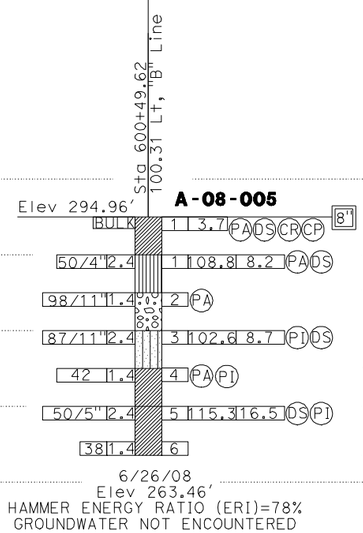
AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.

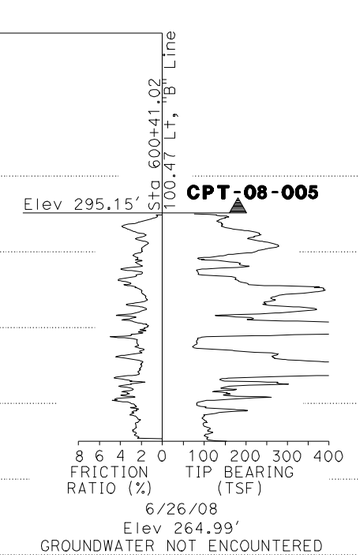


PLAN
1"=50'



Very Old Alluvium Fan Deposits (Qvof):
SANDY LEAN CLAY (CL): hard, olive-yellow, ~~moist~~, 51% medium plastic fines, 48% fine sand, trace fine gravel
SANDY SILT (ML): very dense, yellowish-brown, moist, 51% low plastic fines, 49% fine sand
SILTY GRAVEL with SAND (GM): very dense, brown, moist, 41% fine to coarse, rounded to angular gravel 21% low plastic fines, 38% fine to coarse sand
SILTY SAND (SM): very dense, yellowish-brown, moist, fine to medium sand, low plastic fines
SANDY LEAN CLAY (CL): hard, olive-brown, moist, 66% medium plastic fines, 34% fine sand
LEAN CLAY (CL): hard, yellowish-brown, moist, medium plastic fines, some fine sand olive-gray

APPROX OG AT WALL LOL



300 290 280 270 260 250 240 230

PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "B" Line
2 3 4 595 6 7 8 9 600 1 2 3 4 605 6 7

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. — POST MILES

SOUND WALL NO. 599

LOG OF TEST BORINGS SHEET 1 OF 3 — SW-13

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY): 02/17/09 04/07/09 06/15/09 — SHEET OF

FILE => c0F032rb006.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:42

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	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/11 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

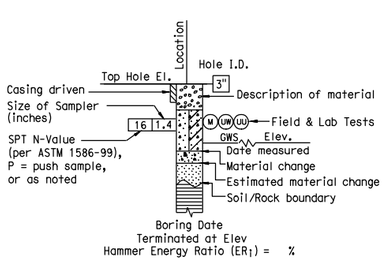
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

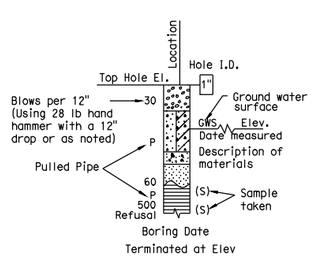
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

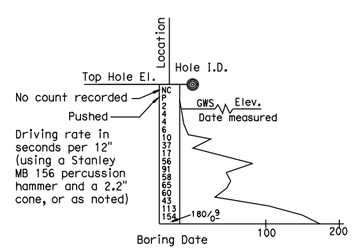
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



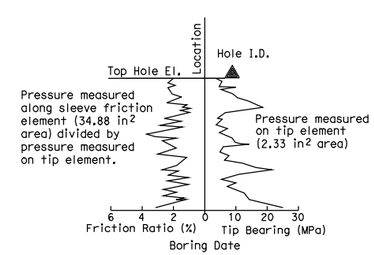
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

SOUND WALL NO. 599

LOG OF TEST BORINGS SHEET 2 OF 3

SW-14

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032rb007.dgn

USERNAME => rmitry DATE PLOTTED => 06-NOV-2009 TIME PLOTTED => 09:59

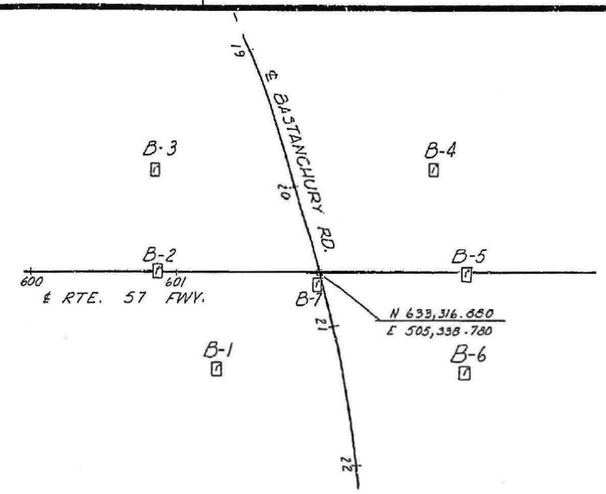
FED. ROAD DIV. No.	STATE	F.A. PROJECT No.	SHEET No.	TOTAL SHEETS
7	CALIF.			

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
07	ORA	57	19/202	150	180

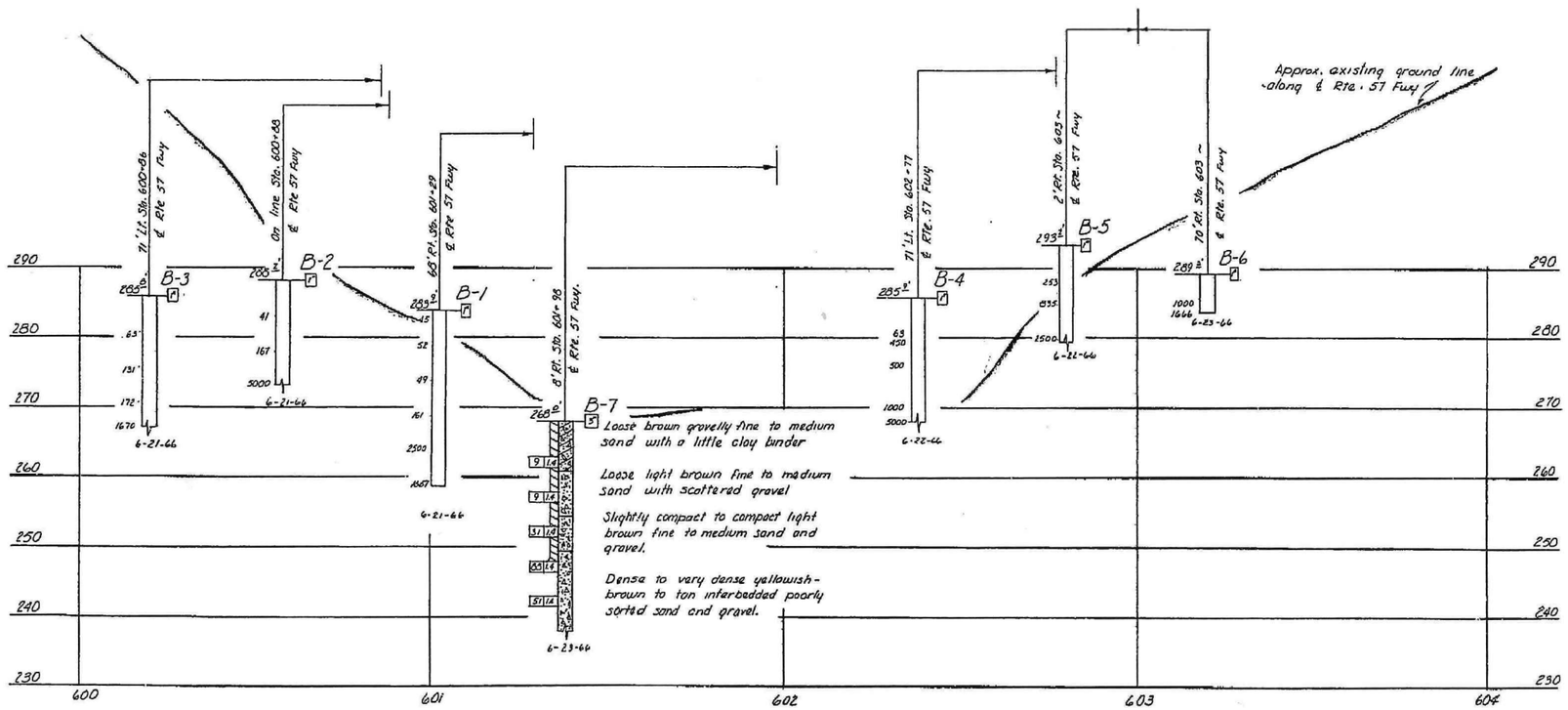
Date Approved September 30, 1968

BENCH MARK

BM 35-19A-56 Elev. 281.90
Set ch. knob on S.W. cor of drop inlet @ W. end of conc. flume 234' E. of Sta. 53B-74' P Line & 1320'± No. of Pioneer Ave.



PLAN
Scale 1"=50'



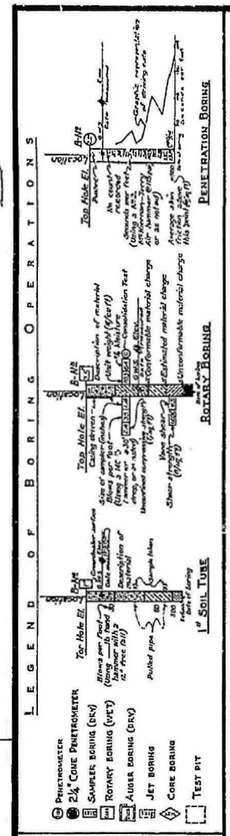
PROFILE
Scale Vert. 1"=10', Horiz. 1"=20'

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION

NO AS Built Corrections
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE June 1966

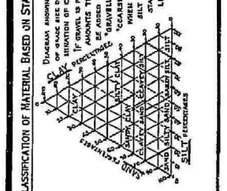
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

Gravel · Silty Clay or Clayey Silt · Sand · Clay 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 D. CRAWFORD 6-23-66
DRAWN	by H. ALLEGRO 7-1-66
CHECKED	by C. Barnes 7-8-66

Approval Recommended: Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

150

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			

Hisham Nofal — 06/08/09
REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/11
GEOTECHNICAL
STATE OF CALIFORNIA

SOUND WALL NO. 599

LOG OF TEST BORINGS SHEET 3 OF 3 | SW-15

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: -12220
EA: 0F0231

BRIDGE No.
Sheet of

AS BUILT PLANS
Contract No. 07-032134
Date Completed
Document No. 7000157 8

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BASTANCHURY ROAD UNDERCROSSING

LOG OF TEST BORINGS

SCALE As Noted	BRIDGE 55-465	FILE	DRAWING 55465-7

PREL. DRAWING No. PR- 130/62

Champ 07208
W.A. 032131

Discard prints beach users

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1048: N2273923.989, E6066816.158, Elev 297.698
Pt 1065: N2276096.906, E6066849.261, Elev 345.199

SAMPLER TYPES:

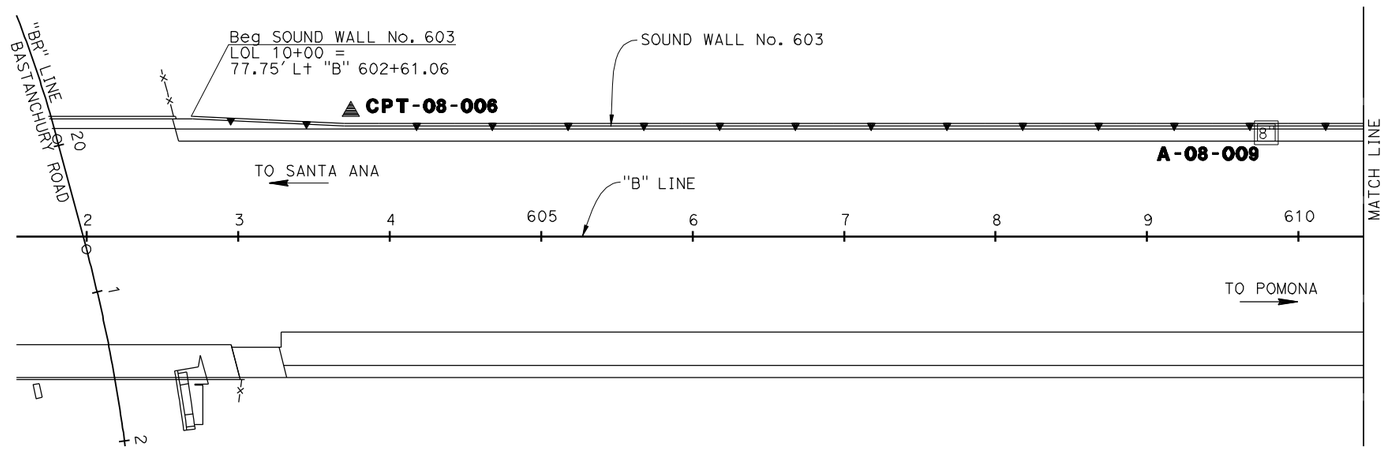
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

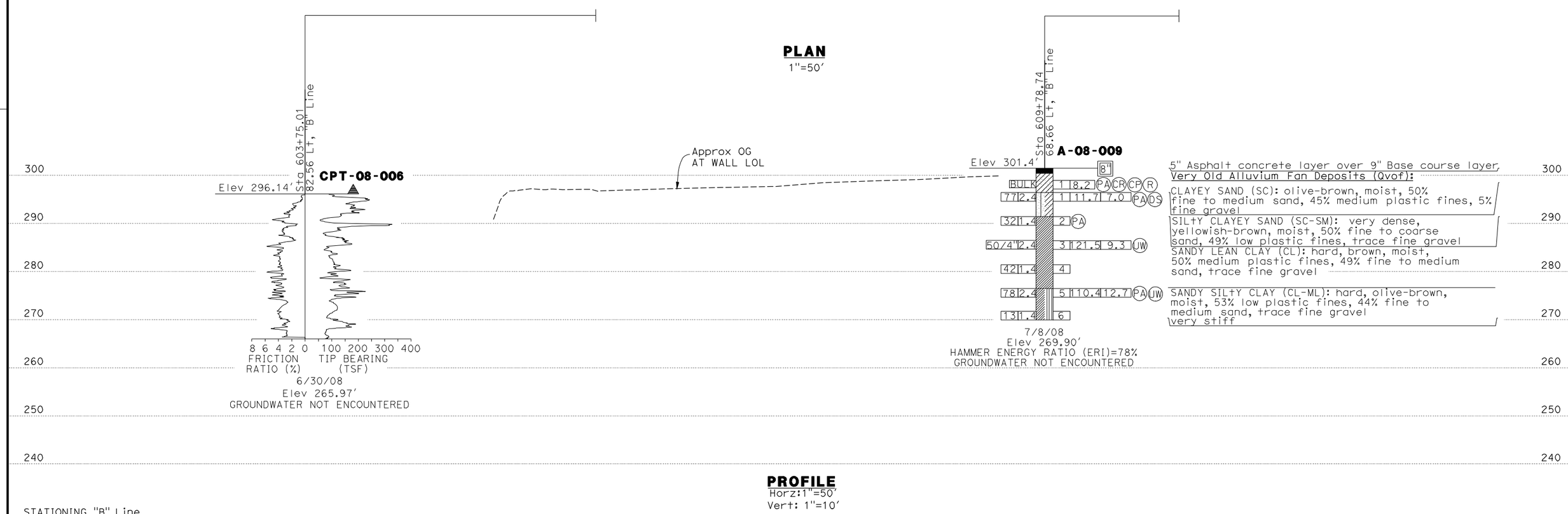
AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "B" Line
8 9 600 1 2 3 4 605 6 7 8 9 610 1 2 3

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. / POST MILES

SOUND WALL NO. 603

LOG OF TEST BORINGS SHEET 1 OF 6 — SW-26

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY): 02/27/09 04/07/09 06/15/09

SHEET 1 OF 6

FILE => c0F032rc011.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:43

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

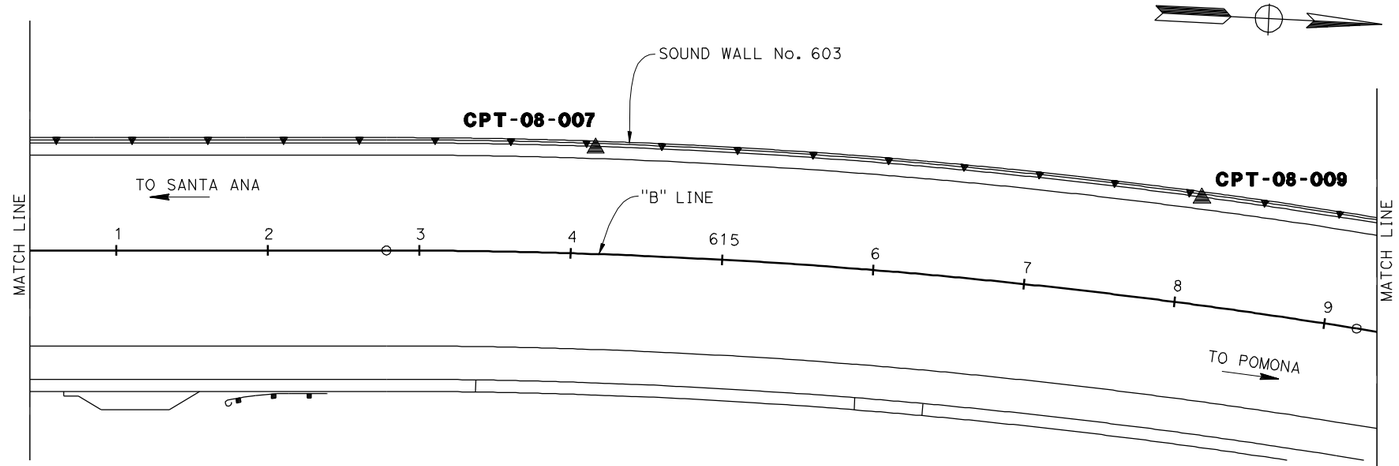
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

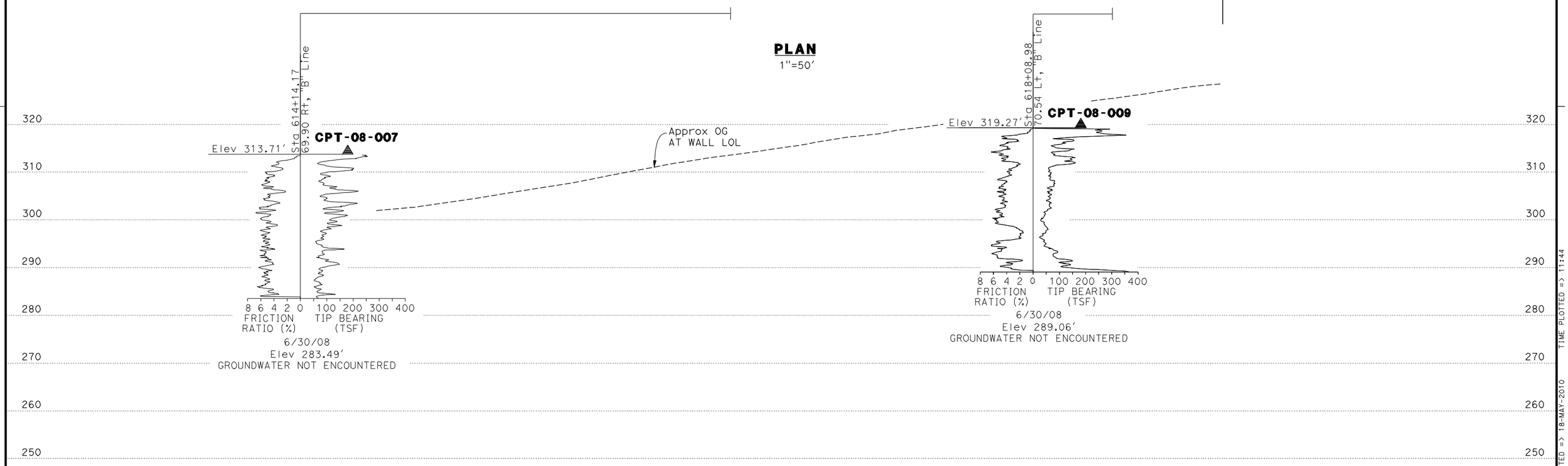
CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1048: N2273923.989, E6066816.158, Elev 297.698
Pt 1065: N2276096.906, E6066849.261, Elev 345.199



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Ayman Salama PROJECT ENGINEER	BRIDGE NO.	SOUND WALL NO. 603
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE			POST MILES	LOG OF TEST BORINGS SHEET 2 OF 6 — SW-27

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/17/09 04/07/09 06/15/09

SHEET 2 OF 6

FILE => c0F032rc012.dgn

USERNAME => mmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:44

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1048: N2273923.989, E6066816.158, Elev 297.698
Pt 1065: N2276096.906, E6066849.261, Elev 345.199

SAMPLER TYPES:

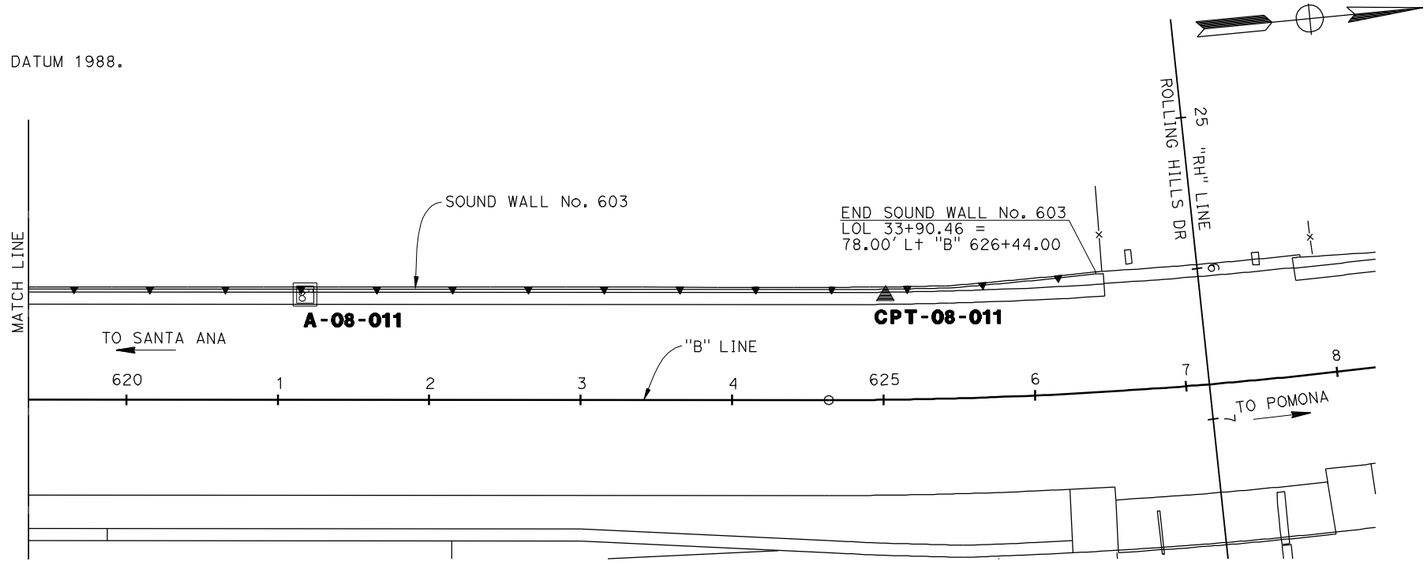
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

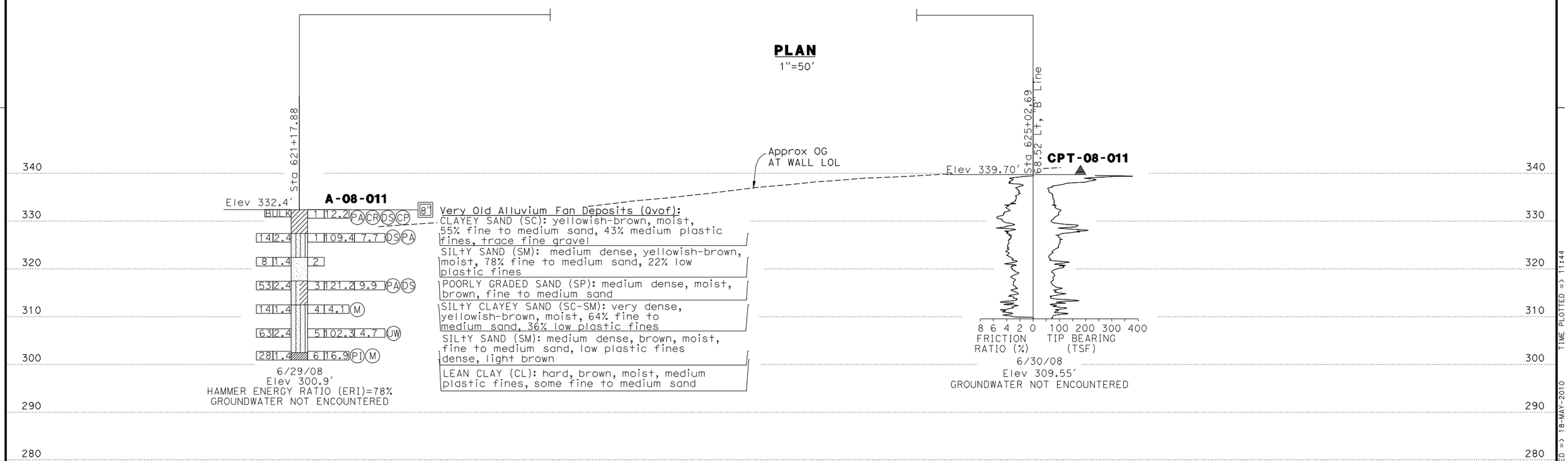
AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "B" Line
6 7 8 9 620 1 2 3 4 625 6 7 8 9 630 1

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.
POST MILES

SOUND WALL NO. 603
LOG OF TEST BORINGS SHEET 3 OF 6 SW-28

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 06/15/09

SHEET 3 OF 6

FILE => c0F032rc013.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:44

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	18.4/20.9		

HishamNofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

CEMENTATION

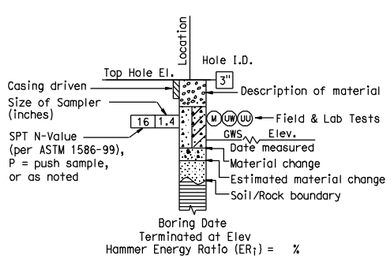
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

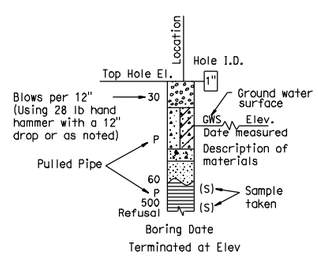
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

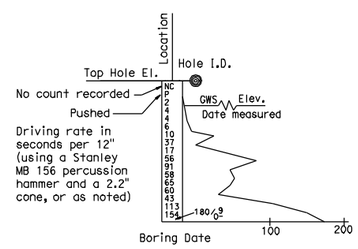
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



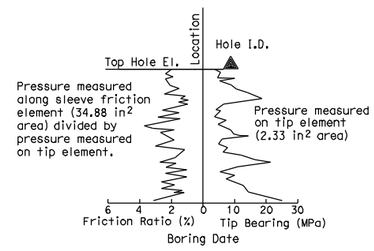
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

BOREHOLE IDENTIFICATION

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

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

SOUND WALL No. 603

LOG OF TEST BORINGS SHEET 4 OF 6

SW-29

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/18/09 04/07/09 06/15/09

SHEET 4 OF 6

FILE => c0F032rc014.dgn

USERNAME => nmorales DATE PLOTTED => 12-MAY-2010 TIME PLOTTED => 13:36

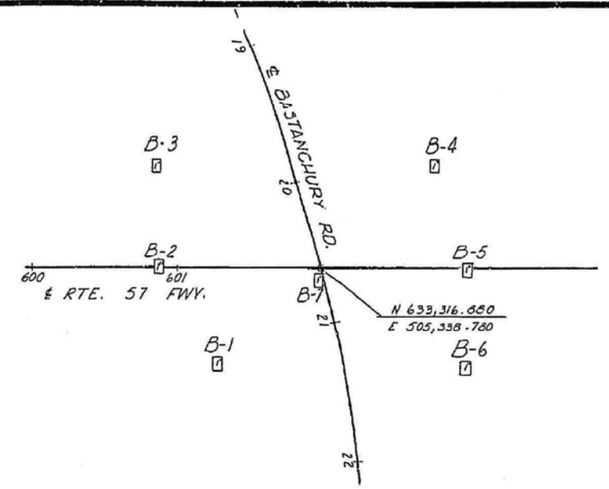
FED. ROAD DIV. No.	STATE	F.A. PROJECT No.	SHEET No.	TOTAL SHEETS
7	CALIF.			

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
07	ORA	57	13.9/20.2	150	180

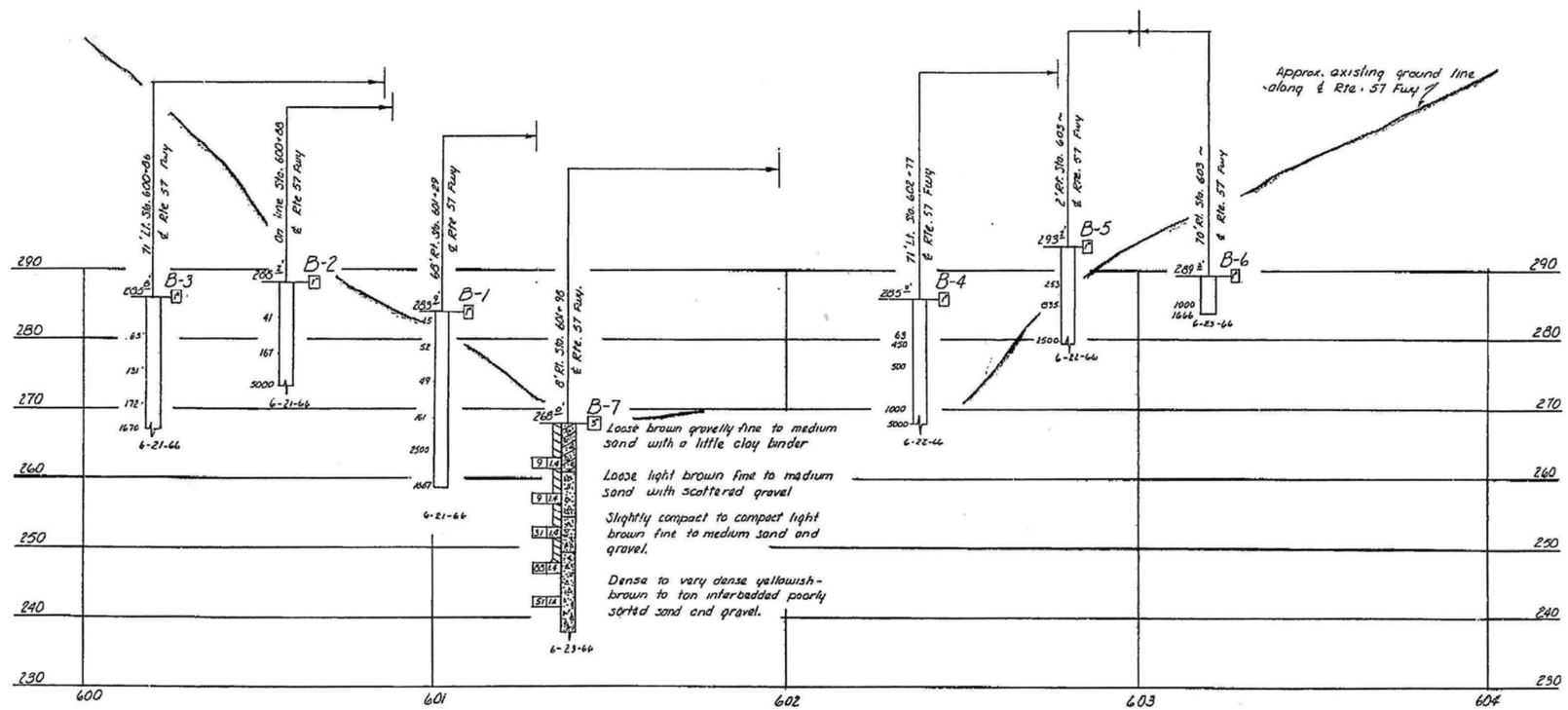
Date Approved September 30, 1968

BENCH MARK

BM 35-19A-56 Elev. 281.90
Set ch. knob on S.W. cor of drop inlet @ W. end of conc. flume 234' E. of Sta. 538-74' P'Line & 1320'± No. of Pioneer Ave.



PLAN
Scale 1"=50'



PROFILE
Scale Vert. 1"=10', Horiz. 1"=20'

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION

NO AS Built Corrections
AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION
DATE June 1966

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			

Hisham Nofal — 06/08/09
REGISTERED CIVIL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL STATE OF CALIFORNIA

SOUND WALL NO. 603

LOG OF TEST BORINGS SHEET 5 OF 6 SW-30

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: 12220
EA: 0F0231

BRIDGE No.

Sheet	of
5	6

LEGEND OF BORING OPERATIONS

- Penetrometer
- 2½" Cone Penetrometer
- Sampler Boring (DEX)
- 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; Silty Clay or Clayey Silt; Sandy Clay or Clayey Sand; Sandy Silt or Silty Sand; Peat and 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 percentages of gravel, sand, and fines in descriptions of class names.

If gravel is present it appreciable amounts this term "gravelly" may be used with the class name, e.g. "gravelly sand". The terms "coarser", "medium" and "finer" refer to the relative grain 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.

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

Approved Recommendation: Geologist

AS BUILT PLANS
Contract No. 07-032134
Date Completed
Document No. 7000157 8

Champ 07200
W.A. 032131

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BASTANCHURY ROAD UNDERCROSSING

LOG OF TEST BORINGS

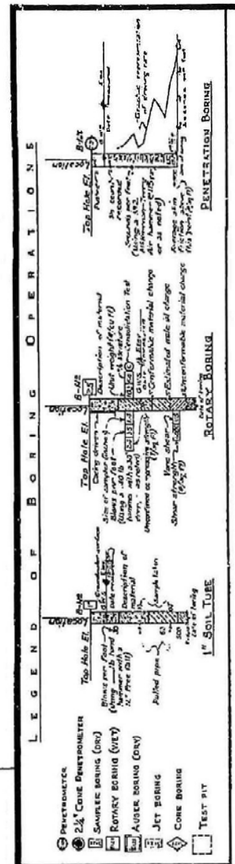
SCALE As Noted	BRIDGE 55-465	FILE	DRAWING 55465-7

PREL. DRAWING No. PR-

150

DIST.	COUNTY	ROUTE	SHEET NO.	TOTAL SHEETS
12	Ora.	57	126/202	160 / 180

Submitted for Approval September 30, 1968



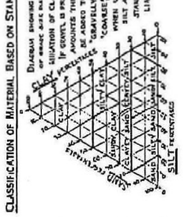
LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND 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 GRADING AND CLASSIFICATION USED IN DETERMINING SOIL TYPES.

IN GRAVEL, IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SILT" OR "GRAVELLY CLAY". THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO 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.

CHECKED: H.R. Carbaley 4-24-67

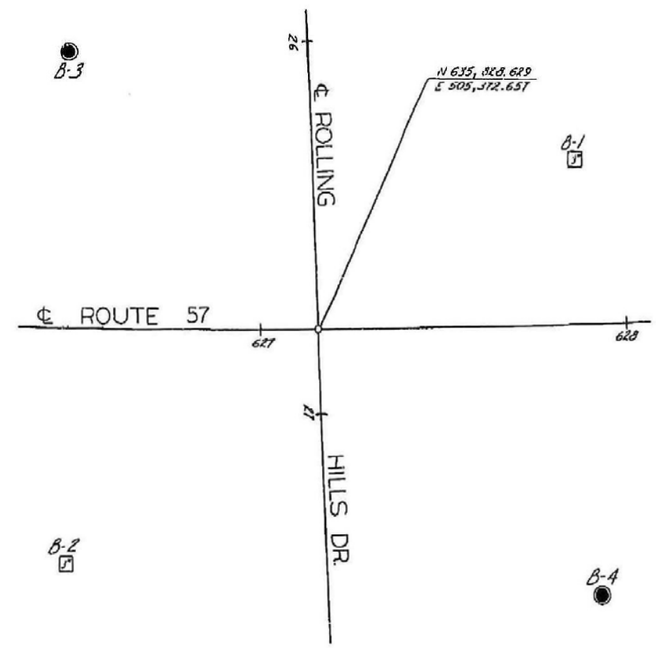
Approval Recommended: Charles E. Sand, Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

160

BENCH MARK

B.M.# 629-D-66 Elev. 361.18
Fd. anchor bolt on top of northeast pedestal of Hathaway Oil Well No. 8



PLAN

Scale: 1" = 20'

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			
Hisham M. Nofal — REGISTERED CIVIL ENGINEER			06/08/09 DATE		
SOUND WALL NO. 603					
LOG OF TEST BORINGS SHEET 6 OF 6				SW-31	
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA		CU: 12220 EA: 0F0321	BRIDGE No.		
			Sheet	of	
			6	6	

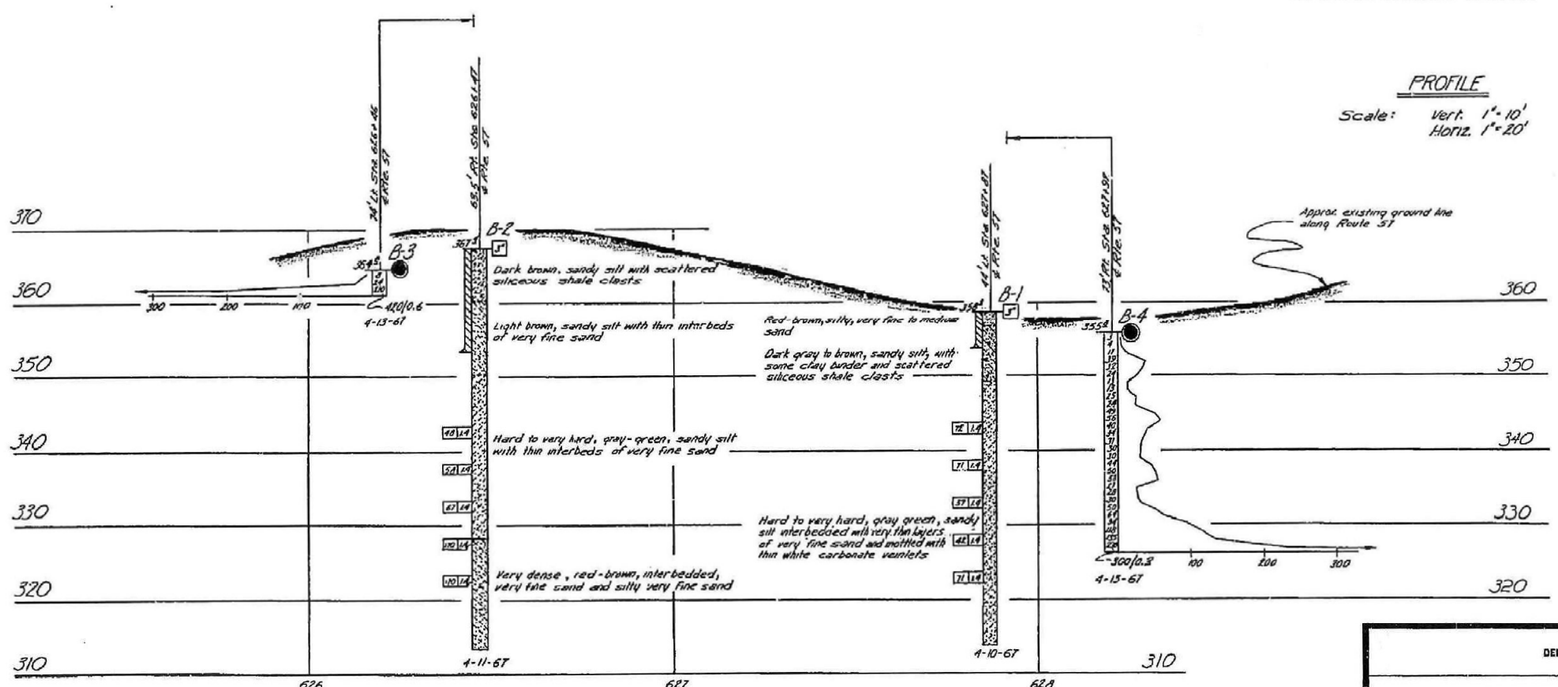
REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL — No. 2765 — Exp. 09/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION BY BRIDGE DEPT. GEOLOGY SECTION DATE April, 1967

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION

PROFILE

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



STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ROLLING HILLS DRIVE UNDERCROSSING

LOG OF TEST BORINGS

SHEET	OF	SCALE: As Noted	BRIDGE 55-0483	FILE	DRAWING 550/13-7
10	10				

AS BUILT PLANS
Contract No. 07-032134
Date Completed
Document No. 70001578

Chg. 07208
W.A. 038131

Disregard prints bearing earlier numbers → PREL. DRAWING No. PR- 1/6/00

FILE => c0F032rc016.dgn

USERNAME => nmorales DATE PLOTTED => 12-MAY-2010 TIME PLOTTED => 13:27

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
HISHAM M. NOFAL
No. 2765
Exp. 09/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1049: N2276409.426, E6066857.705, Elev 348.344
Pt 1050: N2277373.804, E6066685.179, Elev 331.888

SAMPLER TYPES:

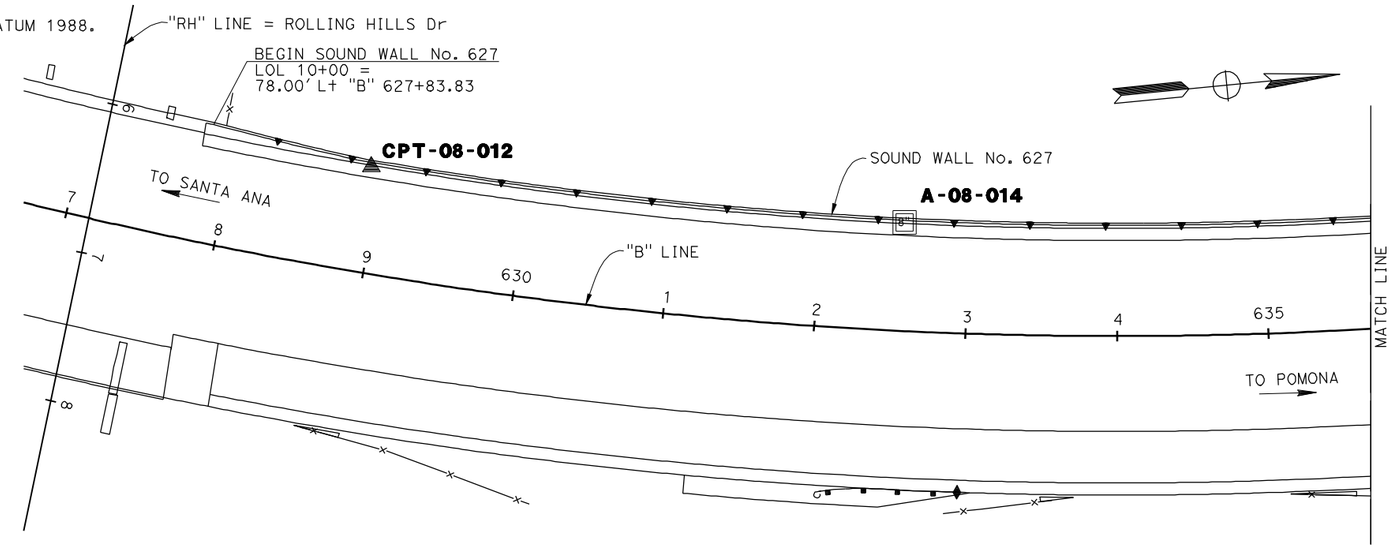
CALIFORNIA MODIFIED RING SAMPLER
STANDARD PENETRATION TEST SAMPLER

HAMMER TYPE:

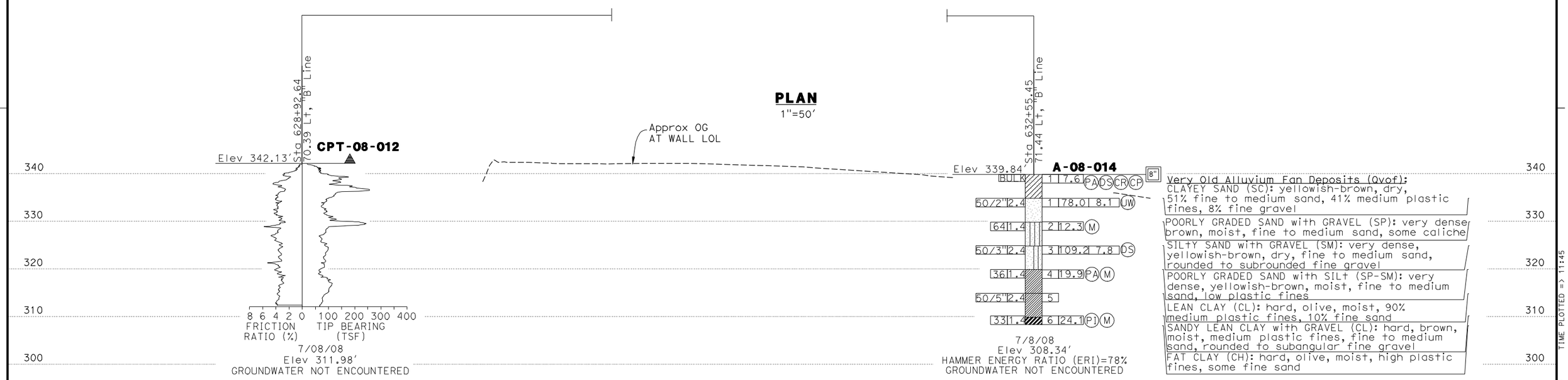
AUTOMATIC HAMMER

CORRECTION FACTOR:

TO CONVERT FROM CALIFORNIA MODIFIED RING SAMPLER BLOW COUNT TO EQUIVALENT STANDARD PENETRATION TEST SAMPLER BLOW COUNT, FOR GRANULAR AND COHESIVE SOIL, MULTIPLY BY 0.67.



PLAN
1"=50'



Very Old Alluvium Fan Deposits (Qvof):
CLAYEY SAND (SC): yellowish-brown, dry, 51% fine to medium sand, 41% medium plastic fines, 8% fine gravel
POORLY GRADED SAND with GRAVEL (SP): very dense brown, moist, fine to medium sand, some caliche
SILTY SAND with GRAVEL (SM): very dense, yellowish-brown, dry, fine to medium sand, rounded to subrounded fine gravel
POORLY GRADED SAND with SILT (SP-SM): very dense, yellowish-brown, moist, fine to medium sand, low plastic fines
LEAN CLAY (CL): hard, olive, moist, 90% medium plastic fines, 10% fine sand
SANDY LEAN CLAY with GRAVEL (CL): hard, brown, moist, medium plastic fines, fine to medium sand, rounded to subangular fine gravel
FAT CLAY (CH): hard, olive, moist, high plastic fines, some fine sand

PROFILE
Horz:1"=50'
Vert: 1"=10'

STATIONING "B" LINE
3 4 625 6 7 8 9 630 1 2 3 4 635 6 7 8

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.
POST MILES

SOUND WALL NO. 627
LOG OF TEST BORINGS SHEET 1 OF 4 SW-39

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/17/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032rd008.dgn

USERNAME => rmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:45

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

GEOTECHNICAL PROFESSIONAL — DATE 06/15/09

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — HISHAM M. NOFAL No. 2765 Exp. 09/30/09 GEOTECHNICAL — STATE OF CALIFORNIA

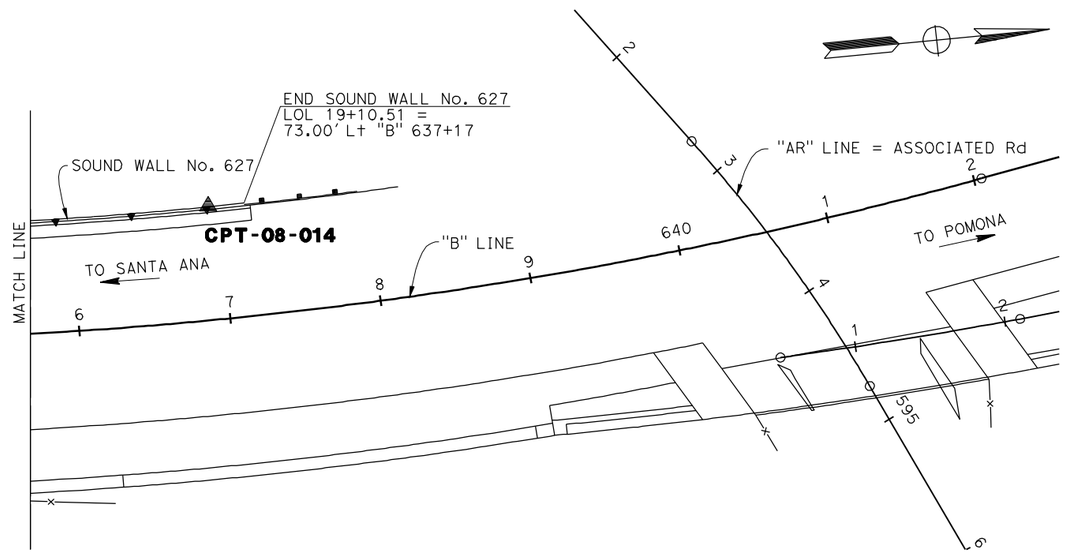
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

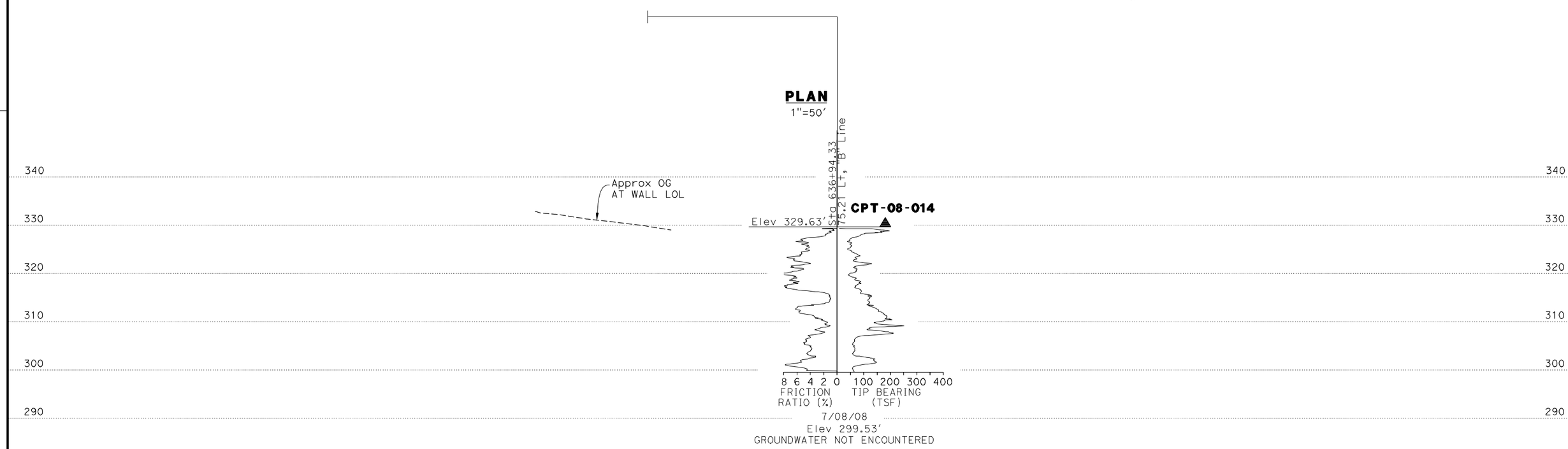
CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

HORIZONTAL COORDINATES ARE CCS NAD-83, ZONE 6.
VERTICAL CONTROL BASED ON NORTH AMERICAN VERTICAL DATUM 1988.
Pt 1049: N2276409.426, E6066857.705, Elev 348.344
Pt 1050: N2277373.804, E6066685.179, Elev 331.888



PLAN
1"=50'



PROFILE
Horz:1"=50'
Vert: 1"=10'

DESIGN OVERSIGHT	DRAWN BY	K. Reyes	R. Bethapudi — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	H. Nofal	DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama — PROJECT ENGINEER

BRIDGE NO. / POST MILES

SOUND WALL NO. 627

LOG OF TEST BORINGS SHEET 2 OF 4 — SW-40

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 02/17/09 04/07/09 06/15/09 — SHEET — OF

FILE => c0F032rd009.dgn

USERNAME => nmorales DATE PLOTTED => 18-MAY-2010 TIME PLOTTED => 11:46

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	57	18.4/20.9		

Hisham Nofal 06/15/09
GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/11 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

OCTA
550 S. MAIN STREET
ORANGE, CA 92863

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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

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

CEMENTATION

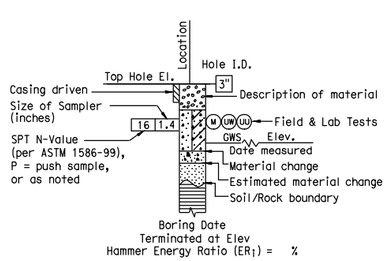
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

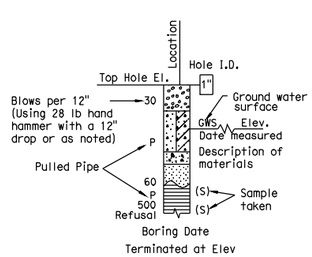
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

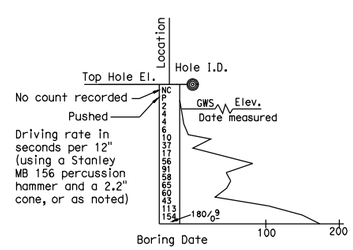
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



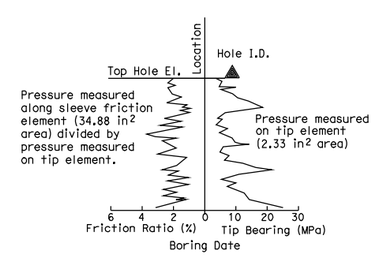
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

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
◕	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

Note: Size in inches.

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY K. Reyes

CHECKED BY H. Nofal

R. Bethapudi
FIELD INVESTIGATION BY:

DATE

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Ayman Salama
PROJECT ENGINEER

BRIDGE NO.

POST MILES

SOIL LEGEND

SOUND WALL No. 627

LOG OF TEST BORINGS SHEET 3 OF 4

SW-41

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12220
EA 0F0321

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 02/12/09 04/07/09 06/15/09

SHEET OF

FILE => c0F032rd010.dgn

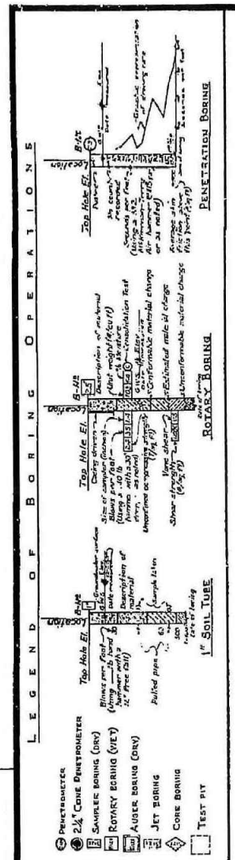
USERNAME => rmitry DATE PLOTTED => 06-NOV-2009 TIME PLOTTED => 09:59

FED. ROAD DIV. NO.	STATE	F. A. PROJECT NO.	SHEET NO.	TOTAL SHEETS
7	CALIF.			

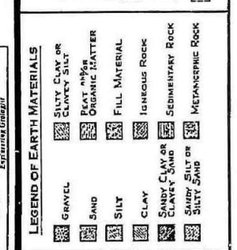
DIST.	COUNTY	ROUTE	REVISION	SHEET NO.	TOTAL SHEETS
07	ORA.	57	7/6/2002	160	180

DATE COMPLETED September 30, 1968

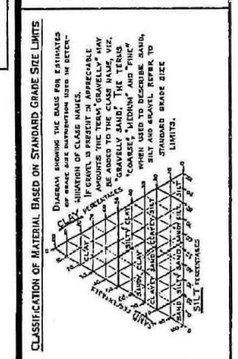
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CLASSIFICATION OF MATERIAL BASED ON STANDARD GRAIN 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.

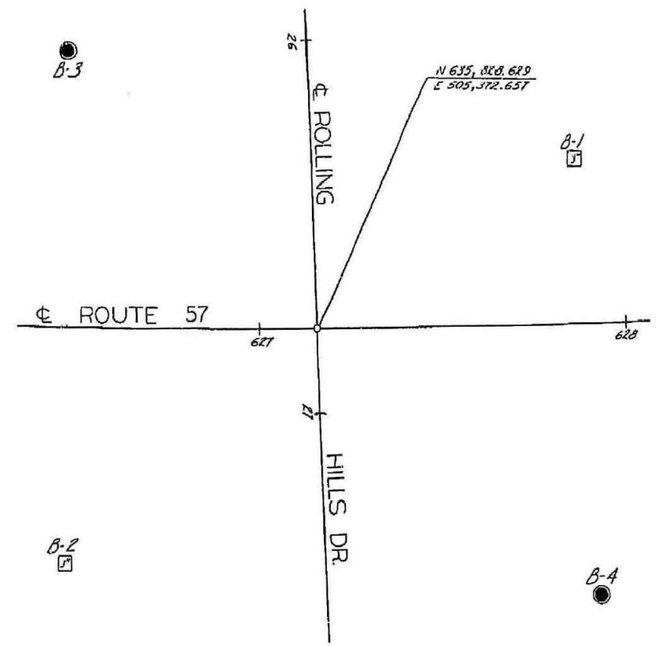
FIELD STUDY by: H. Kim 4-24-67
DRAWN by: A. Allen 4-27-67
CHECKED by: R. Corbaley 4-24-67
Approval Recommended: Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

160

BENCH MARK

B.M. # 629-D-66 Elev. 361.18
Fd. anchor bolt on top of northeast pedestal of Hathaway Oil Well No. 8



PLAN
Scale: 1" = 20'

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
12	Ora	57			
Hisham M. Nofal 06/08/09					
REGISTERED CIVIL ENGINEER			DATE		
SOUND WALL NO. 627					
LOG OF TEST BORINGS SHEET 4 OF 4 SW-42					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA		CU: 12220 EA: 0F0321	BRIDGE No.		
			Sheet	of	

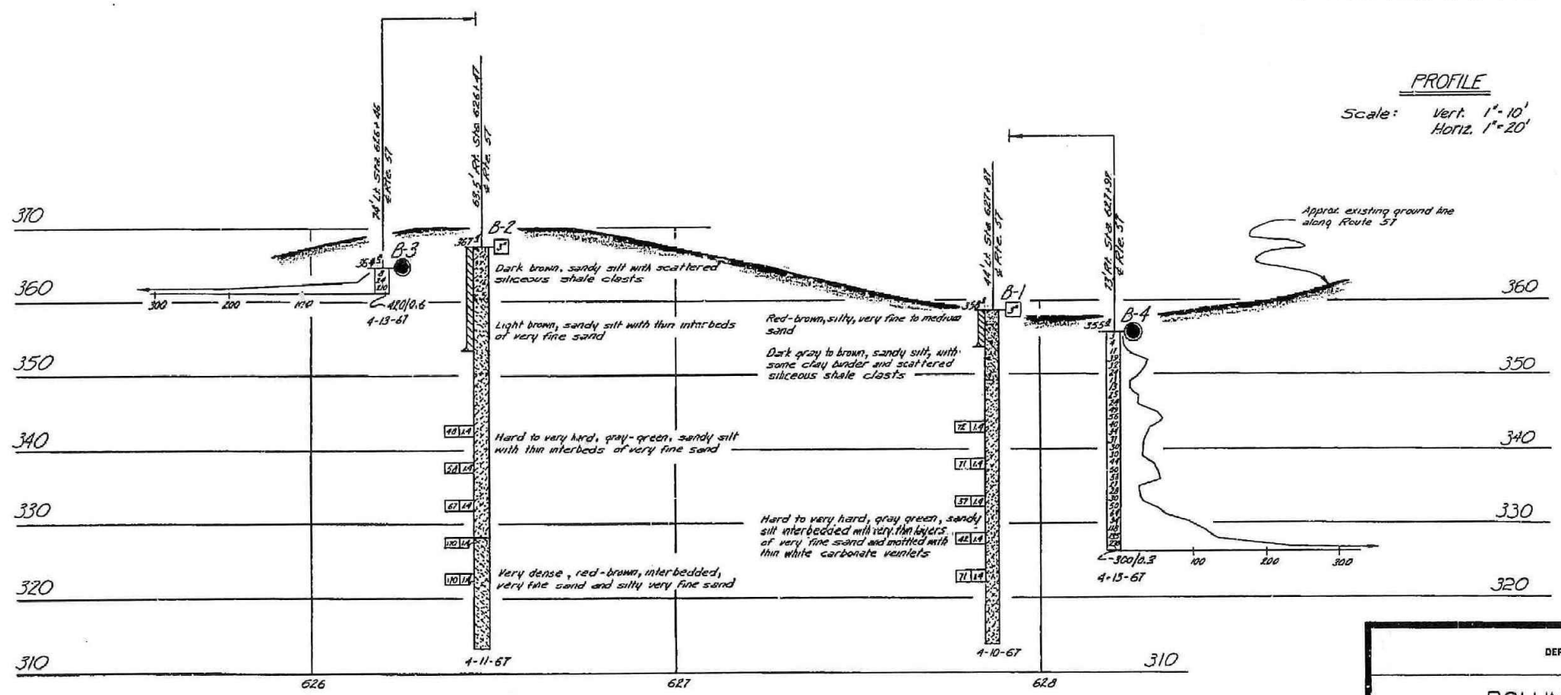
REGISTERED PROFESSIONAL ENGINEER HISHAM M. NOFAL No. 2765 Exp. 09/30/11 GEOTECHNICAL STATE OF CALIFORNIA

NO GROUND WATER ENCOUNTERED DURING THIS INVESTIGATION
BRIDGE DEPT. GEOLOGY SECTION
DATE April, 1967

INFORMATION ON ACTUAL FOUNDATION CONDITIONS ENCOUNTERED IS ON FILE IN BRIDGE GEOLOGY SECTION

PROFILE

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



AS BUILT PLANS
Contract No. 07-032134
Date Completed
Document No. 70001578

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

ROLLING HILLS DRIVE UNDERCROSSING

LOG OF TEST BORINGS

SHEET	OF	SCALE As Noted	BRIDGE 55-0483	FILE	DRAWING S 504/13-7
10	10				

Chg. 07208
W.A. 033131
Disregard prints bearing earlier numbers
PREL. DRAWING No. PR- 1/1

FILE => $REQUEST
USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

APPENDIX C

Boring Logs

APPENDIX C.1

Geotechnical Boring Logs

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)

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
◐	B	Hollow Stem Auger Boring (HSA)
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
	O	Other

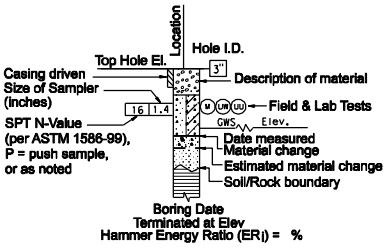
Note: Size in inches.

SAMPLER TYPES

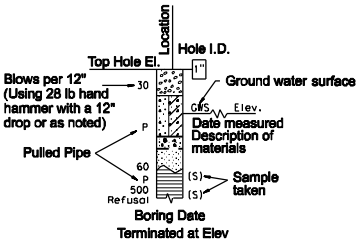
- (S) Standard Split-spoon Drive Sampler, 2.0-inch Outside Diameter, 1.4 inch Inside Diameter (Without liners)
- (D) Modified California Split-spoon Drive Sampler 3.0-inch Outside Diameter, 2.4-inch Inside Diameter (With Liners)
- (B) Bulk Sample Collected From Drill Cuttings

CORRECTION FACTOR

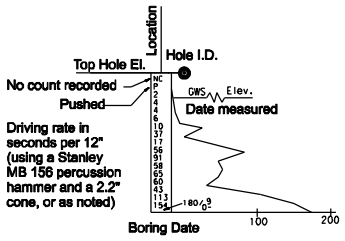
To convert from California modified ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.



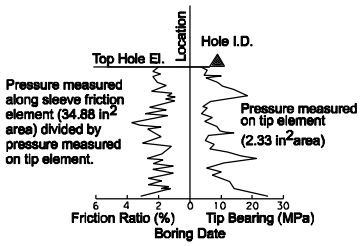
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

CH2MHILL

REPORT TITLE	BORING LOG LEGEND			
DIST. 12	COUNTY Orange	ROUTE SR-57	POSTMILE 18.4/20.9	EA 12-0F0321
PROJECT SR-57 NORTHBOUND WIDENING				
BRIDGE NUMBER X	PREPARED BY X	DATE X	SHEET 1 OF 3	

TIME PLOTTED => $TIME
DATE PLOTTED => $DATE
USERNAME => $USER
FILE => $REQUEST

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

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

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.

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.

NOTE: This legend sheet provides descriptors and associated criteria for required soil description components only. refer to Caltrns Soil and Rock Logging, classification, and Presentation Manual (July 2007), section 2, for tables of aditional soil description components and discussion of soil description and identification.

CH2MHILL

REPORT TITLE	BORING LOG LEGEND			
DIST. 12	COUNTY Orange	ROUTE SR-57	POSTMILE 18.4/20.9	EA 12-0F0321
PROJECT SR-57 NORTHBOUND WIDENING				
BRIDGE NUMBER X	PREPARED BY X		DATE X	SHEET 2 OF 3

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

BEDDING SPACING

Description	Thickness / Spacing
Massive	Greater than 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8" to 1 ft
Thinly bedded	1-1/4" to 3-5/8"
Very thinly bedded	3/8" to 1-1/4"
Laminated	Less than 3/8"

WEATHERING DESCRIPTORS FOR INTACT ROCK

Description	Diagnostic features					General Characteristics
	Chemical Weathering-Discoloration and/or oxidation		Mechanical Weathering-Grain boundary conditions (disaggregation)primarily for granitics and some coarse-grained sediments	Texture and Solutioning		
	Body of Rock	Fracture Surfaces		Texture	Solutioning	
Fresh	No discoloration, not oxidized.	No discoloration or oxidation.	No separation, intact (tight).	No change.	No solutioning.	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull.	Minor to complete discoloration or oxidation of most surfaces.	No visible separation, intact (tight).	Preserved.	Minor leaching of some soluble minerals may be noted.	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty," feldspar crystals are "cloudy."	All fracture surfaces are discolored or oxidized.	Partial separation of boundaries visible.	Generally preserved.	Soluble minerals may be mostly leached.	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in-situ disaggregation, see grain boundary conditions.	All fracture surfaces are discolored or oxidized, surfaces friable.	Partial separation, rock is friable; in semiarid conditions granitics are disaggregated.	Texture altered by chemical disintegration (hydration, argillation).	Leaching of soluble minerals may be complete.	Dull sound when struck with hammer, usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay.		Complete separation of grain boundaries (disaggregated).	Resembles a soil, partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete.		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes."

Combination descriptors (such as "slightly weathered to fresh") are permissible where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant, identifiable zones can be delineated. Only two adjacent descriptors may be combined. "Very intensely weathered" is the combination descriptor for "intensely weathered to decomposed."

RELATIVE STRENGTH OF INTACT ROCK

Term	Uniaxial Compressive Strength (PSI)
Extremely Strong	> 30,000
Very Strong	14,500 - 30,000
Strong	7,000 - 14,500
Medium Strong	3,500 - 7,000
Weak	700 - 3,500
Very Weak	150 - 700
Extremely Weak	< 150

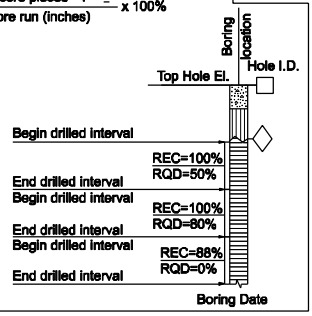
ROCK HARDNESS

Description	Criteria
Extremely Hard	Specimen cannot be scratched with a pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows.
Very Hard	Specimen cannot be scratched with a pocket knife or sharp pick. Breaks with repeated heavy hammer blows.
Hard	Specimen can be scratched with a pocket knife or sharp pick with difficulty (heavy pressure). Heavy hammer blows required to break specimen.
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure. Core breaks with moderate hammer pressure.
Moderately Soft	Specimen can be grooved 1/6" deep with a pocket knife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Specimen can be grooved or gouged easily by a pocket knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
Very Soft	Specimen can be readily indented, grooved or gouged with fingernail, or carved with a pocket knife. Breaks with light manual pressure.

PERCENT CORE RECOVERY (REC) & ROCK QUALITY DESIGNATION (RQD)

$$REC = \frac{\sum \text{Length of the recovered core pieces (inches)}}{\text{Total length of core run (inches)}} \times 100\%$$

$$RQD = \frac{\sum \text{Length of intact core pieces } 4" \geq}{\text{Total length of core run (inches)}} \times 100\%$$



FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures.
Very slightly fractured	Lengths greater than 3 feet.
Slightly fractured	Lengths from 1 to 3 feet with few lengths less than 1 foot or greater than 3 feet.
Moderately fractured	Lengths mostly in 4" to 1 foot range with most lengths about 8"
Intensely fractured	Lengths average from 1 to 4" with scattered fragmented intervals with lengths less than 4"
Very intensely fractured	Mostly chips and fragments with a few scattered short core lengths.

Combination descriptors (such as "Very intensely to intensely fractured") are used where equal distribution of both fracture density characteristics is present over a significant interval or exposure, or where characteristics are "In between" the descriptor definitions. Only two adjacent descriptors may be combined.

CH2MHILL

REPORT TITLE	BORING ROCK LEGEND			
DIST. 12	COUNTY Orange	ROUTE SR-57	POSTMILE 18.4/20.9	EA 12-0F0321
PROJECT SR-57 NORTHBOUND WIDENING				
BRIDGE NUMBER X	PREPARED BY X	DATE X	SHEET 3 OF 3	

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME
FILE => $REQUEST

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-001
PROJECT NO	370900.03.GE.FR			STATION (FT)	588+89.16
DATE STARTED	6/26/08	DATE FINISHED	6/26/08	OFFSET (FT)	91.38 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	286.17
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	285	B	1			**Artificial Fill (Af):** SANDY LEAN CLAY (CL) to CLAYEY SAND (SC): olive-brown, moist	8.5		PA, CR, CP	
5	280	D	1	74		**Very Old Alluvium Fan Deposits (Qvof):** SANDY LEAN CLAY (CL): olive-brown, moist, 51% medium plastic fines, 48% fine to medium sand, trace fine gravel; hard, brown, 57% medium plastic fines, 43% fine to medium sand	4.3	107.2	DS, PA	
10	275	S	2	88/11"		59% medium plastic fines, 41% fine to medium sand			PA	
15	270	D	3	50/5"		SILTY SAND (SM): very dense, light brown, moist, fine to medium sand, low plastic fines	4.4	108.4	UW	
						CLAYEY SAND (SC): very dense, moist, brown, fine to medium sand, medium plastic fines				
20	265	S	4	23		SILTY SAND (SM): dense, light brown, moist, fine sand, low plastic fines				
25	260	D	5	83		POORLY GRADED SAND with SILT (SP-SM): very dense, yellowish-brown, moist, 93% fine to medium sand, 7% low plastic fines	1.9	101.2	DS, PA	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-001
PROJECT NO	370900.03.GE.FR			STATION (FT)	588+89.16
DATE STARTED	6/26/08	DATE FINISHED	6/26/08	OFFSET (FT)	91.38 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	286.17
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	255	S	6	26		WELL-GRADED SAND with SILT (SW-SM): dense, brown, moist, 88% fine to coarse sand, 10% low plastic fines, trace fine gravel			PA	
						Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-002
PROJECT NO	370900.03.GE.FR			STATION (FT)	592+68.09
DATE STARTED	7/9/08	DATE FINISHED	7/9/08	OFFSET (FT)	85.42 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	288.82
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						Very Old Alluvium Fan Deposits (Qvof): SANDY LEAN CLAY (CL): brown, moist, 42% medium to fine sand, 58% medium plastic fines				
	285	B	1				7.5		CP, PA, CR, DS, EI, R, PI	
5						hard				
		D	1	34						
	280									
10						stiff, 70% medium plastic fines, 30% fine sand			PA	
		S	2	7						
	275									
15						FAT CLAY (CH): hard, olive-brown, moist, high plastic fines, fine sand	15.7	109.7	CN, PI	
		D	3	45						
	270									
20						SANDY LEAN CLAY (CL): very stiff, brown, moist, 51% medium plastic fines, 49% medium to fine sand			PA, PI	
		S	4	20						
	265									
25						hard				
		D	5	46						
	260									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-002
PROJECT NO	370900.03.GE.FR			STATION (FT)	592+68.09
DATE STARTED	7/9/08	DATE FINISHED	7/9/08	OFFSET (FT)	85.42 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	288.82
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	56						
	255					Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-003
PROJECT NO	370900.03.GE.FR			STATION (FT)	596+78.93
DATE STARTED	6/26/08	DATE FINISHED	6/26/08	OFFSET (FT)	98.00 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	292.23
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	290	B	1			**Very Old Alluvium Fan Deposits (Qvof):** SANDY LEAN CLAY (CL): yellowish-brown, moist, 58% medium plastic fines, 41% fine to medium sand, trace fine gravel	9.3		PA, CR, CP	
5		D	1	57		SANDY SILTY CLAY (CL-ML): hard, yellowish-brown, moist, 62% low plastic fines, 38% fine sand	8.0	94.7	DS, PA	
	285									
10		S	2	19		SILTY SAND (SM): medium dense, brown, moist, 81% fine sand, 17% low plastic fines, trace fine gravel			PA	
	280									
15		D	3	89		very dense, light brown	4.5	109.6	UW	
	275									Encountered cobbles @17'
20		S	4	69		SILTY SAND with GRAVEL (SM): very dense, brown, moist, fine to coarse sand, low plastic fines, rounded to subangular fine gravel				
	270									
25		D	5	50/6"		POORLY GRADED GRAVEL with SAND (GP): very dense, brown, dry, fine to coarse, rounded to subrounded gravel, fine to coarse sand				Rig Shattering @23'
	265									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-003
PROJECT NO	370900.03.GE.FR			STATION (FT)	596+78.93
DATE STARTED	6/26/08	DATE FINISHED	6/26/08	OFFSET (FT)	98.00 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	292.23
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	27		SANDY LEAN CLAY (CL): hard, yellowish-brown, moist, medium plastic fines, fine sand			PI	
	260					Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-004
PROJECT NO	370900.03.GE.FR			STATION (FT)	600+05.67
DATE STARTED	7/2/08	DATE FINISHED	7/2/08	OFFSET (FT)	69.33 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	294.36
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		B	1			**Very Old Alluvium Fan Deposits (Qvof):** POORLY GRADED SAND with SILT (SP-SM): brown, moist, 72% fine to medium sand, 7% low plastic fines, 21% fine to coarse, rounded to angular gravel	3.4		EI, CP, PA, CR, DS, PI	
5	290	D	1	50/4"		WELL GRADED SAND with SILT and GRAVEL (SW-SM): very dense, brown, moist, 54% fine to coarse sand, 9% low plastic fines, 37% fine to coarse, rounded to angular gravel	4.8	112.7	PA, DS	
10	285	S	2	34		CLAYEY SAND (SC): very dense, olive, moist, 38% fine to medium sand, 49% medium plastic fines, 13% fine gravel			PA	
15	280	D	3	50/4"		POORLY GRADED GRAVEL with SAND (GP): very dense, brown, moist, fine to coarse rounded to angular gravel, fine to coarse sand				
20	275	S	4	28		SANDY LEAN CLAY (CL): hard, brown, moist, 39% fine sand, 61% medium plastic fines			PA	
25	270	D	5	93/8"		LEAN CLAY with SAND (CL): hard, yellowish-brown, moist, 81% medium plastic fines, 19% fine sand	18.2	107.8	PA, DS	
	265									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-004
PROJECT NO	370900.03.GE.FR			STATION (FT)	600+05.67
DATE STARTED	7/2/08	DATE FINISHED	7/2/08	OFFSET (FT)	69.33 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	294.36
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	42						
						Borehole completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				
	260									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-005
PROJECT NO	370900.03.GE.FR			STATION (FT)	600+49.62
DATE STARTED	6/26/08	DATE FINISHED	6/26/08	OFFSET (FT)	100.31 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	294.96
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		B	1			**Very Old Alluvium Fan Deposits (Qvof):** SANDY LEAN CLAY (CL): olive-yellow, moist, 51% medium plastic fines, 48% fine sand, trace fine gravel	3.7		PA, DS, CR, CP	
5	290	D	1	50/4"		SANDY SILT (ML): very dense, yellowish-brown, moist, 51% low plastic fines, 49% fine sand	8.2	108.8	PA, DS	
10	285	S	2	98/11"		SILTY GRAVEL with SAND (GM): very dense, brown, moist, 41% fine to coarse, rounded to angular gravel, 21% low plastic fines, 38% fine to coarse sand			PA	
15	280	D	3	87/11"		SILTY SAND (SM): very dense, yellowish-brown, moist, fine to medium sand, low plastic fines	8.7	102.6	PI, DS	
20	275	S	4	42		SANDY LEAN CLAY (CL): hard, olive-brown, moist, 66% medium plastic fines, 34% fine sand			PA, PI	
25	270	D	5	50/5"		LEAN CLAY (CL): hard, yellowish-brown, moist, medium plastic fines, some fine sand	16.5	115.3	DS, PI	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-005
PROJECT NO	370900.03.GE.FR			STATION (FT)	600+49.62
DATE STARTED	6/26/08	DATE FINISHED	6/26/08	OFFSET (FT)	100.31 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	294.96
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	38		olive-gray				
						Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				
	260									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-006
PROJECT NO	370900.03.GE.FR			STATION (FT)	601+90
DATE STARTED	9/25/08	DATE FINISHED	9/25/08	OFFSET (FT)	175.75 RT
DRILLER	2R Drilling	LOGGED BY	A.Thakur	GSE (FT)	274.16
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						5" Asphalt concrete layer over 6" Base course layer				
	270	B	1			**Artificial Fill (Af):** CLAYEY SAND with GRAVEL (SC): dark brown, moist, 52% fine to coarse sand, 44% medium plastic fines, trace gravel	5.6		PA, CR	
5		S	1	15		**Young Alluvium Fan Deposits (Qyf):** SANDY LEAN CLAY (CL): very stiff, dark brown, moist, medium plastic fines, fine to medium sand	10.3		M	
	265									
10		D	2	20			11.6	118.8	PI, UW	
	260									
15		S	3	10		stiff, olive-brown, with caliche	12.4		PI, M	
	255									
20		D	4	57		**Very Old Alluvium Fan Deposits (Qvof):** LEAN CLAY with SAND (CL): hard, brown to dark brown, moist, medium plastic fines, fine sand	19.6	109.8	UW	
	250									
25		S	5	31		yellowish-brown	18.5		M	
	245									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-006
PROJECT NO	370900.03.GE.FR			STATION (FT)	601+90
DATE STARTED	9/25/08	DATE FINISHED	9/25/08	OFFSET (FT)	175.75 RT
DRILLER	2R Drilling	LOGGED BY	A.Thakur	GSE (FT)	274.16
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		D	6	81		light brown	19.4	109.1	PI, UW	
	240					Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings and cold patch asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-007
PROJECT NO	370900.03.GE.FR			STATION (FT)	603+52.10
DATE STARTED	7/1/08	DATE FINISHED	7/1/08	OFFSET (FT)	71.96 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	296.82
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						4" Asphalt Concrete over 6" Base course layer				
	295					**Very Old Alluvium Fan Deposits (Qvof):** SILTY SAND (SM): brown, dry to moist, fine to medium sand, low plastic fines, trace fine to coarse, rounded to angular gravel				
5		D	1	66		very dense, yellowish-brown, 86% fine sand, 14% low plastic fines	3.2	99.0	PA, DS	
	290					grades with gravel				Rig shattering @ 7.5'
10		S	2	41		brown, 83% fine sand, 17% low plastic fines			PA	
	285									Rig shattering @ 11.5'
						Borehole terminated at a depth of 12 feet below ground surface due to rig refusal. No groundwater encountered. Borehole backfilled with soil cuttings and cold patch asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-008
PROJECT NO	370900.03.GE.FR			STATION (FT)	606+56.07
DATE STARTED	7/1/08	DATE FINISHED	7/1/08	OFFSET (FT)	69.92 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	299.18
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						5" Asphalt Concrete on 6" Base course				
	295	B	1			**Very Old Alluvium Fan Deposits (Qvof)**: LEAN CLAY with SAND (CL): hard, dark brown, moist, 85% medium plastic fines, 15% fine to medium sand	4.7		PA, CP, DS, EI, CR, PI	
5		D	1	52		hard	22.0	108.7	DS, CN	
	290									
10		S	2	20		FAT CLAY (CH): very stiff, yellowish-brown, moist, 90% high plastic fines with caliche, 10% fine sand			PA, PI	
	285									
15		D	3	50/4"		LEAN CLAY (CL): hard, yellowish-brown, moist, medium plastic fines	14.1	119.4	DS, UW	
	280									
20		S	4	50		SILTY SAND (SM): very dense, grayish-brown, moist, 63% fine sand, 37% low plastic fines			PA	
	275									
25		D	5	50/6"		LEAN CLAY (CL): hard, olive-brown, moist, 98% medium plastic fines, trace fine to medium sand	22.5	102.5	PA, UW	
	270									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-008
PROJECT NO	370900.03.GE.FR			STATION (FT)	606+56.07
DATE STARTED	7/1/08	DATE FINISHED	7/1/08	OFFSET (FT)	69.92 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	299.18
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	34						
	265					Boring Completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings and cold patch asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-009
PROJECT NO	370900.03.GE.FR			STATION (FT)	609+78.74
DATE STARTED	7/8/08	DATE FINISHED	7/8/08	OFFSET (FT)	68.66 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	301.44
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						5" Asphalt concrete layer over 9" Base course layer				
	300	B	1			**Very Old Alluvium Fan Deposits (Qvof):** CLAYEY SAND (SC): olive-brown, moist, 50% fine to medium sand, 45% medium plastic fines, 5% fine gravel	8.2		PA, CR, CP, R	
5		D	1	77		SILTY CLAYEY SAND (SC-SM): very dense, yellowish-brown, moist, 50% fine to coarse sand, 49% low plastic fines, trace fine gravel	7.0	11.7	PA, DS	
10	295	S	2	32		SANDY LEAN CLAY (CL): hard, brown, moist, 50% medium plastic fines, 49% fine to medium sand, trace fine gravel			PA	
15	290	D	3	50/4"			9.3	121.5	UW	
20	285	S	4	42						
25	280	D	5	78		SANDY SILTY CLAY (CL-ML): hard, olive-brown, moist, 53% low plastic fines, 44% fine to medium sand, trace fine gravel	12.7	110.4	PA, UW	
	275									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-009
PROJECT NO	370900.03.GE.FR			STATION (FT)	609+78.74
DATE STARTED	7/8/08	DATE FINISHED	7/8/08	OFFSET (FT)	68.66 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	301.44
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	270	S	6	13		very stiff				
						Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings and cold patch asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-010
PROJECT NO	370900.03.GE.FR			STATION (FT)	611+86.12
DATE STARTED	7/2/08	DATE FINISHED	7/2/08	OFFSET (FT)	125.05 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	302.84
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	300	B	1			**Artificial Fill (Af)**: CLAYEY SAND (SC): brown, moist, 53% fine to coarse sand, 44% medium plastic fines, trace fine to coarse gravel	4.9		PA, CP, DS, EI, CR, PI	
5		D	1	53		very dense				
	295									
10		S	2	13		SILTY SAND (SM): medium dense, brown, moist, 58% medium to coarse sand, 42% non plastic fines			PA	
	290									
15		D	3	73		**Very Old Alluvium Fan Deposits (Qvof)**: LEAN CLAY (CL): hard, dark brown, moist, fine sand, medium plastic fines	12.4	124.6	PI, DS	
	285									
20		S	4	22		SANDY LEAN CLAY (CL): hard, dark brown, moist, 51% medium plastic fines, 49% medium to fine sand			PA, PI	
	280									
25		D	5	42		CLAYEY SAND (SC): dense, olive-brown, moist, fine to medium sand, medium plastic fines	10.6	125.9	UU	
	275									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-010
PROJECT NO	370900.03.GE.FR			STATION (FT)	611+86.12
DATE STARTED	7/2/08	DATE FINISHED	7/2/08	OFFSET (FT)	125.05 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	302.84
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	24						
	270					Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-011
PROJECT NO	370900.03.GE.FR			STATION (FT)	621+17.88
DATE STARTED	6/29/08	DATE FINISHED	6/29/08	OFFSET (FT)	69.63 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	332.43
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	330	B	1			**Very Old Alluvium Fan Deposits (Qvof):** CLAYEY SAND (SC): yellowish-brown, moist, 55% fine to medium sand, 43% medium plastic fines, trace fine gravel	12.2		PA, CR, DS, CP	
5		D	1	14		SILTY SAND (SM): medium dense, yellowish-brown, moist, 78% fine to medium sand, 22% low plastic fines	7.7	109.4	DS, PA	
	325									
10		S	2	8		POORLY GRADED SAND (SP): medium dense, moist, brown, fine to medium sand				
	320									
15		D	3	53		SILTY CLAYEY SAND (SC-SM): very dense, yellowish-brown, moist, 64% fine to medium sand, 36% low plastic fines	9.9	121.2	PA, DS	
	315									
20		S	4	14		SILTY SAND (SM): medium dense, brown, moist, fine to medium sand, low plastic fines	4.1		M	
	310									
25		D	5	63		very dense, light brown	4.7	102.3	UW	
	305									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-011
PROJECT NO	370900.03.GE.FR			STATION (FT)	621+17.88
DATE STARTED	6/29/08	DATE FINISHED	6/29/08	OFFSET (FT)	69.63 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	332.43
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	28		LEAN CLAY (CL): hard, brown, moist, medium plastic fines, some fine to medium sand	16.9		PI, M	
	300					Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-012
PROJECT NO	370900.03.GE.FR			STATION (FT)	626+09.55
DATE STARTED	7/15/08	DATE FINISHED	7/15/08	OFFSET (FT)	116.06 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	360.74
GROUND WATER ELEV	290.9	GW DEPTH (FT)	69.8	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	360					**Very Old Alluvial Fan Deposits (Qvof)** SANDY LEAN CLAY (CL): brown, moist, medium plastic fines, fine to medium sand				
5	355	D	1	47		hard				
10	350	S	2	18		FAT CLAY (CH): very stiff, olive-brown, moist, 90% high plasticity fines, 10% fine sand	21.7		PA, PI, M	
15	345	D	3	50/6"		**SEDIMENTARY ROCK: La Habra formation (Qlh)** CLAYSTONE, olive-brown, moist, very intensely weathered, extremely weak, soft to very soft, contains clay with medium plastic fines	12.9	107.0	PI, DS, UW	
20	340	S	4	37			20.6		M	
25	335	D	5	79/10"		olive, contains clay with high plastic fines	16.4	115.5	PI, UU	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-012
PROJECT NO	370900.03.GE.FR			STATION (FT)	626+09.55
DATE STARTED	7/15/08	DATE FINISHED	7/15/08	OFFSET (FT)	116.06 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	360.74
GROUND WATER ELEV	290.9	GW DEPTH (FT)	69.8	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	330	S	6	30		yellowish-brown, contains clay with medium plastic fines, some fine sand				
35	325	D	7	86			16.8	117.7	PI, DS, CN	
		B	1				9.4		PI, EI, CR	
40	320	S	8	29						
		B	2							
45	315	D	9	50/5"		brown	18.6	113.0	PI, UW	
50	310	S	10	30						
55	305	D	11	50/5"			16.0	117.5	PI, UW	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-012
PROJECT NO	370900.03.GE.FR			STATION (FT)	626+09.55
DATE STARTED	7/15/08	DATE FINISHED	7/15/08	OFFSET (FT)	116.06 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	360.74
GROUND WATER ELEV	290.9	GW DEPTH (FT)	69.8	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	300	S	12	37						
65	295	D	13	50/4"		olive, contains clay with high plastic fines	18.1	113.5	PI, UW	
70	290	S	14	41						▼
						Boring completed to a depth of 71.5 feet below ground surface. Groundwater encountered at 69.8 feet bgs. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

▼ GW WHILE DRILLING
▽ GW HRS.
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-013
PROJECT NO	370900.03.GE.FR			STATION (FT)	628+28.01
DATE STARTED	6/27/08	DATE FINISHED	6/27/08	OFFSET (FT)	68.82 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	347.39
GROUND WATER ELEV	289.9	GW DEPTH (FT)	57.5	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	345					**SEDIMENTARY ROCK: La Habra formation (Qlh)** CLAYSTONE: olive-gray, very intensely weathered, extremely weak, soft to very soft, contains clay with medium plastic fines				
5		D	1	61			20.7	107.2	UW	
	340									
10		S	2	38		gray	17.1		PI, M	
	335									
15		D	3	50/5"		olive-gray, contains clay with high plastic fines, fine sand	23.8	103.2	PI, DS, UW	
	330	B	1				15.0		PI, EI, CR	
20		S	4	53		gray, contains clay with medium plastic fines, some fine sand	14.4		M	
	325									
25		D	5	95/9"		olive			PI, DS	
	320	B	2			contains clay with high plastic fines	6.0		PI, EI, CR	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-013
PROJECT NO	370900.03.GE.FR			STATION (FT)	628+28.01
DATE STARTED	6/27/08	DATE FINISHED	6/27/08	OFFSET (FT)	68.82 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	347.39
GROUND WATER ELEV	289.9	GW DEPTH (FT)	57.5	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	40		olive-brown, contains clay with medium plastic fines, fine sand	19.2		PA, M	
	315									
35		D	7	50/5"		contains clay with high plastic fines	19.0	113.0	PI, DS, CN	
	310	B	3							
40		S	8	26		contains clay with medium plastic fines	24.5		M	
	305									
45		D	9	50/4"			18.8	111.5	UU	
	300									
50		S	10	34			19.0		M	
	295									
55		D	11	50/4"		brown, contains clay with medium plastic fines, fine sand	17.0	115.0	PI, DS	
	290									▼

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- ▼ GW WHILE DRILLING
- ▽ GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-013
PROJECT NO	370900.03.GE.FR			STATION (FT)	628+28.01
DATE STARTED	6/27/08	DATE FINISHED	6/27/08	OFFSET (FT)	68.82 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	347.39
GROUND WATER ELEV	289.9	GW DEPTH (FT)	57.5	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	12	34		contains clay with medium plastic fines and fine sand			PA, PI	
	285									
65		D	13	50/2"		olive-gray, some fine sand				
	280									
70		S	14	53		brown, contains clay with medium plastic fines, some fine sand			PI	
						Boring completed to a depth of 71.5' below ground surface (bgs). Groundwater encountered at 57.5 feet bgs. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-014
PROJECT NO	370900.03.GE.FR			STATION (FT)	632+55.45
DATE STARTED	7/8/08	DATE FINISHED	7/8/08	OFFSET (FT)	71.44 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	339.84
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		B	1			**Very Old Alluvium Fan Deposits (Qvof):** CLAYEY SAND (SC): yellowish-brown, dry, 51% fine to medium sand, 41% medium plastic fines, 8% fine gravel	7.6		PA, DS, CR, CP	
5	335	D	1	50/2"		POORLY GRADED SAND with GRAVEL (SP): very dense, brown, moist, fine to medium sand, some caliche	8.1	78.0	UW	
10	330	S	2	64		SILTY SAND with GRAVEL (SM): very dense, yellowish-brown, dry, fine to medium sand, rounded to subrounded fine gravel	12.3		M	
15	325	D	3	50/3"		POORLY GRADED SAND with SILT (SP-SM): very dense, yellowish-brown, moist, fine to medium sand, low plastic fines	7.8	109.2	DS	
20	320	S	4	36		LEAN CLAY (CL): hard, olive, moist, 90% medium plastic fines, 10% fine sand	19.9		PA, M	
25	315	D	5	50/5"		SANDY LEAN CLAY with GRAVEL (CL): hard, brown, moist, medium plastic fines, fine to medium sand, rounded to subangular fine gravel				
	310									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-014
PROJECT NO	370900.03.GE.FR			STATION (FT)	632+55.45
DATE STARTED	7/8/08	DATE FINISHED	7/8/08	OFFSET (FT)	71.44 LT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	339.84
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	33		FAT CLAY (CH): hard, olive, moist, high plastic fines, some fine sand	24.1		PI, M	
	305					Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-015
PROJECT NO	370900.03.GE.FR			STATION (FT)	634+82.72
DATE STARTED	7/9/08	DATE FINISHED	7/9/08	OFFSET (FT)	69.80 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	341.06
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	340	B	1			**Artificial Fill (Af):** LEAN CLAY with SAND (CL): dark brown, moist, medium plastic fines, fine sand	8.0		CR, EI, CP, PI, DS	
5	335	D	1	32		FAT CLAY (CH): hard, pale olive, moist, 95% high plastic fines, 5% fine to medium sand	20.6	100.7	PI, PA, DS	
						Very Old Alluvium Fan Deposits (Qvof): LEAN CLAY (CL): hard, brown, moist, medium plastic fines, fine sand, with trace caliche				
10	330	S	2	25			14.7		M	
15	325	D	3	50/5"		yellowish-brown, medium plastic fines, with trace caliche	14.5	117.4	PI, DS	
20	320	S	4	36		SANDY LEAN CLAY (CL): hard, yellowish-brown, medium plastic fines, fine to medium sand	14.2		PI, M	
25	315	D	5	73		FAT CLAY (CH): hard, light brown, moist, high plastic fines, some sand	22.5	105.5	CN, PI	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-015
PROJECT NO	370900.03.GE.FR			STATION (FT)	634+82.72
DATE STARTED	7/9/08	DATE FINISHED	7/9/08	OFFSET (FT)	69.80 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	341.06
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	310	S	6	22		olive-gray	21.9		M	
						Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings and cold patch asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-016
PROJECT NO	370900.03.GE.FR			STATION (FT)	639+77.27
DATE STARTED	7/7/08	DATE FINISHED	7/7/08	OFFSET (FT)	78.93 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	327.19
GROUND WATER ELEV	278.2	GW DEPTH (FT)	49	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						7" Asphalt concrete layer, 9" base course layer				
	325					**Artificial Fill (Af)**: LEAN CLAY (CL): hard, dark brown, moist, medium plastic fines, some fine sand				
5		D	1	40			12.8	120.5	UW	
	320									
10		S	2	15		SANDY LEAN CLAY (CL): very stiff, brown, moist, medium plastic fines, fine sand	12.6		PI, M	
	315									
15		D	3	54		LEAN CLAY with SAND (CL), hard, yellowish-brown, moist, medium plastic fines, fine sand	16.3	111.1	PI, DS, UW	
	310	B	1						DS, CR, CP	
20		S	4	21		LEAN CLAY (CL): hard, brown, moist, medium plastic fines	17.2		M	
	305									
25		D	5	74		LEAN CLAY with SAND (CL): hard, yellowish-brown, moist, medium plastic fines, fine sand	11.0	121.5	PI, DS	
	300	B	2						CR	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-016
PROJECT NO	370900.03.GE.FR			STATION (FT)	639+77.27
DATE STARTED	7/7/08	DATE FINISHED	7/7/08	OFFSET (FT)	78.93 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	327.19
GROUND WATER ELEV	278.2	GW DEPTH (FT)	49	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	18		LEAN CLAY (CL): very stiff, dark brown, moist, medium plastic fines, some fine sand	16.7		M	
	295									
35		D	7	44		**Young Alluvium Fan Deposits (Qyf)**: LEAN CLAY (CL): hard, dark olive-brown, moist, medium plastic fines	22.4	103.2	UU	
	290									
40		S	8	13		very stiff, dark brown, moist	18.3		M	
	285									
45		D	9	28		brown, wet	20.5	110.6	DS, PI	▼
	280									
50		S	10	9		stiff, dark gray, some fine sand	26.0		M	
	275									
55		D	11	9		LEAN CLAY with SAND (CL): stiff, pale olive, wet, 72% medium plastic fines and 28% fine to medium sand	28.4	97.2	PI, PA, UW	
	270									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

▼ GW WHILE DRILLING
▽ GW HRS.
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-016
PROJECT NO	370900.03.GE.FR			STATION (FT)	639+77.27
DATE STARTED	7/7/08	DATE FINISHED	7/7/08	OFFSET (FT)	78.93 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	327.19
GROUND WATER ELEV	278.2	GW DEPTH (FT)	49	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	12	5		SANDY LEAN CLAY (CL): medium stiff, olive, wet, 58% medium plastic fines, 42% fine to medium sand	24.2		PI, PA, M	
	265									
65		D	13	68		**Very Old Alluvium Fan Deposits (Qvof)**: CLAYEY SAND (SC): very dense, olive-brown, wet, fine sand, medium plastic fines	22.5	104.6	DS, PI	
	260									
70		S	14	46		SANDY LEAN CLAY (CL): hard, olive-gray, wet, 57% medium plastic fines, 41% fine sand, trace gravel up to ¾" diameter particles	22.9		PI, PA, M	
	255									
75		D	15	50/3"		LEAN CLAY (CL): hard, olive-gray, wet, medium plastic fines	20.7	106.0	UU	
	250									
80		S	16	56			23.1		M	
						Boring completed to a depth of 81.5' below ground surface (bgs). Groundwater encountered at 49 feet bgs. Borehole backfilled with soil cuttings and cold patch asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

C ROCK CORE	B BULK SAMPLE	GW WHILE DRILLING	
S SPLIT SPOON	T TUBE SAMPLE	GW HRS.	C CONTACT
D DRIVE SAMPLE	P PITCHER TUBE	B BEDDING PLANE	F FAULT
		J JOINTING	S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-017
PROJECT NO	370900.03.GE.FR			STATION (FT)	641+51.08
DATE STARTED	9/11/08	DATE FINISHED	9/11/08	OFFSET (FT)	161.31 RT
DRILLER	2R Drilling	LOGGED BY	HMN	GSE (FT)	301.97
GROUND WATER ELEV	284.0	GW DEPTH (FT)	18	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						5" Asphalt Concrete layer over 18" base course layer				
	300					**Artificial Fill (Af):** LEAN CLAY with SAND (CL): soft, dark olive-brown, moist, medium plastic fines, fine to medium sand				
5						medium stiff				
		S	1	4						
	295									
10						**Young Alluvium Fan Desposits (Qyf):** LEAN CLAY with SAND (CL): hard, dark olive-brown, moist, medium plastic fines, fine sand, with trace caliche	22.0	104.2	PI, DS	
		D	2	32						
	290									
15						very stiff				
		S	3	20						
	285									▼
20						hard, olive, wet			PI	
		D	4	51						
	280									
25						very stiff, olive-brown, trace fine sand				
		S	5	19						
	275									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- ▼ GW WHILE DRILLING
- ▽ GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-017
PROJECT NO	370900.03.GE.FR			STATION (FT)	641+51.08
DATE STARTED	9/11/08	DATE FINISHED	9/11/08	OFFSET (FT)	161.31 RT
DRILLER	2R Drilling	LOGGED BY	HMN	GSE (FT)	301.97
GROUND WATER ELEV	284.0	GW DEPTH (FT)	18	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		D	6	32		FAT CLAY (CH): hard, olive-gray, wet, high plastic fines	24.6	100.5	PI, UU	
	270									
35						very stiff				
		S	7	17						
	265									
40						**Very Old Alluvium Fan Deposits (Qvof):** LEAN CLAY (CL): hard, olive, wet, medium plastic fines	22.7	106.1	PI, DS	
		D	8	64						
	260									
45						trace reddish-brown to orange-brown, fine sand				
		S	9	33						
	255									
50						FAT CLAY (CH): hard, dark olive, wet, high plastic fines	22.0	105.1	PI, UU	
		D	10	50/4"						
	250									
55										
		S	11	32						
	245									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-017
PROJECT NO	370900.03.GE.FR			STATION (FT)	641+51.08
DATE STARTED	9/11/08	DATE FINISHED	9/11/08	OFFSET (FT)	161.31 RT
DRILLER	2R Drilling	LOGGED BY	HMN	GSE (FT)	301.97
GROUND WATER ELEV	284.0	GW DEPTH (FT)	18	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		D	12	82/11"		LEAN CLAY (CL): hard, olive-brown, wet, medium plastic fines	23.5	102.9	UW	
	240									
65						grades with more sand				
		S	13	23						
	235									
70							24.4	100.2	UW	
		D	14	68/11"						
	230									
75						FAT CLAY (CH): hard, yellowish-brown, wet, high plastic fines			PI	
		S	15	29						
	225									
80						LEAN CLAY (CL): hard, olive-brown, wet, medium plastic fines	26.0	97.8	UW	
		D	16	50/6"						
						Boring completed to a depth of 81.5 feet below ground surface (bgs). Groundwater encountered at 18 feet bgs. Borehole backfilled with bentonite and surface patched with cold asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-018
PROJECT NO	370900.03.GE.FR			STATION (FT)	650+43.40
DATE STARTED	7/2/08	DATE FINISHED	7/2/08	OFFSET (FT)	280.67 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	308.65
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						6" Asphalt concrete layer, 8" base course layer				
	305	B	1			**Artificial Fill (Af):** SANDY LEAN CLAY (CL): dark brown, moist, 53% medium plastic fines, 47% fine to medium sand			PA, DS, CP, EI, R, PI	
5		D	1	36		hard, brown	16.3	115.6	UW	
	300									
10		S	2	12		very stiff, yellowish-brown, 54% medium plastic fines, 46% fine sand			PA, PI	
						Boring completed to a depth of 11.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings and cold patch asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-019
PROJECT NO	370900.03.GE.FR			STATION (FT)	654+15.00
DATE STARTED	8/28/08	DATE FINISHED	8/28/08	OFFSET (FT)	140.45 RT
DRILLER	2R Drilling	LOGGED BY	J. Lee	GSE (FT)	341.80
GROUND WATER ELEV	299.8	GW DEPTH (FT)	42	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	340					**Artificial Fill (Af):** CLAYEY SAND (SC): orange-brown, moist, fine sand, medium plastic fines				
5		S	1	19		medium dense				
	335									
10		D	2	36		**Very Old Alluvium Fan Deposits (Qvof):** LEAN CLAY (CL): hard, brown, moist, medium plastic fines, trace white caliche	17.5	114.4	DS, CN, PI	
	330									
15		S	3	17		SILT with SAND (ML): very stiff, yellow, moist, low plastic fines, fine sand, trace caliche			PI	
	325									
		B	1			LEAN CLAY (CL): yellowish-brown, moist, medium plastic fines, some fine sand	16.3		DS, CR, CP	
20		D	4	82		hard	18.6	103.9	DS, PI	
	320									
25		S	5	24		SANDY SILT (ML): dense, light brown, moist, low plastic fines, fine sand				
	315									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-019
PROJECT NO	370900.03.GE.FR			STATION (FT)	654+15.00
DATE STARTED	8/28/08	DATE FINISHED	8/28/08	OFFSET (FT)	140.45 RT
DRILLER	2R Drilling	LOGGED BY	J. Lee	GSE (FT)	341.80
GROUND WATER ELEV	299.8	GW DEPTH (FT)	42	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		D	6	73		LEAN CLAY with SAND (CL): hard, olive-brown, 81% medium plastic fines, 19% fine sand	23.9	102.6	PA, UW	
	310									
35		S	7	15		LEAN CLAY (CL): very stiff, brown, moist, medium plastic fines, some fine sand				
	305									
40		D	8	46		FAT CLAY (CH): hard, olive-brown, wet, high plastic fines, some fine sand	29.4	102.7	DS, PI	▼
	300									
45		S	9	33		SANDY SILT (ML): dense, brown, wet, low plastic fines, fine sand				
						Boring completed to a depth of 46.5 feet below ground surface (bgs). Groundwater encountered at 42 feet bgs. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

▼ GW WHILE DRILLING
▽ GW HRS.
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-020
PROJECT NO	370900.03.GE.FR			STATION (FT)	655+41.39
DATE STARTED	8/28/08	DATE FINISHED	8/28/08	OFFSET (FT)	162.71 RT
DRILLER	2R Drilling	LOGGED BY	J. Lee	GSE (FT)	339.01
GROUND WATER ELEV	301.5	GW DEPTH (FT)	37.5	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	335					**Artificial Fill (Af):** SILTY SAND (SM): brown to dark brown, moist, fine to medium sand, low plastic fines				
5		D	1	47		**Very Old Alluvium Fan Deposits (Qvof):** FAT CLAY (CH): hard, brown, moist, high plastic fines, some fine to medium sand	25.0	96.5	PI, DS	
	330									
10		S	2	32		olive-brown	27.9		PI, M	
	325									
15		D	3	50/4"		LEAN CLAY with SAND (CL): hard, reddish-brown, moist, medium plastic fines, thin sandy interlayers				
	320	B	1				10.3		DS, CR, CP	
20		S	4	66		SANDY LEAN CLAY (CL): hard, light olive-brown, moist, 54% medium plastic fines, 46% fine to medium sand			PA	
	315									
25		D	5	50/5"		LEAN CLAY (CL): hard, brown, moist, medium plastic fines, some fine to medium sand	10.7	118.3	UW	
	310									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-020
PROJECT NO	370900.03.GE.FR			STATION (FT)	655+41.39
DATE STARTED	8/28/08	DATE FINISHED	8/28/08	OFFSET (FT)	162.71 RT
DRILLER	2R Drilling	LOGGED BY	J. Lee	GSE (FT)	339.01
GROUND WATER ELEV	301.5	GW DEPTH (FT)	37.5	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	16		FAT CLAY (CH): very stiff, yellowish-brown to brown, moist, high plastic fines, some fine to medium sand			PI	
	305									
35		D	7	70/11"		SILTY CLAYEY SAND (SC-SM): very dense, yellowish-brown, wet, 63% fine sand, 37% low plastic fines	21.7	105.4	PA, UW	▼
	300									
40		S	8	16		LEAN CLAY (CL): very stiff, pale brown, wet, medium plastic fines, some fine sand				
	295									
45		D	9	66		hard, brown	21.7	105.4	UW	
	290									
50		S	10	30		SILTY CLAY (CL-ML): hard, pale brown, wet, low plastic fines, some sand				
						Boring completed to a depth of 51.5 feet below ground surface (bgs). Groundwater encountered at 37.5 feet bgs. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

▼ GW WHILE DRILLING
▽ GW HRS.
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-021
PROJECT NO	370900.03.GE.FR			STATION (FT)	664+80.57
DATE STARTED	7/10/08	DATE FINISHED	7/10/08	OFFSET (FT)	121.99 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	339.53
GROUND WATER ELEV	309.0	GW DEPTH (FT)	30.5	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		B	1			**Very Old Alluvium Fan Deposits (Qvof):** LEAN CLAY with SAND (CL): yellowish-brown, moist, 70% medium plastic fines, 28% fine sand, trace fine gravel	14.8		PA, CR, CP, PI	
5	335	D	1	50/5"		hard, 74% medium plastic fines, 25% fine to medium sand, trace fine gravel	12.6	114.5	PA, DS	
10	330	S	2	58		POORLY GRADED SAND with SILT (SP-SM): very dense, brown, moist, 92% fine sand, 8% low plastic fines			PA	
15	325	D	3	50/5"		olive-brown, 94% fine sand, 6% low plastic fines	3.3	96.5	PA, UW	
20	320	S	4	49		SANDY LEAN CLAY (CL): hard, brown, moist, medium plastic fines, fine sand				
25	315	D	5	62		CLAYEY SAND (SC): very dense, yellowish-brown, moist, 55% fine sand, 45% medium plastic fines	17.7	116.1	PA, PI, UW	
	310									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-021
PROJECT NO	370900.03.GE.FR			STATION (FT)	664+80.57
DATE STARTED	7/10/08	DATE FINISHED	7/10/08	OFFSET (FT)	121.99 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	339.53
GROUND WATER ELEV	309.0	GW DEPTH (FT)	30.5	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	13		very stiff, wet				▼
						Boring completed to a depth of 31.5 feet below ground surface (bgs). Groundwater encountered at 30 feet bgs. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				
	305									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- ▼ GW WHILE DRILLING
- ▽ GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-022
PROJECT NO	370900.03.GE.FR			STATION (FT)	669+31.10
DATE STARTED	7/10/08	DATE FINISHED	7/10/08	OFFSET (FT)	88.88 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	349.86
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		B	1			**Artificial Fill (Af):** CLAYEY SAND (SC): brown, moist, 52% fine to medium sand, 47% medium plastic fines, trace fine to coarse gravel	6.1		PA, CR, CP, R, PI	
5	345	D	1	70		very dense, 57% fine to medium sand, 43% medium plastic fines	13.6	121.8	PA, DS	
10	340	S	2	29		dense, 59% fine to medium sand, 40% medium plastic fines, trace fine gravel			PA	
15	335	D	3	50/6"		**Very Old Alluvial Fan Deposits (Qvof):** SILTY SAND (SM): very dense, brown, moist, 74% fine to medium sand, 26% low plastic fines	8.5	111.0	PA, UW	
20	330	S	4	19		SANDY LEAN CLAY (CL): very stiff, brown, moist, medium plastic fines, fine to medium sand	18.5		PI, M	
25	325	D	5	50/4"		SILTY SAND (SM): very dense, yellowish-brown, moist, fine to medium sand, low plastic fines	6.2	100.6	UW	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-022
PROJECT NO	370900.03.GE.FR			STATION (FT)	669+31.10
DATE STARTED	7/10/08	DATE FINISHED	7/10/08	OFFSET (FT)	88.88 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	349.86
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	35		SANDY LEAN CLAY (CL): hard, brown, moist, medium plastic fines, fine to medium sand	13.8		M	
						Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				
	315									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-023
PROJECT NO	370900.03.GE.FR			STATION (FT)	684+27.43
DATE STARTED	7/14/08	DATE FINISHED	7/14/08	OFFSET (FT)	76.45 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	390.34
GROUND WATER ELEV	315.3	GW DEPTH (FT)	75	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	390					**Artificial Fill (Af):**				
5	385	D	1	83		SANDY LEAN CLAY (CL): hard, olive, dry, 59% low plastic fines, 30% fine to coarse sand, 11% fine to coarse gravel			PA, PI	
10	380	S	2	21		SANDY CLAY (CL): hard, brown, dry to moist, medium plastic fines, fine to medium sand				
15	375	D	3	50/5"		SANDY SILT (ML): very dense, olive-gray, moist, non plastic to low plastic fines, fine to medium sand, trace gravel	10.1	116.3	UW	
20	370	S	4	27		CLAYEY SAND (SC): dense, olive-gray, 56% fine to coarse sand, 42% medium plastic fines, trace gravel			PA	
		B	1				13.6		PI, CR	
25	365	D	5	87		very dense, dark brown, mottling	11.7	119.0	PI, DS	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

GW WHILE DRILLING
GW HRS.
B BEDDING PLANE
J JOINTING
C CONTACT
F FAULT
S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-023
PROJECT NO	370900.03.GE.FR			STATION (FT)	684+27.43
DATE STARTED	7/14/08	DATE FINISHED	7/14/08	OFFSET (FT)	76.45 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	390.34
GROUND WATER ELEV	315.3	GW DEPTH (FT)	75	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	360	S	6	30		**Very Old Alluvium Fan Deposits (Qvof):** CLAYEY SAND (SC): dense, brown, moist, fine to medium sand, medium plastic fines, mottling				
35	355	D	7	31		SILTY CLAY with SAND (CL-ML): hard, grayish-brown, moist, low plastic fines, fine to medium sand	14.2	117.5	PI, UU	
40	350	S	8	31		brown				
45	345	D	9	50/6"		SILTY SAND (SM): very dense, yellowish-brown, moist, 67% fine to medium sand, 33% non plastic to low plastic fines	9.5	116.0	DS, PA	
50	340	S	10	91		POORLY GRADED SAND with SILT (SP-SM): very dense, brown, moist, 92% fine to medium sand, 7% non plastic to low plastic fines, trace fine gravel			PA	
55	335	D	11	75		LEAN CLAY (CL): hard, yellowish-brown, moist, medium plastic fines, some fine to medium sand	18.9	108.4	PI, UU	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-023
PROJECT NO	370900.03.GE.FR			STATION (FT)	684+27.43
DATE STARTED	7/14/08	DATE FINISHED	7/14/08	OFFSET (FT)	76.45 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	390.34
GROUND WATER ELEV	315.3	GW DEPTH (FT)	75	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	330	S	12	18		very stiff				
65	325	D	13	50/6"		hard, brown, trace gravel	22.5	106.2	DS	
70	320	S	14	33						
75	315	D	15	82		yellowish-brown, wet	18.1	112.3	PI, UU	▼
80	310	S	16	27						
						Boring completed to a depth of 81.5 feet below ground surface (bgs). Groundwater encountered at 75 feet bgs. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- ▼ GW WHILE DRILLING
- ▽ GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-024
PROJECT NO	370900.03.GE.FR			STATION (FT)	685+84.80
DATE STARTED	7/10/08	DATE FINISHED	7/10/08	OFFSET (FT)	69.05 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	394.35
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		B	1			**Artificial Fill (Af):** LEAN CLAY with SAND (CL): olive, moist, 74% medium plastic fines, 24% fine to coarse sand, trace fine gravel	13.0		PA, CP, CR, DS, EI, PI	
5	390	D	1	50/6"		SANDY LEAN CLAY (CL): hard, olive-brown, moist, 66% medium plastic fines, 30% fine to coarse sand, trace fine gravel	11.5	123.0	PA, DS	
10	385	S	2	26		CLAYEY SAND (SC): dense, olive-gray moist, 50% fine to coarse sand, 44% medium plastic fines, 6% fine gravel	10.1		PA, M	
15	380	D	3	94/11"		SILTY SAND (SM): very dense, dark olive-brown, moist, fine to medium sand, low plastic fines, with caliche	8.7	120.2	UW	
20	375	S	4	27		CLAYEY SAND (SC): dense, grayish-brown, moist, fine to medium sand, trace coarse sand, medium plastic fines	12.3		M	
25	370	D	5	90/9"		SANDY SILT (ML): very dense, light brown, moist, low plastic fines, fine to medium sand, with caliche	10.6	117.2	UW	
	365									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-024
PROJECT NO	370900.03.GE.FR			STATION (FT)	685+84.80
DATE STARTED	7/10/08	DATE FINISHED	7/10/08	OFFSET (FT)	69.05 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	394.35
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	35		CLAYEY SAND (SC): very dense, light gray, moist, 54% fine to coarse sand, 43% medium plastic fines, trace fine gravel	14.7		PA, M	
						Boring completed to a depth of 31.5 ft below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				
	360									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-025
PROJECT NO	370900.03.GE.FR			STATION (FT)	693+47.72
DATE STARTED	7/12/08	DATE FINISHED	7/12/08	OFFSET (FT)	68.65 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	413.10
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						5" Asphalt concrete layer over 9" base course layer				
						Artificial Fill (Af):				
	410									
5		D	1	78		LEAN CLAY with SAND (CL): hard, olive, moist, 78% medium plastic fines, 21% fine to coarse sand, trace fine gravel	14.8	118.2	PA, UW, PI	
	405									
10		S	2	15		very stiff				
	400									
15		D	3	62		LEAN CLAY (CL): hard, olive-gray, moist, medium plastic fines, some fine to medium sand	18.7	111.3	UW	
	395									
20		S	4	20		very stiff, olive-brown, trace gravel	15.4		PI, M	
	390	B	1				8.3		PI, CR	
25		D	5	51		hard, olive	18.2	109.0	PI, DS	
	385	B	2				16.1		PI, CR	

SAMPLE TYPES:

C ROCK CORE	B BULK SAMPLE	GW WHILE DRILLING	
S SPLIT SPOON	T TUBE SAMPLE	GW HRS.	C CONTACT
D DRIVE SAMPLE	P PITCHER TUBE	B BEDDING PLANE	F FAULT
		J JOINTING	S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-025
PROJECT NO	370900.03.GE.FR			STATION (FT)	693+47.72
DATE STARTED	7/12/08	DATE FINISHED	7/12/08	OFFSET (FT)	68.65 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	413.10
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	26		SANDY LEAN CLAY (CL): hard, dark brown, moist, medium plastic fines, fine sand				
	380									
35		D	7	65		LEAN CLAY (CL): hard, olive-brown, moist, silty sand interbeds, some mottling, medium plastic fines, fine sand	16.6	109.4	PI, UU	
	375									
40		S	8	15		very stiff, dark brown, mottling	18.2		M	
	370									
45		D	9	50/6"		**Very Old Alluvium Fan Deposits (Qvof):** WELL GRADED SAND with SILT and GRAVEL (SW-SM): very dense, gray, moist, 49% fine to coarse sand, 7% non-plastic fines, 44% fine gravel	2.0	123.9	PA, DS	
	365									
50		S	10	21		LEAN CLAY with SAND (CL): hard, moist, brown, medium plastic fines, fine sand				
	360									
55		D	11	36		SANDY LEAN CLAY (CL): hard, dark olive, moist, medium plastic fines, fine sand	11.1	118.6	PI, UU	
	355									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-025
PROJECT NO	370900.03.GE.FR			STATION (FT)	693+47.72
DATE STARTED	7/12/08	DATE FINISHED	7/12/08	OFFSET (FT)	68.65 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	413.10
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	12	8		stiff				
	350									
65		D	13	50/6"		hard, brown, 53% medium plastic fines, 44% fine to coarse sand, trace fine gravel	10.5	123.4	PA, DS	
	345									
70		S	14	22						
	340									
75		D	15	50/4"		dark brown, moist, medium plastic fines, fine sand	13.6	115.4	PI, UU	

Borehole terminated at depth of 77 feet below ground surface due to rig refusal.
No groundwater encountered.
Borehole backfilled with soil cuttings and cold patch asphalt at the surface.
Hammer efficiency = 78%

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-026
PROJECT NO	370900.03.GE.FR			STATION (FT)	695+00
DATE STARTED	9/2/08	DATE FINISHED	9/2/08	OFFSET (FT)	86.0 RT
DRILLER	2R Drilling	LOGGED BY	HMN	GSE (FT)	371.58
GROUND WATER ELEV	360.6	GW DEPTH (FT)	11	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	370					**Very Old Alluvium Fan Deposits (Qvof)**: CLAYEY SAND (SC): gray, moist, fine to coarse sand, medium plastic fines				
5		S	1	9		SANDY LEAN CLAY (CL): stiff, yellowish-brown, moist, 67% medium plastic fines, 31% fine to coarse sand and trace fine gravel				
	365	B	1				12.7		PA, CR, PI	
10		D	2	40		SILTY SAND with GRAVEL (SM): dense, light olive-brown, moist, 51% fine to coarse sand, 22% low plastic fines, 27% fine to coarse gravel				▼
	360									
15		S	3	92/11"		very dense, wet			PA	
	355									
20		D	4	62		LEAN CLAY (CL): hard, dark brown, wet, medium plastic fines, trace fine sand			PI	
	350									
25		S	5	28		SANDY LEAN CLAY (CL): hard, light olive-brown, wet, 55% medium plastic fines, 45% fine to coarse sand			PA	
	345									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- ▼ GW WHILE DRILLING
- ▽ GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-026
PROJECT NO	370900.03.GE.FR			STATION (FT)	695+00
DATE STARTED	9/2/08	DATE FINISHED	9/2/08	OFFSET (FT)	86.0 RT
DRILLER	2R Drilling	LOGGED BY	HMN	GSE (FT)	371.58
GROUND WATER ELEV	360.6	GW DEPTH (FT)	11	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	340	D	6	50/4"		LEAN CLAY (CL): hard, yellowish-brown, wet, medium plastic fines, some fine sand, trace fine gravel	13.1	122.4	PI, DS	
35	335	S	7	35						
40	330	D	8	45		CLAYEY SAND (SC): dense, yellowish-brown, wet, 54% fine sand, 42% medium plastic fines, trace fine gravel	16.9	111.8	PA, DS	
45	325	S	9	15		LEAN CLAY (CL): very stiff, light brown, wet, medium plastic fines, some fine sand				
50	320	D	10	36		hard, yellowish-brown	32.2	90.4	PI, UU	
55	315	S	11	14		LEAN CLAY with SAND (CL): very stiff, brown, wet, medium plastic fines, fine sand				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-026
PROJECT NO	370900.03.GE.FR			STATION (FT)	695+00
DATE STARTED	9/2/08	DATE FINISHED	9/2/08	OFFSET (FT)	86.0 RT
DRILLER	2R Drilling	LOGGED BY	HMN	GSE (FT)	371.58
GROUND WATER ELEV	360.6	GW DEPTH (FT)	11	DROP (IN)	30
TYPE OF DRILL RIG	CME 55	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	310	D	12	56/9"		LEAN CLAY (CL): hard, brown, wet, medium plastic fines, some fine sand	24.6	101.9	DS, CN	
65	305	S	13	64		POORLY GRADED SAND with SILT (SP-SM): very dense, yellowish-brown, wet, 89% medium to fine, 11% non plastic fines			PA	
70	300	D	14	50/4"		LEAN CLAY (CL): hard, brown, wet, medium plastic fines, trace fine to medium sand	20.0	109.6	UW	
75	295	S	15	25		LEAN CLAY with SAND (CL): hard, brown, wet, medium plastic fines, fine sand			PI	
80		D	16	96/11"		LEAN CLAY (CL): hard, light brown, wet, medium plastic fines	16.2	116.2	UW	
						Boring completed to a depth of 81.5 feet below ground surface (bgs). Goundwater measured at 11 feet bgs after completing drilling. Borehole backfilled with bentonite and soil cuttings mix. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-027
PROJECT NO	370900.03.GE.FR			STATION (FT)	701+06.37
DATE STARTED	7/17/08	DATE FINISHED	7/17/08	OFFSET (FT)	104.60 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	430.13
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						7" Asphalt concrete layer over 12" Base course layer				
		B	1			**Artificial Fill (Af):** SANDY LEAN CLAY (CL): pale olive, moist, 53% medium plastic fines, 39% fine to coarse sand, 8% fine to coarse gravel	10.7		PA, CP, EI, CR, DS, PI	
5	425	D	1	79		hard				
10	420	S	2	37		SILTY CLAYEY SAND (SC-SM): very dense, olive-brown, 51% fine to coarse sand, 43% low plastic fines, 6% fine gravel			PA	
15	415	D	3	50/6"		SANDY LEAN CLAY (CL): hard, dark brown, moist, 58% medium plastic fines, 42% fine to coarse sand	9.9	120.1	PA, DS, UW	
20	410	S	4	39		CLAYEY SAND with GRAVEL (SC): very dense, olive-brown, moist, 38% fine to medium sand, 42% medium plastic fines, 20% fine to coarse gravel			PI, PA	
25	405	D	5	50/6"		SANDY LEAN CLAY with GRAVEL (CL): hard, yellowish-brown, moist, medium plastic fines, fine sand, fine gravel	13.3	117.7	DS, UW	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-027
PROJECT NO	370900.03.GE.FR			STATION (FT)	701+06.37
DATE STARTED	7/17/08	DATE FINISHED	7/17/08	OFFSET (FT)	104.60 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	430.13
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	32						
						Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings and cold patch asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-028
PROJECT NO	370900.03.GE.FR			STATION (FT)	702+92.60
DATE STARTED	7/17/08	DATE FINISHED	7/17/08	OFFSET (FT)	148.74 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	429.69
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		B	1			**Artificial Fill (Af):** SANDY LEAN CLAY with GRAVEL (CL): olive, moist, 61% medium plastic fines, 23% fine to coarse sand, 16% fine to coarse gravel	8.7		PA, CP, DS, CR, R, PI	
5	425	D	1	78		LEAN CLAY with SAND (CL): hard, olive, moist, 75% medium plastic fines, 24% fine to coarse sand, trace fine gravel			PA	
10	420	S	2	33		SANDY LEAN CLAY (CL): hard, olive, moist, 64% medium plastic fines, 36% fine to medium sand			PI, PA	
15	415	D	3	50/5"		CLAYEY SAND (SC): very dense, grayish-brown, moist, 50% fine to coarse sand, 48% medium plastic fines, trace fine gravel	12.3	116.4	PA, DS, UW	
20	410	S	4	44		pale olive, moist, 41% fine to coarse sand, 45% medium plastic fines, 14% fine to coarse gravel			PI, PA	
25	405	D	5	91/11"		LEAN CLAY (CL): hard, brown, moist, medium plastic fines, some fine to medium sand	14.3	115.3	UW	
	400					CLAYEY SAND (SC): very dense, brown, moist, fine to medium sand, medium plastic fines				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-028
PROJECT NO	370900.03.GE.FR			STATION (FT)	702+92.60
DATE STARTED	7/17/08	DATE FINISHED	7/17/08	OFFSET (FT)	148.74 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	429.69
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	42						
						Boring completed to a depth of 31.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				
	395									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-029
PROJECT NO	370900.03.GE.FR			STATION (FT)	708+36.43
DATE STARTED	8/27/08	DATE FINISHED	8/27/08	OFFSET (FT)	113.60 RT
DRILLER	2R Drilling	LOGGED BY	J. Lee	GSE (FT)	447.13
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
	445					**Artificial Fill (Af):** SILTY SAND (SM): brown, slightly moist, fine to coarse grained				
5		S	1	24		dense				
	440									
10		D	2	45		SILTY SAND to CLAYEY SAND (SM/SC): dense, brown to gray, moist, fine to coarse grained				
	435									
15		S	3	16		SILTY SAND (SM): medium dense, brown, moist, fine to medium grained, trace of clay				
	430									
20		D	4	28		CLAYEY SAND (SC): dense, grayish-brown, very moist, fine to medium grained				
	425	B	1							
25		S	5	25		**Very Old Alluvium Fan Deposits (Qvof):** SILTY CLAY (CL-ML): hard, gray, very moist, CLAYEY SAND interlayer, medium dense, reddish brown, fine to medium grained				
	420									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-029
PROJECT NO	370900.03.GE.FR			STATION (FT)	708+36.43
DATE STARTED	8/27/08	DATE FINISHED	8/27/08	OFFSET (FT)	113.60 RT
DRILLER	2R Drilling	LOGGED BY	J. Lee	GSE (FT)	447.13
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		D	6	23		FAT CLAY (CH): hard, dark brown, moist, thin caliche				
	415									
35						very stiff				
		S	7	11						
	410									
		B	2							
40						SILTY CLAY (CL-ML): very stiff, brown, moist, trace of caliche				
		D	8	19						
	405									
45						medium stiff, brown, moist, SILTY SAND interlayer				
		S	9	6						
	400									
50						POORLY GRADED SAND with SILT (SP-SM): medium dense, orange brown, slightly moist, fine grained				
		D	10	26						
	395									
55						SILTY CLAY (CL-ML): very stiff, dark brown, moist				
		S	11	11						
	390									

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-029
PROJECT NO	370900.03.GE.FR			STATION (FT)	708+36.43
DATE STARTED	8/27/08	DATE FINISHED	8/27/08	OFFSET (FT)	113.60 RT
DRILLER	2R Drilling	LOGGED BY	J. Lee	GSE (FT)	447.13
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		D	12	50/5"		hard				1.5' boulder or cobble layer
	385									
65		S	13	18		SILTY CLAY to SAND CLAY (CL): very stiff, dark brown, moist				
	380									
70		D	14	70		SANDY CLAY (CL): hard, dark brown, moist, trace of gravel				
	375									
75		S	15	29		SILTY CLAY (CL): hard, brown, moist, cobble interlayer				
	370									
80		D	16	50/6"						
						Boring completed to a depth of 81.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings. Hammer efficiency = 78%				

SAMPLE TYPES:

C	ROCK CORE	B	BULK SAMPLE	GW WHILE DRILLING	
S	SPLIT SPOON	T	TUBE SAMPLE	GW HRS.	C CONTACT
D	DRIVE SAMPLE	P	PITCHER TUBE	B BEDDING PLANE	F FAULT
				J JOINTING	S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-030
PROJECT NO	370900.03.GE.FR			STATION (FT)	600+90.20
DATE STARTED	7/16/08	DATE FINISHED	7/16/08	OFFSET (FT)	67.56 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	295.01
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
						5" Asphalt concrete layer, 9" Base				
						Very Old Alluvium Fan Deposits (Qvof): FAT CLAY with SAND (CH): hard, yellowish-brown, moist, fine to coarse sand				
5	290	D	1	80					PI	
						SILTY SAND with GRAVEL (SM): very dense, yellowish-brown, moist, fine to coarse sand, rounded to subangular gravel up to 1/2" size				
10	285	S	2	50/4"						
15	280	D	3	50/3"		CLAYEY SAND (SC): very dense, brown, moist, fine to medium sand, medium plastic fines	14.9	116.1	DS	
20	275	S	4	36		grades with 42% fines			PA	
		B	1							
25	270	D	5	50/5"			11.1	110.7	UW	
		B	2			SANDY LEAN CLAY (CL): hard, light olive-brown, moist, trace fine gravel, 43% sand	5.9		PA, EI, CR	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-030
PROJECT NO	370900.03.GE.FR			STATION (FT)	600+90.20
DATE STARTED	7/16/08	DATE FINISHED	7/16/08	OFFSET (FT)	67.56 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	295.01
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	6	33		SANDY LEAN CLAY (CL): hard, brown, moist, low plastic fines, fine sand			PI	
35	260	D	7	50/5"		LEAN CLAY with SAND (CL): hard, yellowish-brown, moist, medium plastic fines, 15% fine sand	21.0	99.6	PA, PI, UU	
40	255	S	8	46		SANDY LEAN CLAY (CL): hard, brown, moist, 70% medium plastic fines, 30% fine to medium sand			PA, PI	
45	250	D	9	50/5"		yellowish-brown	16.6	106.1	DS, UW	
50	245	S	10	27						
55	240	D	11	50/4"		LEAN CLAY with SAND (CL): hard, brown, moist, 85% medium plastic fines, 15% fine sand	18.6	111.0	PA, DS	

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

GEOTECHNICAL BORING LOG

PROJECT NAME	SR-57 Northbound Widening			BORING DESIG.	A-08-030
PROJECT NO	370900.03.GE.FR			STATION (FT)	600+90.20
DATE STARTED	7/16/08	DATE FINISHED	7/16/08	OFFSET (FT)	67.56 RT
DRILLER	2R Drilling	LOGGED BY	RB	GSE (FT)	295.01
GROUND WATER ELEV	0.0	GW DEPTH (FT)	NE	DROP (IN)	30
TYPE OF DRILL RIG	CME 75 Limited Access Rig	DRIVE WT (LBS)	140- lb. Auto Hammer		

DEPTH (FEET)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT OR REC/RQD	GRAPHIC LOG	SOIL DESCRIPTION	MOISTURE CONTENT%	γ_d (PCF)	LAB TESTS	COMMENTS
		S	12	60		SANDY LEAN CLAY (CL): hard, olive-brown, moist, 57% medium plastic fines, 41% fine to coarse sand, trace gravel			PA	
						Boring completed to a depth of 61.5 feet below ground surface. No groundwater encountered. Borehole backfilled with soil cuttings and cold patch asphalt at the surface. Hammer efficiency = 78%				

SAMPLE TYPES:

- C ROCK CORE
- S SPLIT SPOON
- D DRIVE SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- P PITCHER TUBE

- GW WHILE DRILLING
- GW HRS.
- B BEDDING PLANE
- J JOINTING
- C CONTACT
- F FAULT
- S SHEAR

CH2MHILL

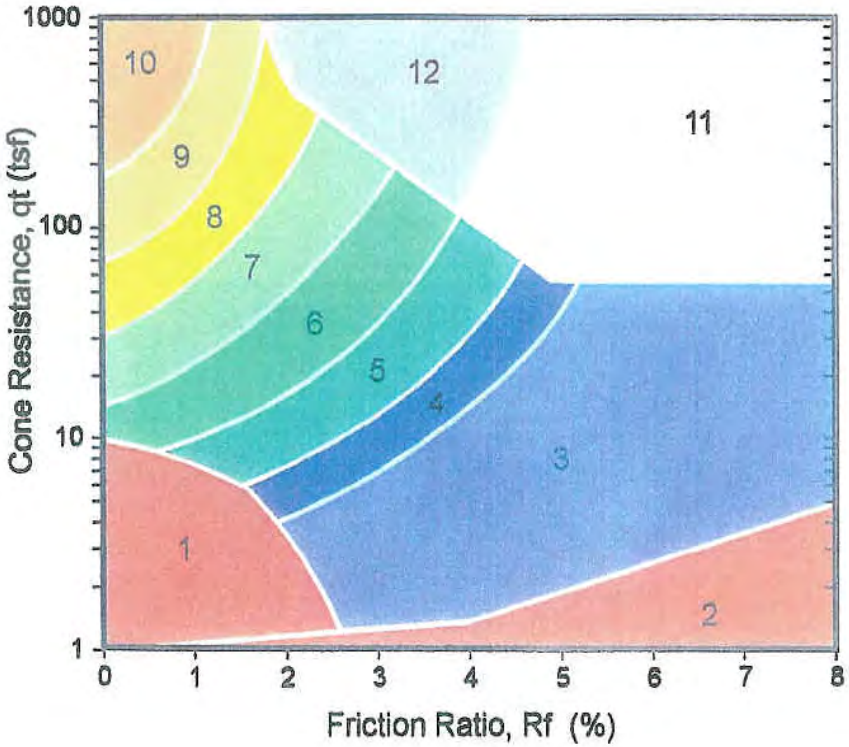
APPENDIX C.2

Cone Penetration Test Soundings

KEHOE TESTING & ENGINEERING

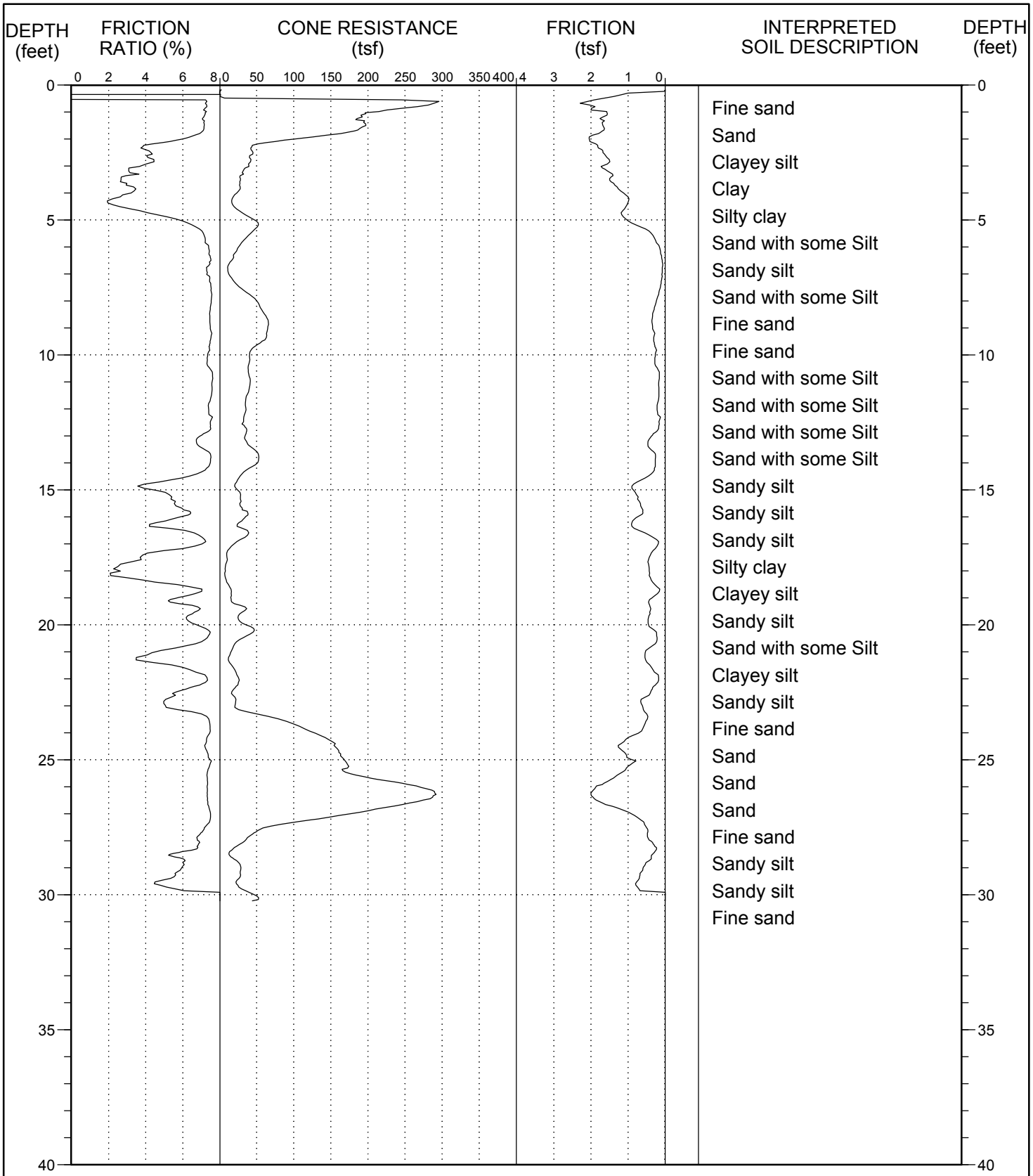
CPT Classification Chart

(after Robertson and Campanella, 1988)



Zone	q_t / N	Soil Behavior Type	UCSCS
1	2	sensitive fine grained	OL-OH
2	1	organic material	Pt-OH
3	1	clay	CH
4	1.5	silty clay to clay	CL-CH
5	2	clayey silt to silty clay	ML-CL
6	2.5	sandy silt to clayey silt	MH-ML
7	3	silty sand to sandy silt	SM-ML
8	4	sand to silty sand	SP-SM
9	5	sand	SP
10	6	gravelly sand to sand	SW-SP
11	1	very stiff fine grained *	CL-MH
12	2	sand to clayey sand *	SP-SC

* overconsolidated or cemented

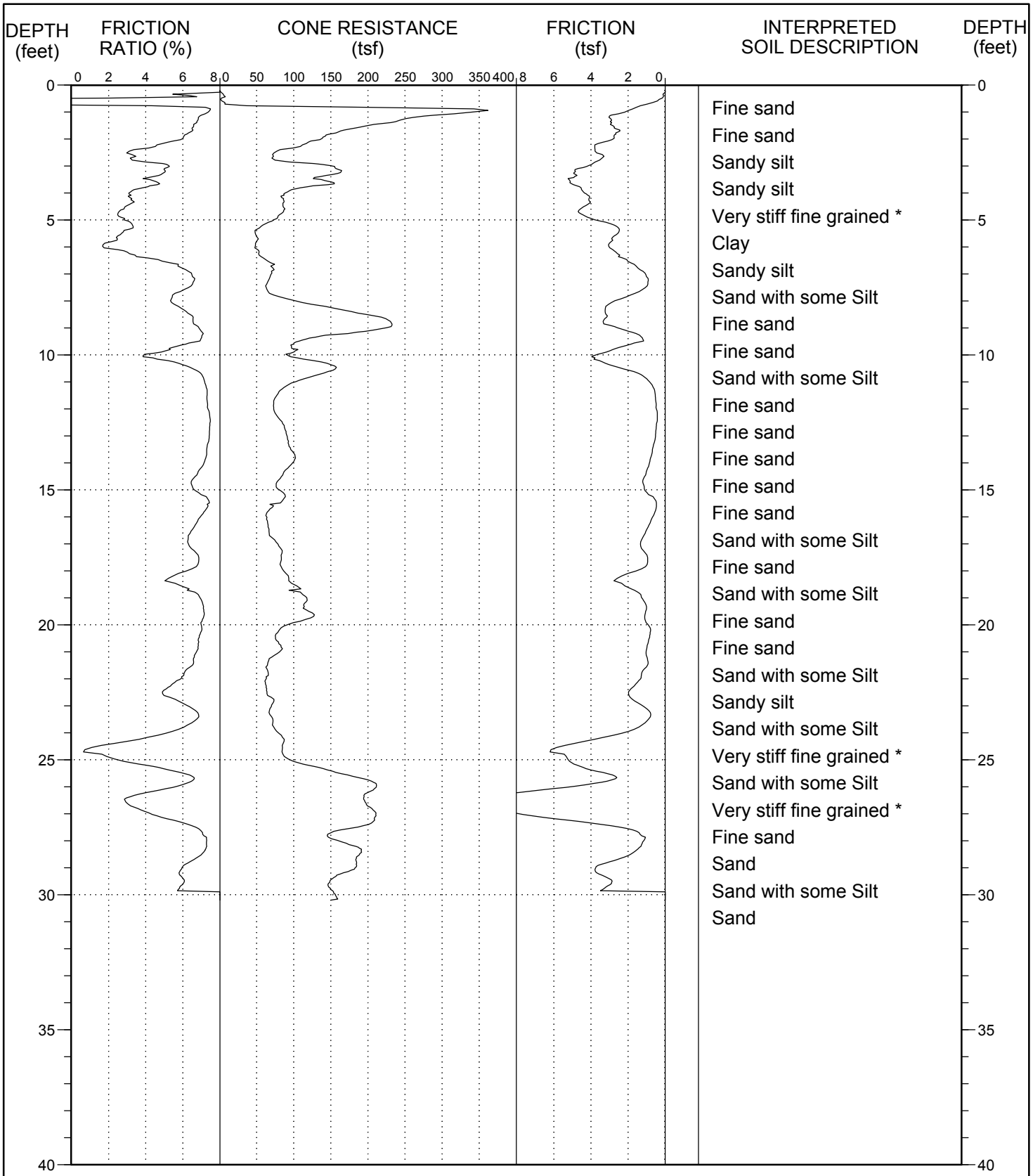


CH2MHILL

LOG OF CPT NO. CPT-08-01

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	281.7'	581+09.55	126.85 Lt	6/26/2008

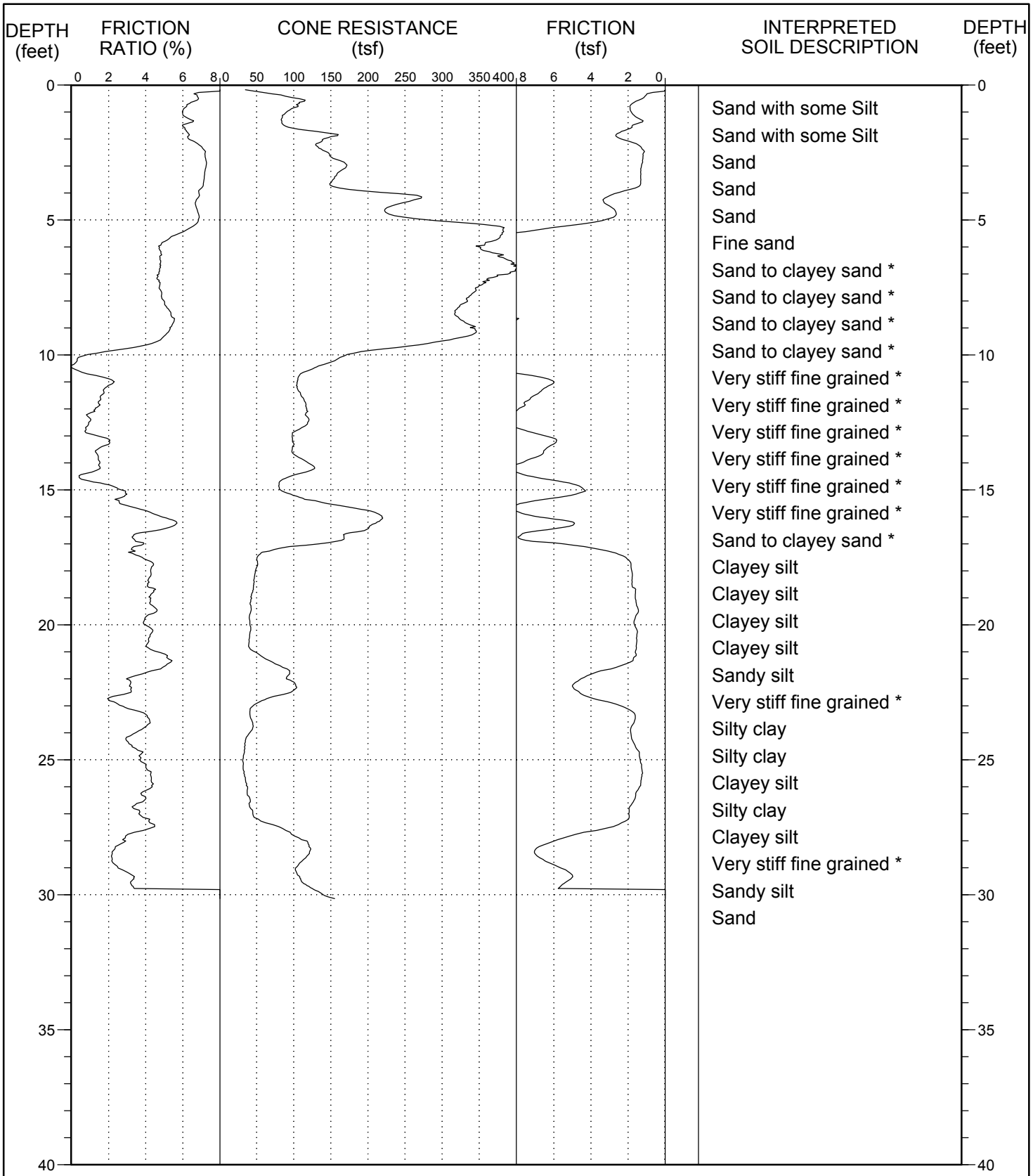


CH2MHILL

LOG OF CPT NO. CPT-08-02

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	284.65'	585+99.60	85.14 Lt	6/26/2008

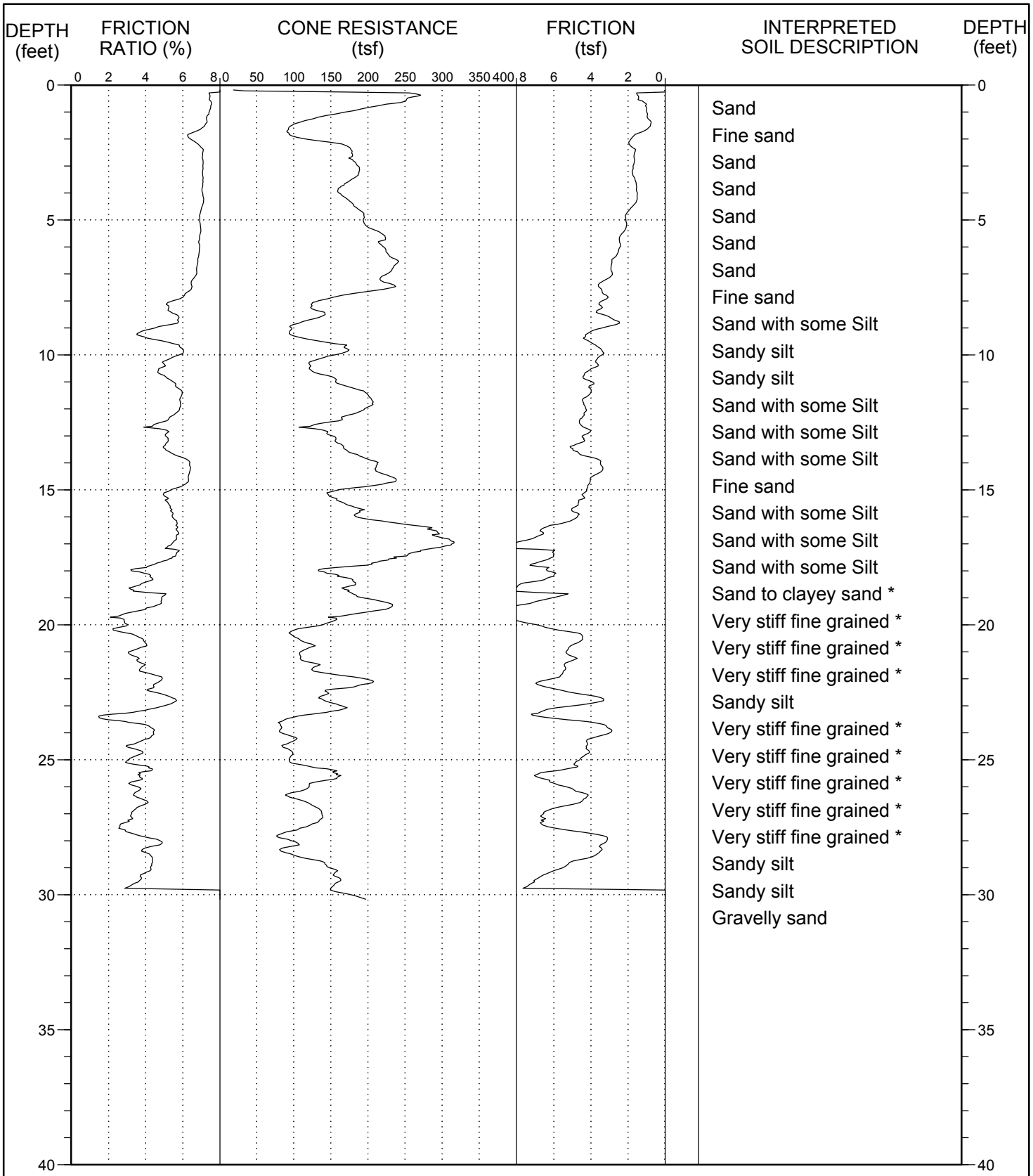


CH2MHILL

LOG OF CPT NO. CPT-08-03

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	290.94'	591+63.91	89.22 Lt	6/26/2008

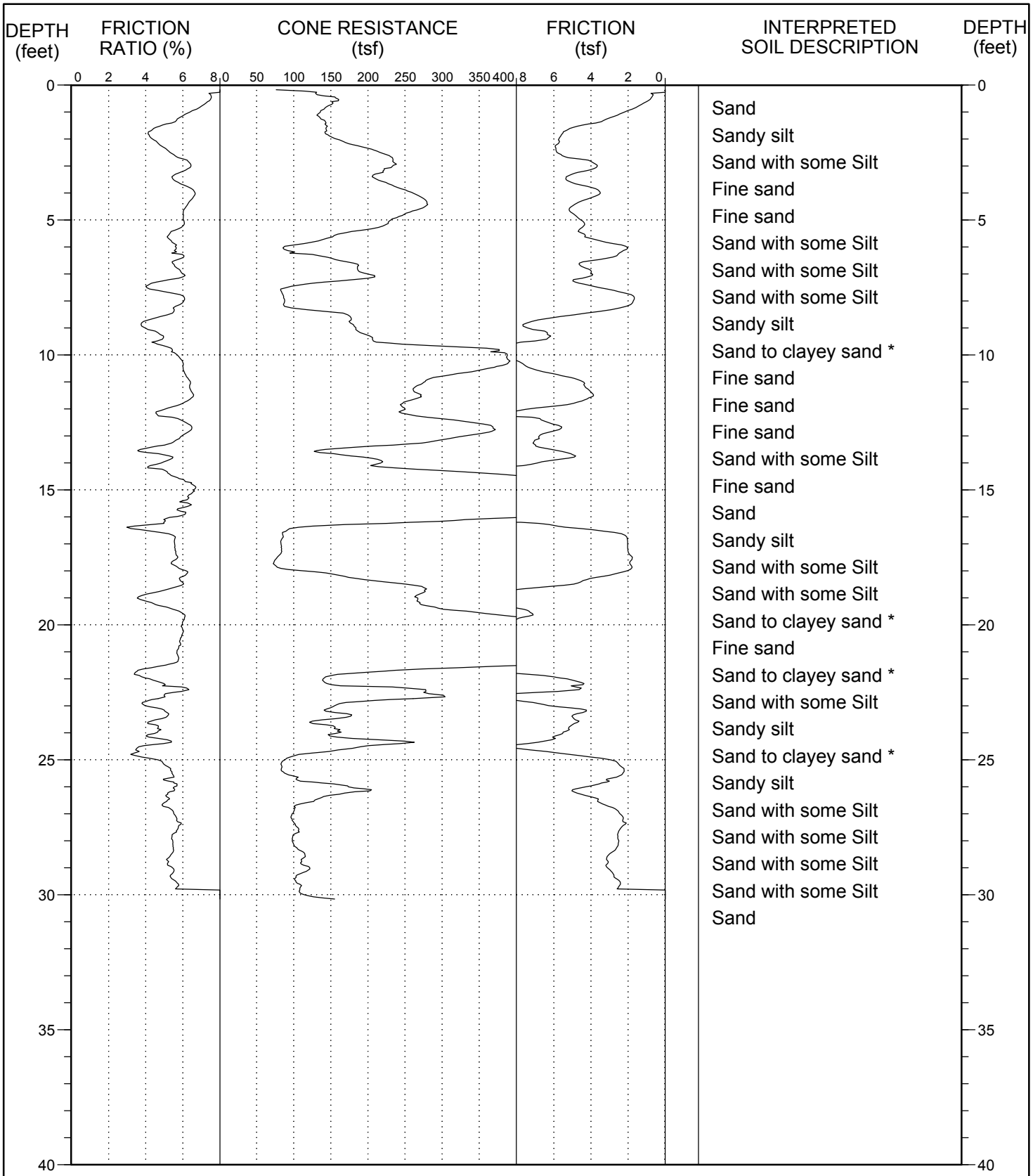


CH2MHILL

LOG OF CPT NO. CPT-08-04

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	291.56'	596+60.81	69.79 Rt	1/7/2008

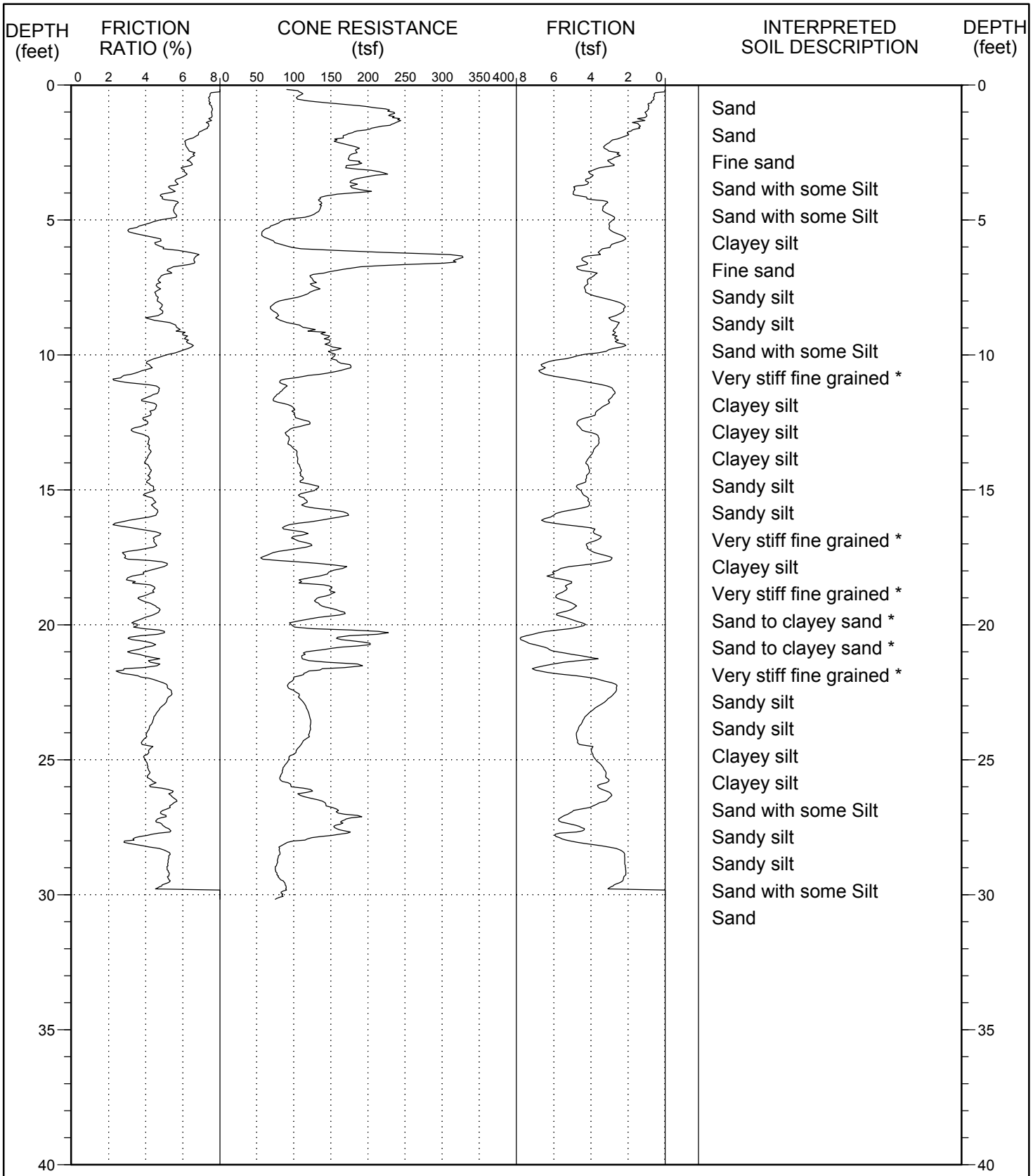


CH2MHILL

LOG OF CPT NO. CPT-08-05

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	295.15'	600+41.02	100.47 Lt	6/26/2008

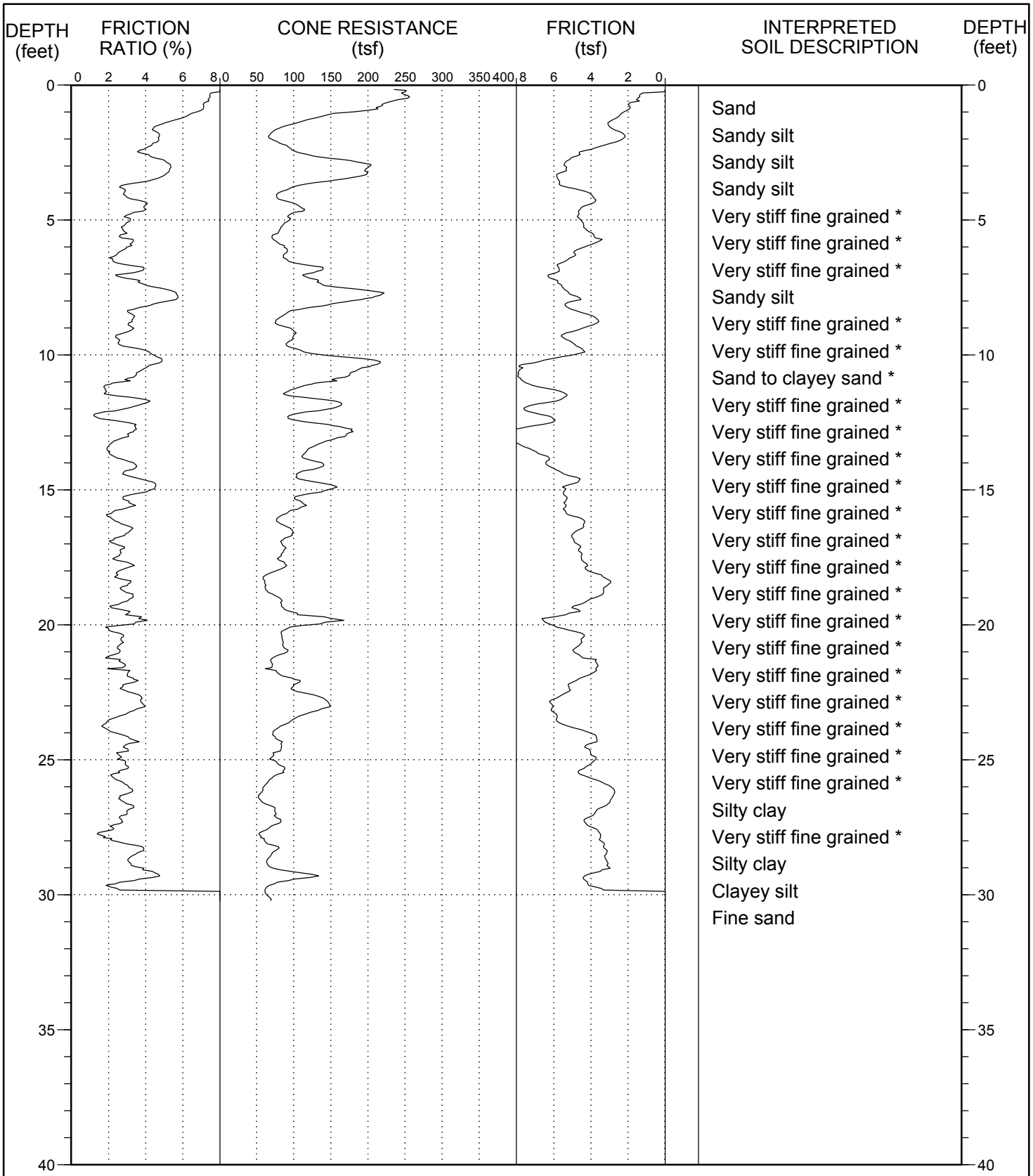


CH2MHILL

LOG OF CPT NO. CPT-08-06

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	296.14'	603+75.01	82.56 Lt	6/30/2008

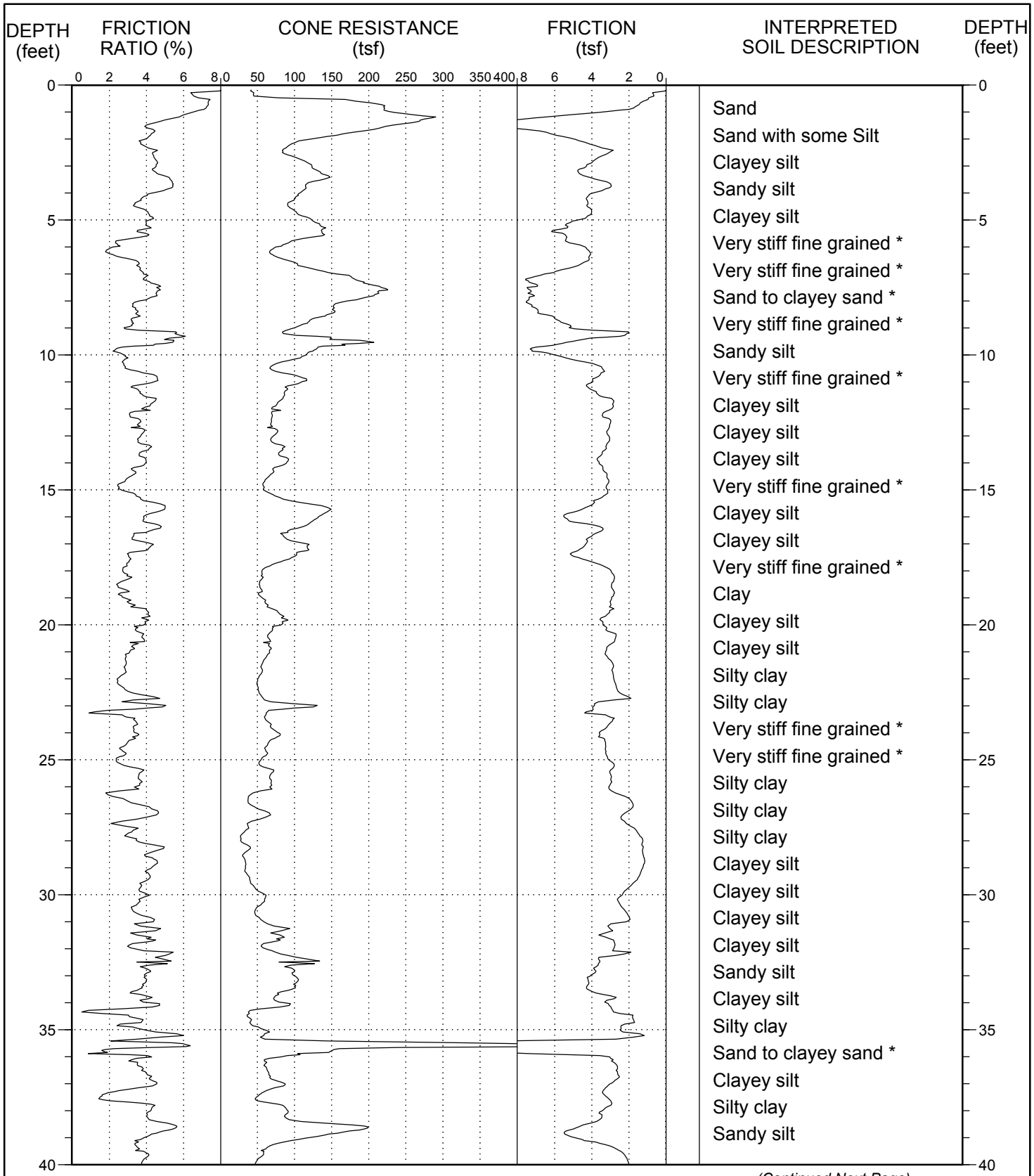


CH2MHILL

LOG OF CPT NO. CPT-08-07

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	313.71'	614+14.17	69.90 Lt	6/30/2008



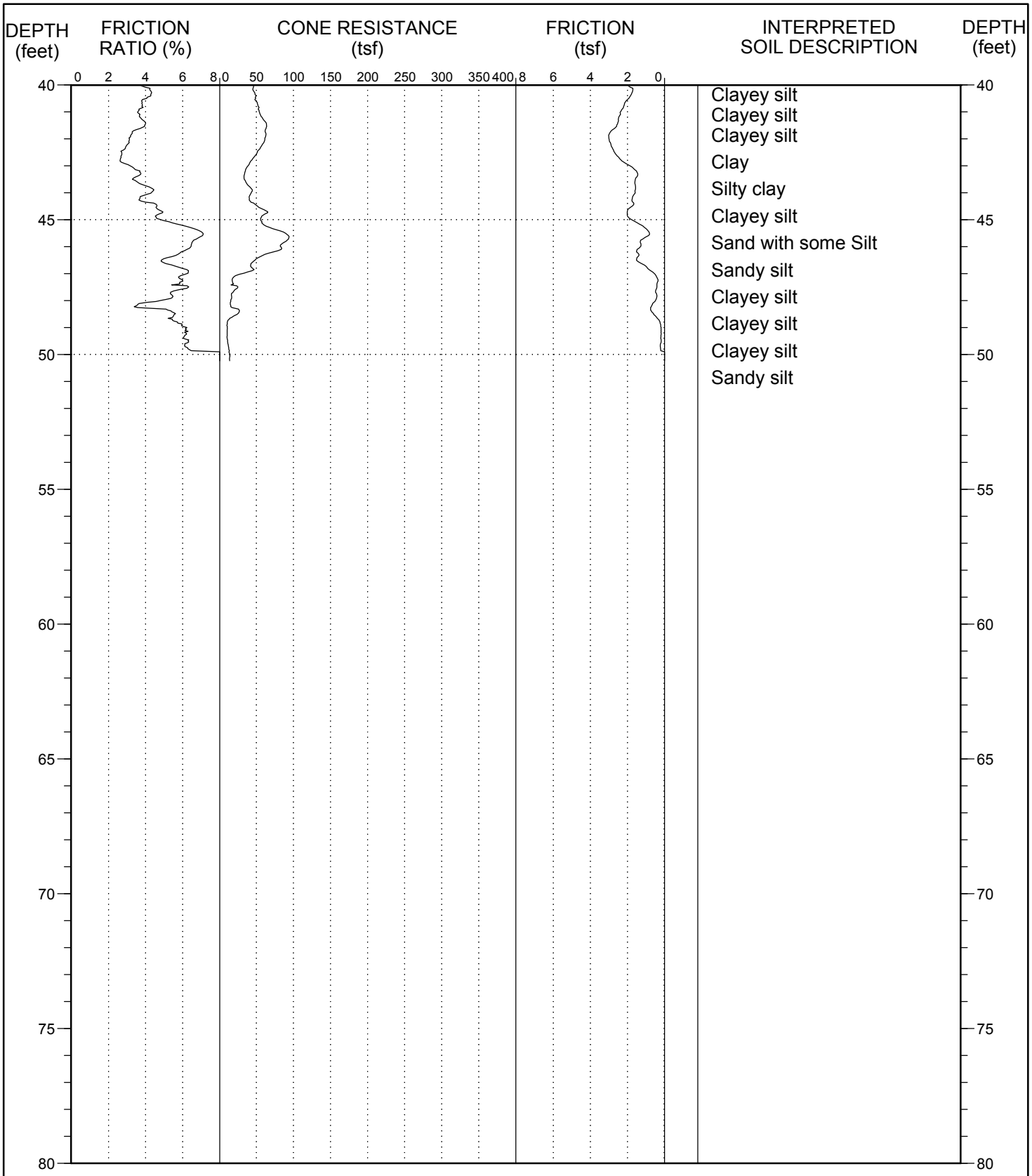
(Continued Next Page)

CH2MHILL

LOG OF CPT NO. CPT-08-08

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	319.27'	617+42.99	68.07 Rt	1/7/2008

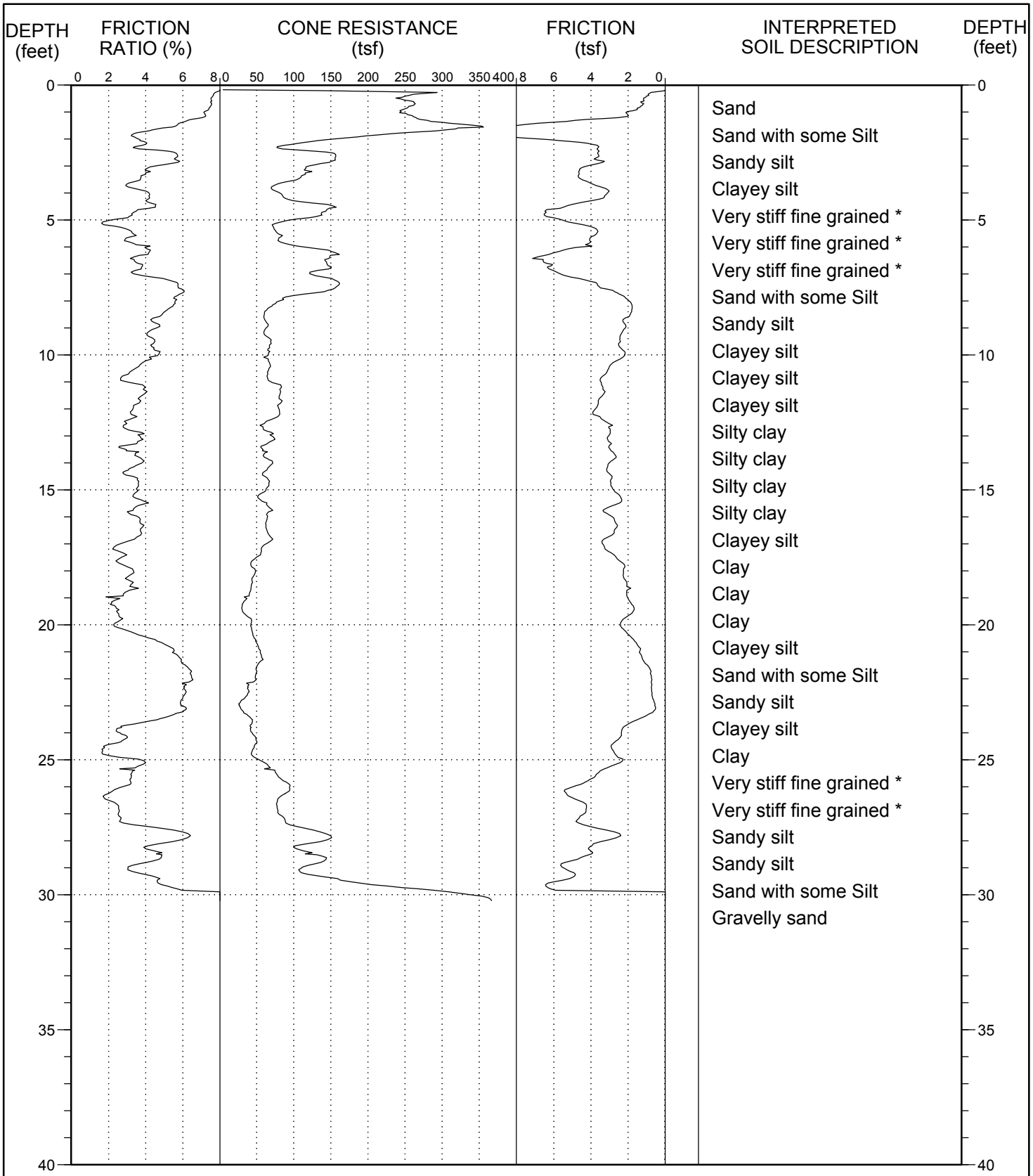


CH2MHILL

LOG OF CPT NO. CPT-08-08

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	319.27'	617+42.99	68.07 Rt	1/7/2008

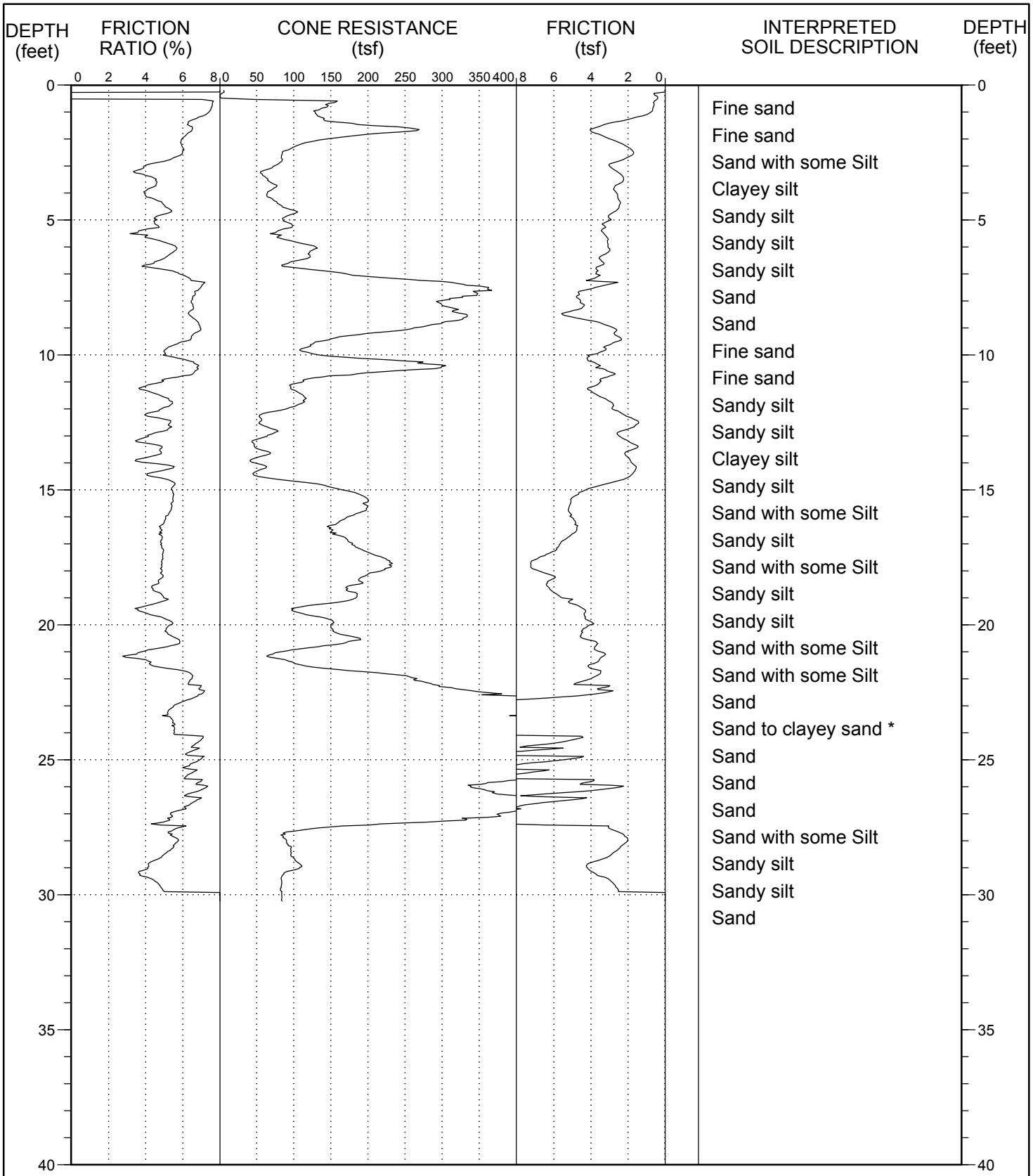


CH2MHILL

LOG OF CPT NO. CPT-08-09

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	325.55'	618+08.98	70.54 Lt	6/30/2008

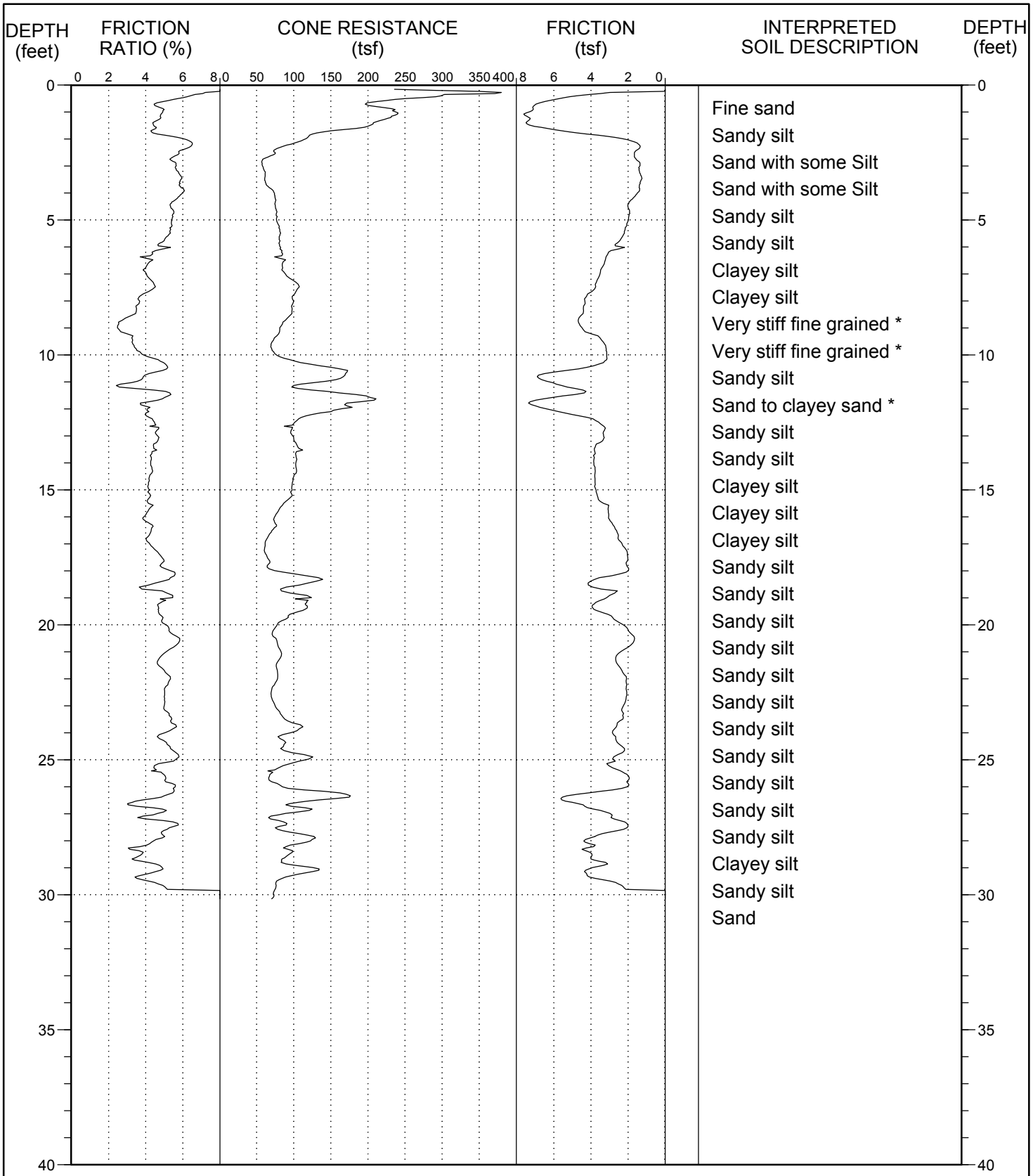


CH2MHILL

LOG OF CPT NO. CPT-08-10

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	332.56'	621+48.22	68.59 Rt	1/7/2008

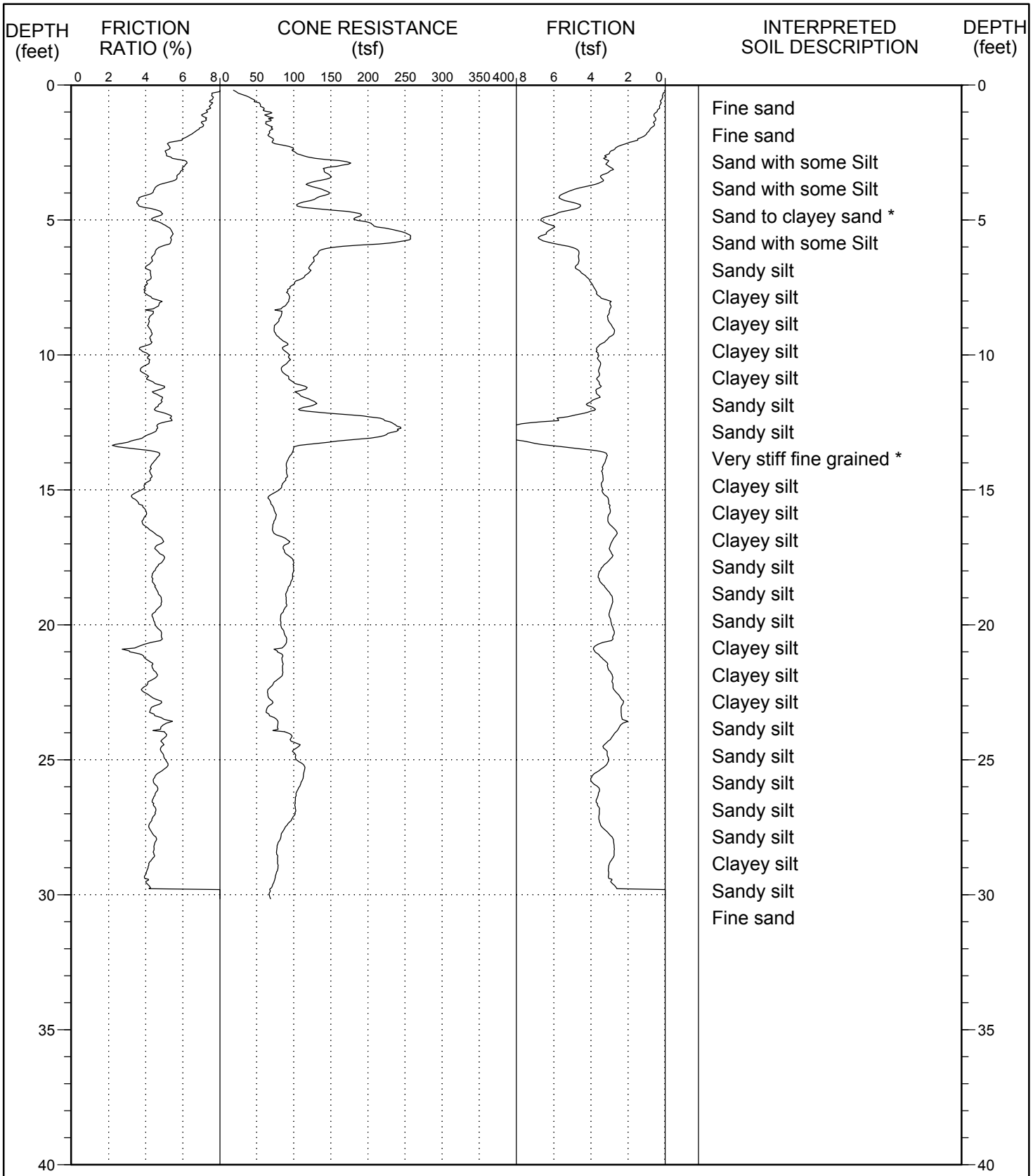


CH2MHILL

LOG OF CPT NO. CPT-08-11

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	339.7'	625+02.69	68.52 Lt	6/30/2008

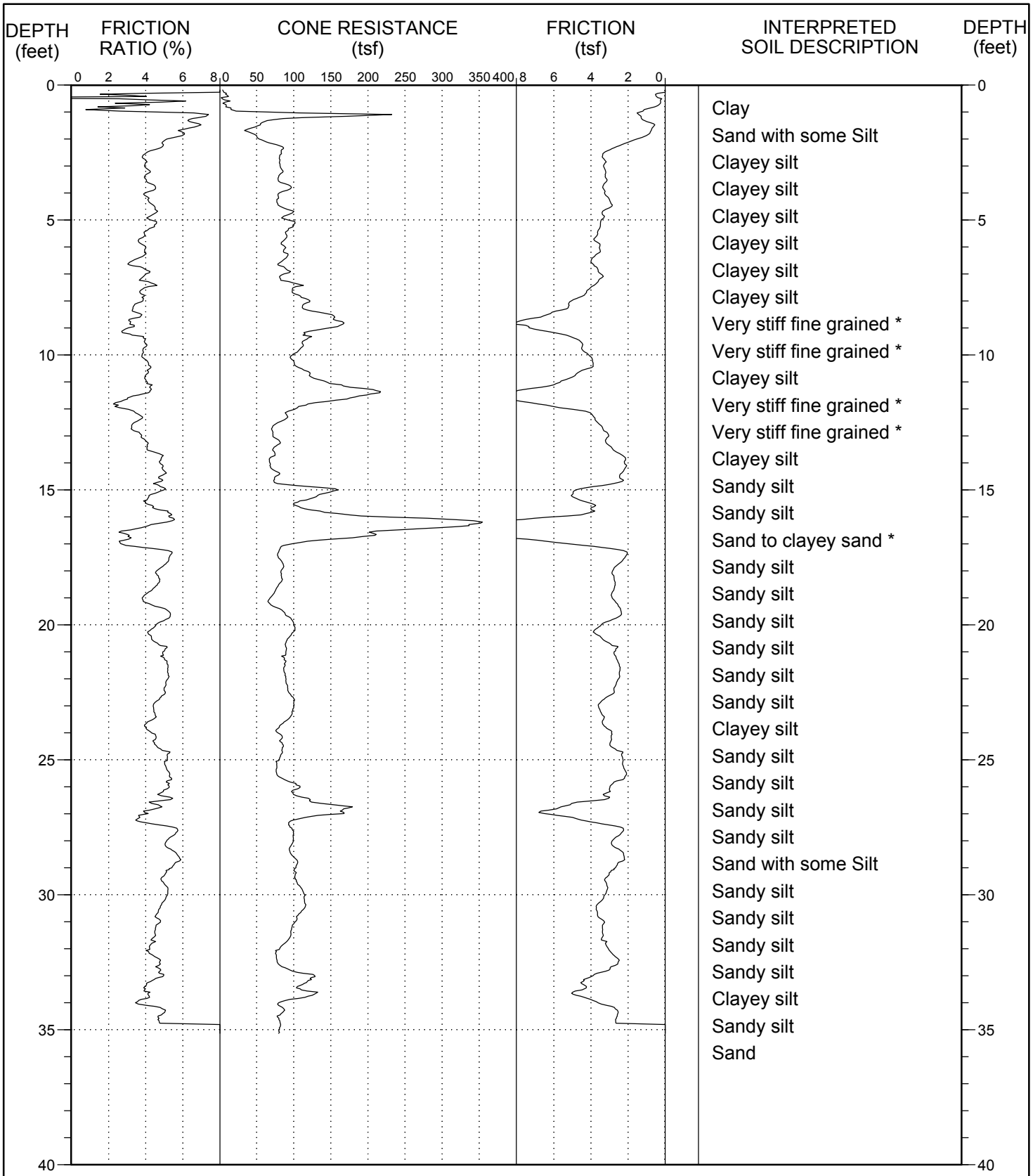


CH2MHILL

LOG OF CPT NO. CPT-08-12

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	342.13'	628+92.64	70.39 Lt	8/7/2008

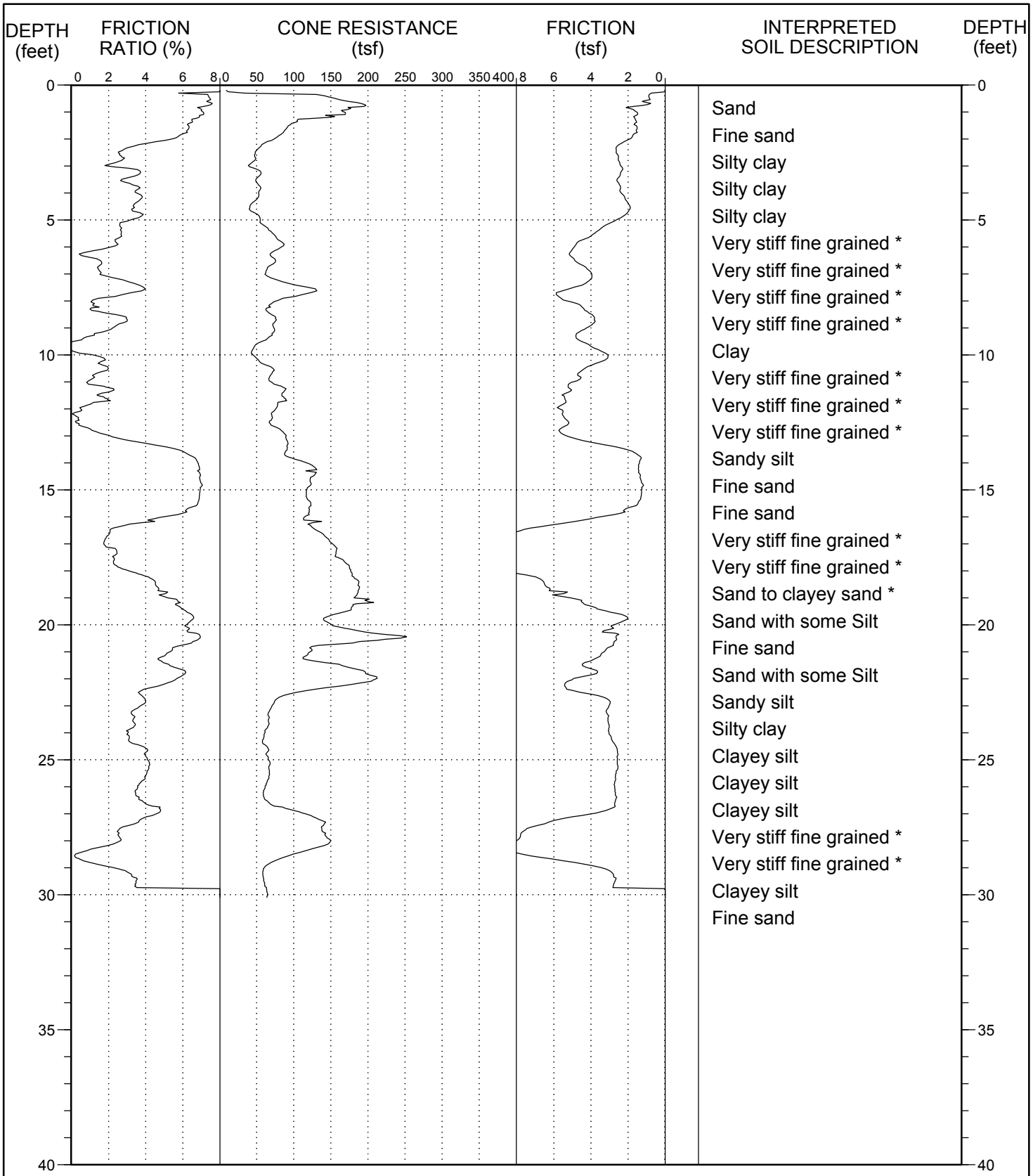


CH2MHILL

LOG OF CPT NO. CPT-08-13

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	346.86'	631+20.11	69.87 Rt	1/7/2008

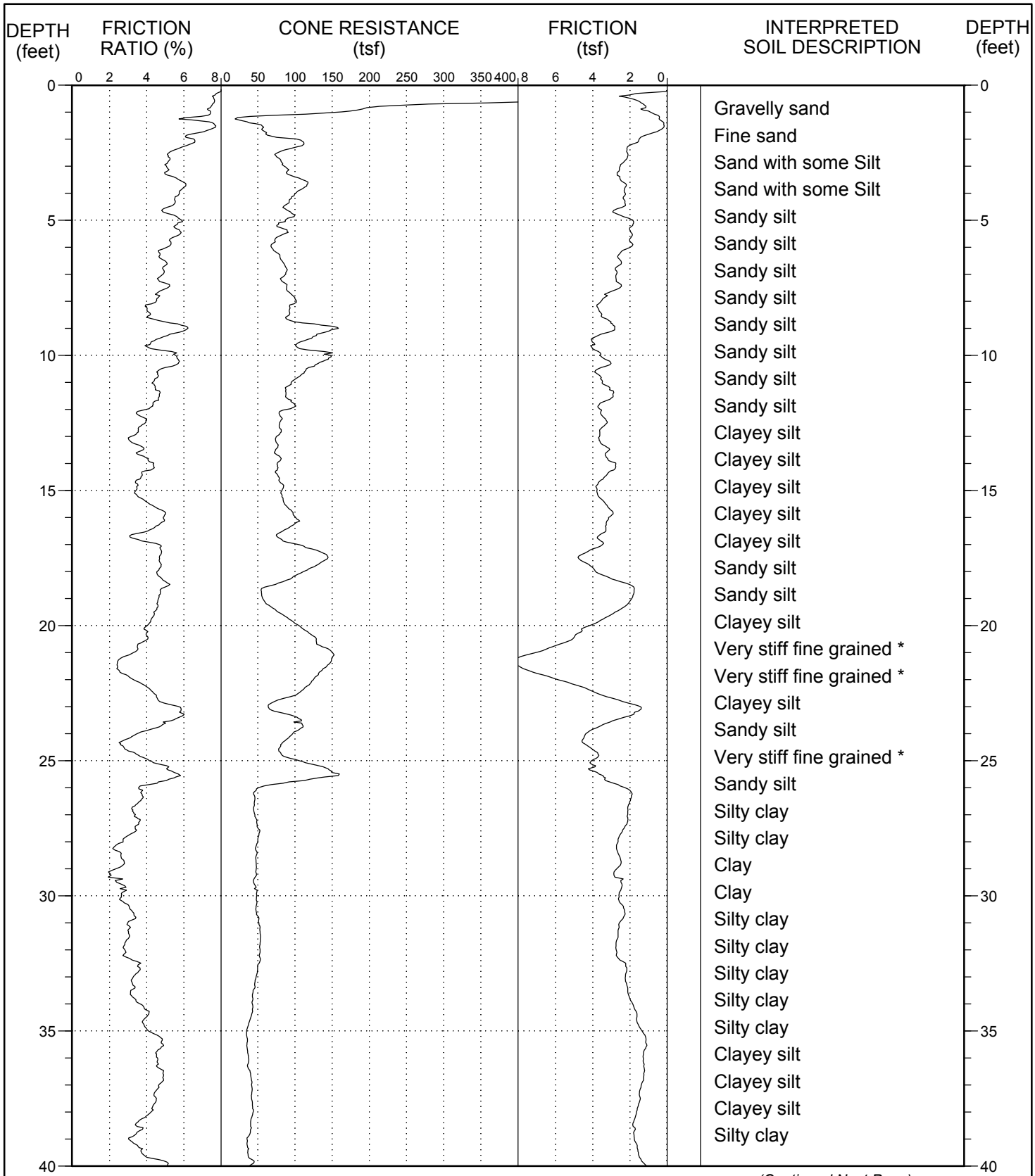


CH2MHILL

LOG OF CPT NO. CPT-08-14

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	329.63'	636+94.33	75.21 Lt	8/7/2008



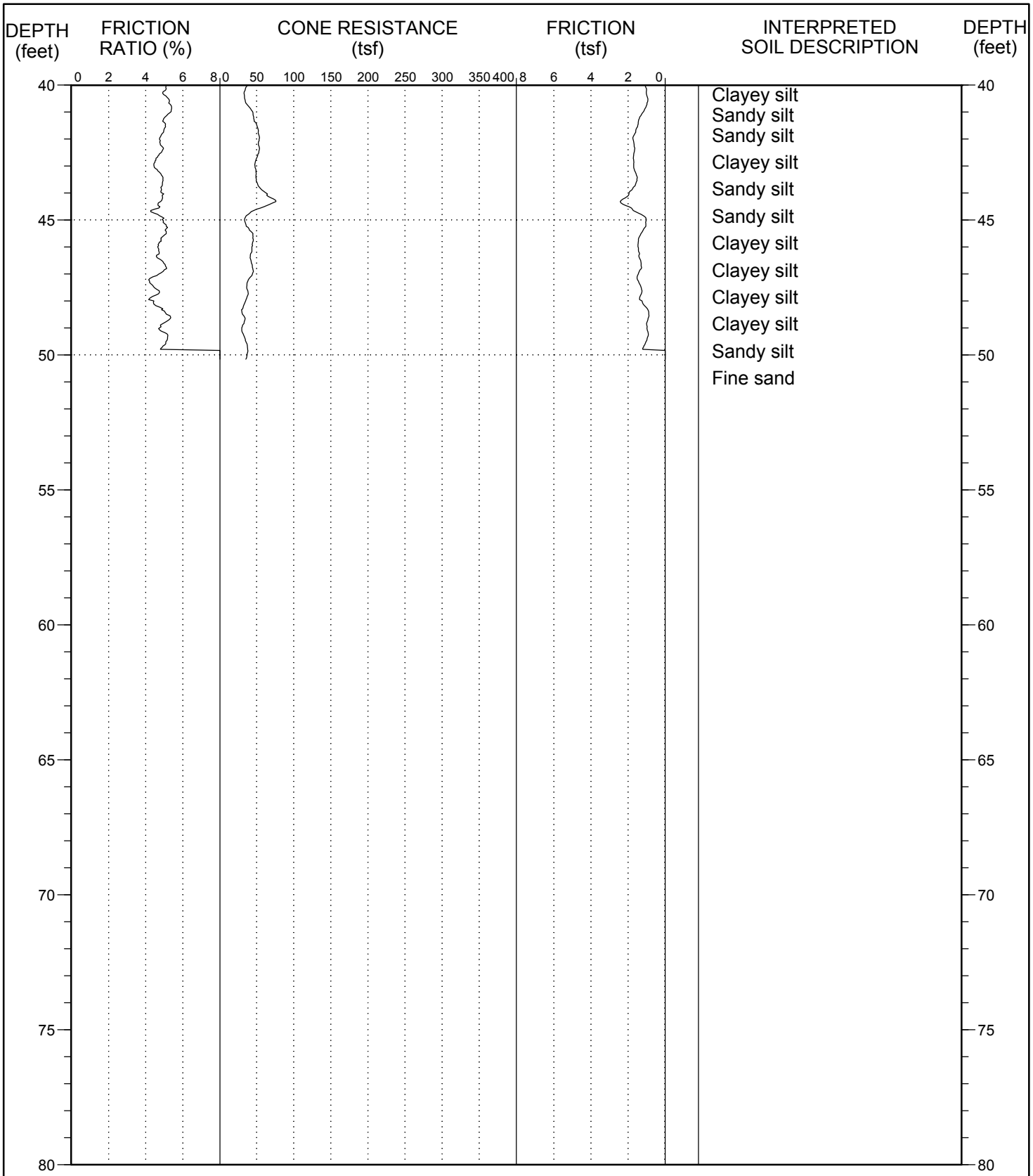
(Continued Next Page)

CH2MHILL

LOG OF CPT NO. CPT-08-15

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	334.81'	637+11.12	76.21 Rt	7/7/2008

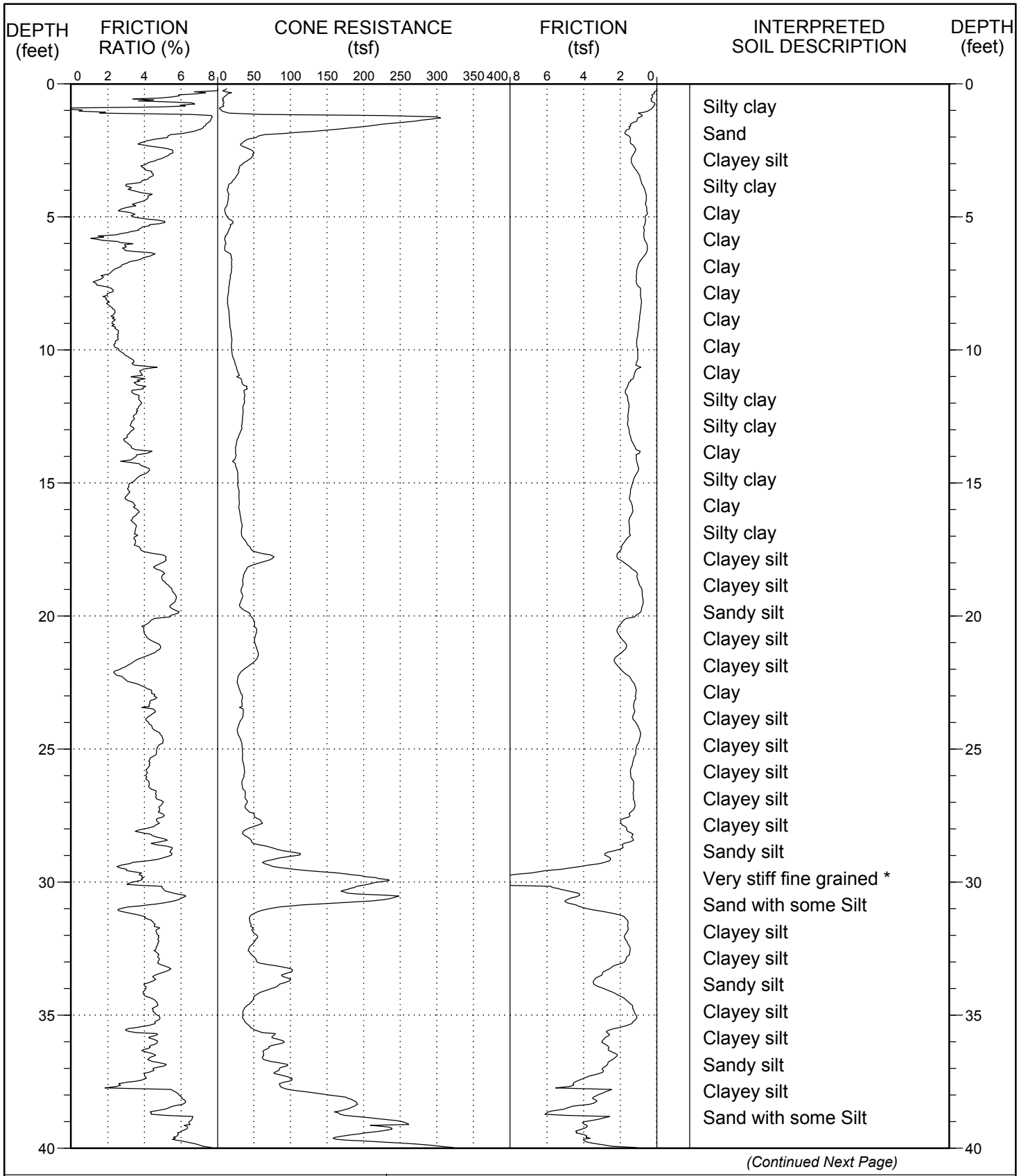


CH2MHILL

LOG OF CPT NO. CPT-08-15

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	334.81'	637+11.12	76.21 Rt	7/7/2008



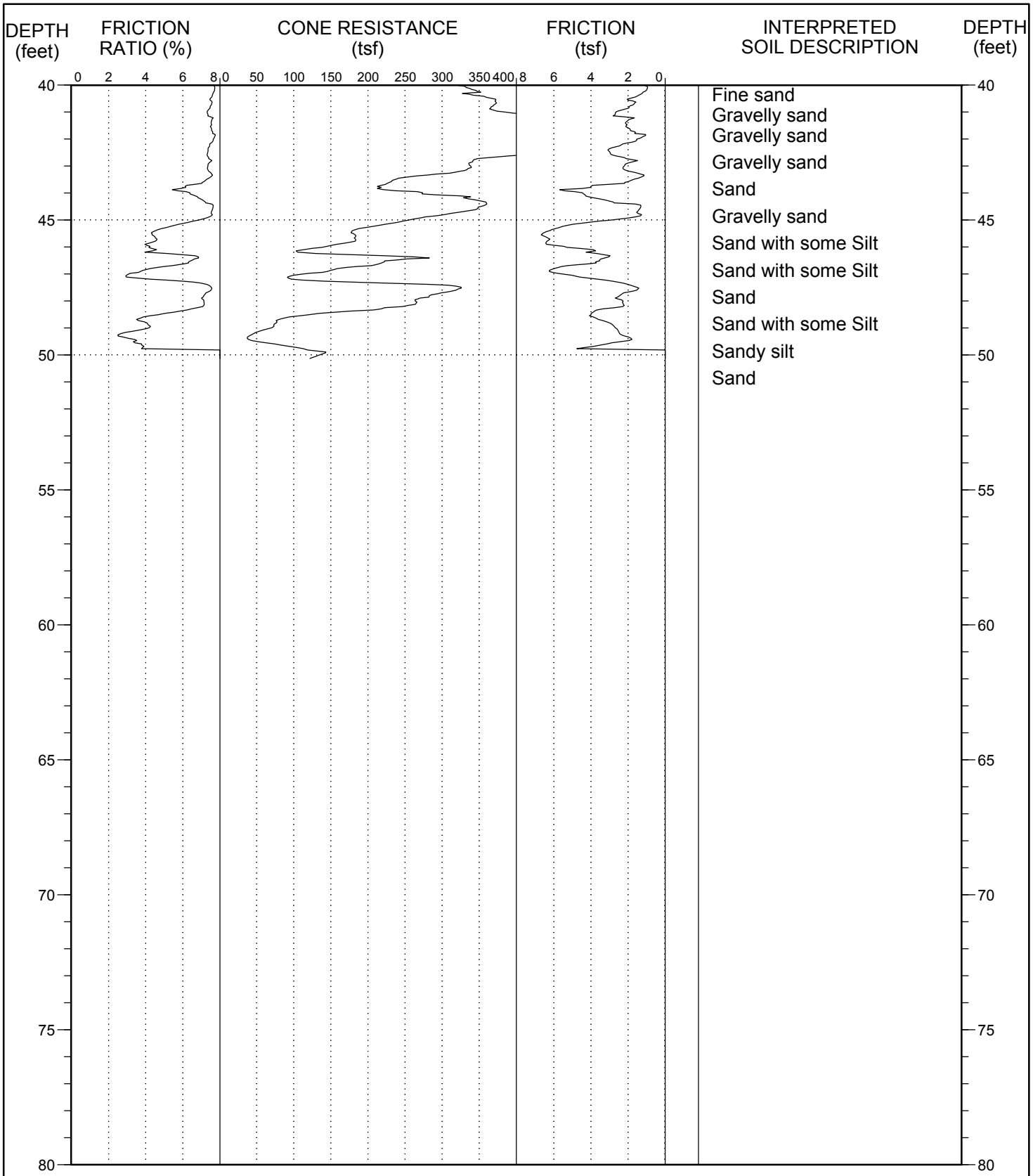
(Continued Next Page)

CH2MHILL

LOG OF CPT NO. CPT-08-16

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	309.52'	646+05.92	143.98 Rt	7/7/2008

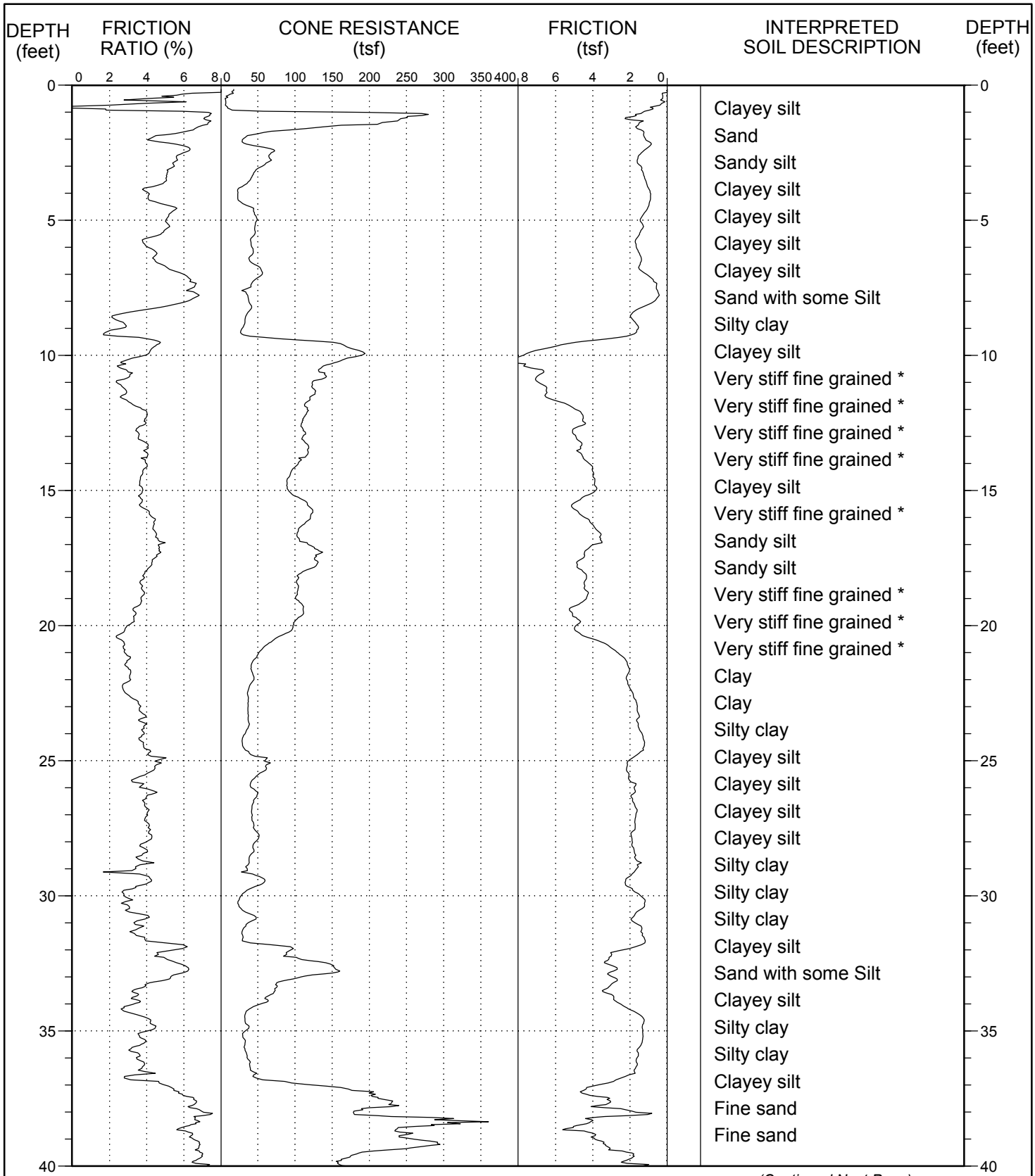


CH2MHILL

LOG OF CPT NO. CPT-08-16

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	309.52'	646+05.92	143.98 Rt	7/7/2008



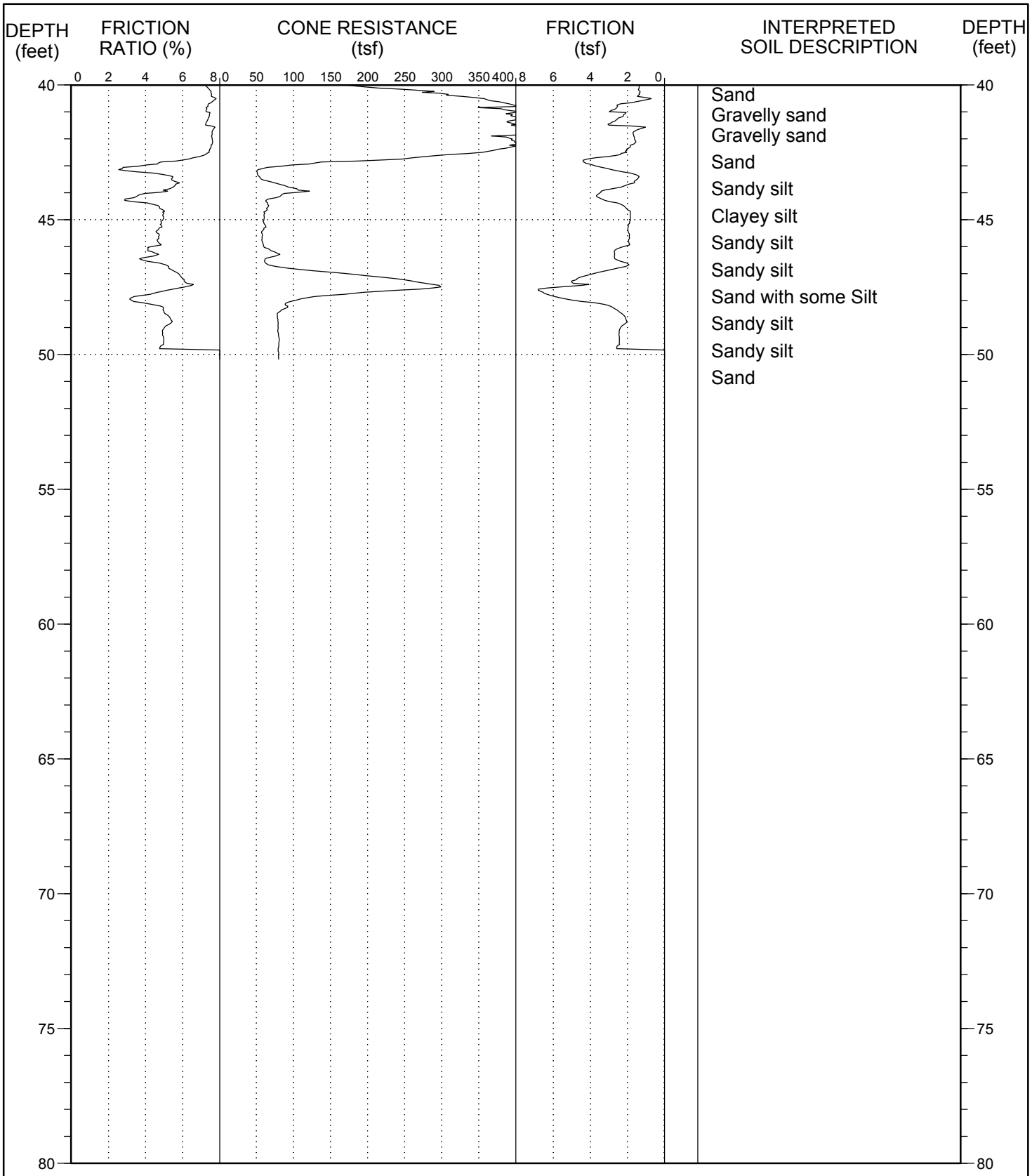
(Continued Next Page)

CH2MHILL

LOG OF CPT NO. CPT-08-17

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	317.18'	649+31.39	382.39 Rt	8/7/2008

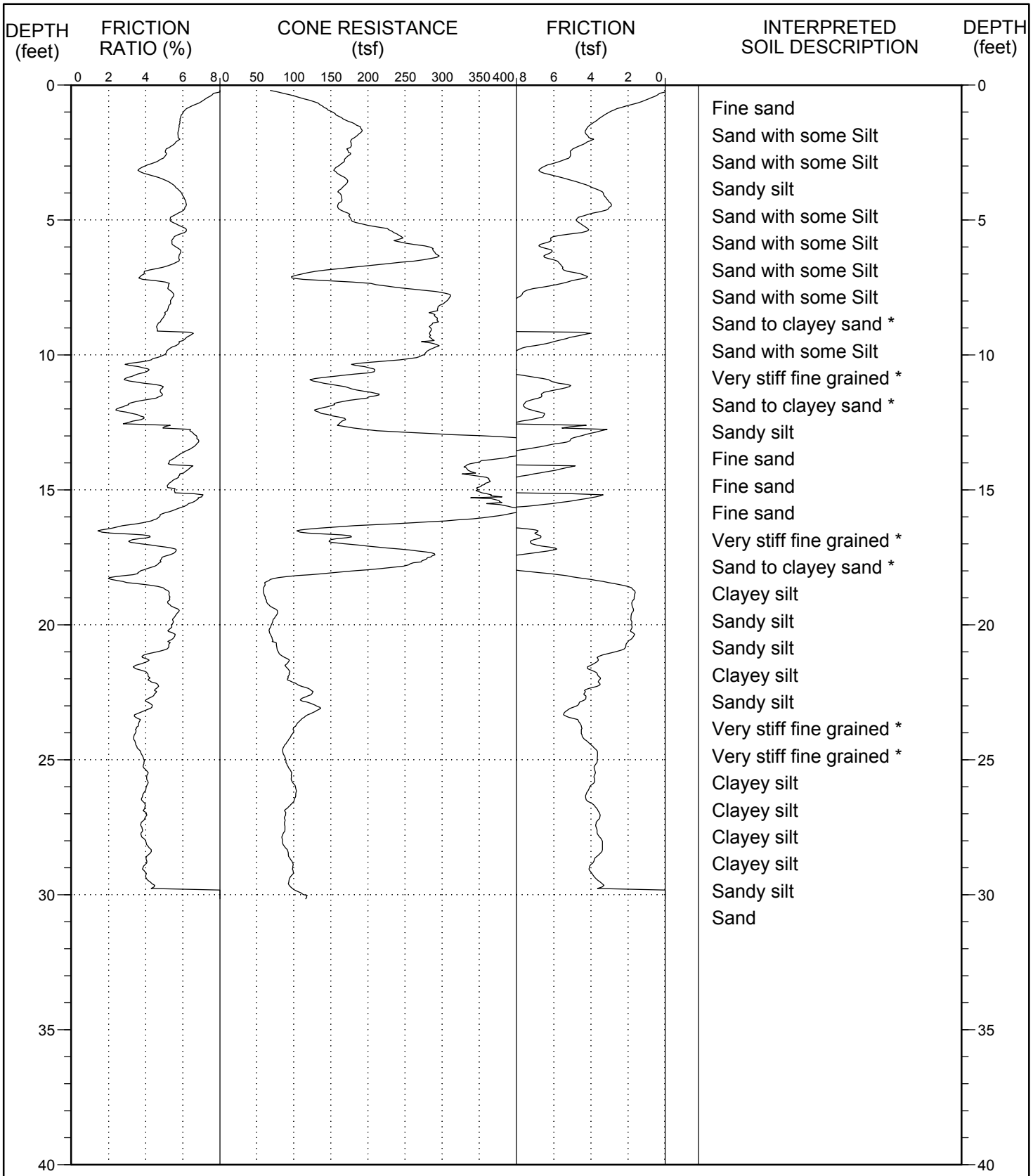


CH2MHILL

LOG OF CPT NO. CPT-08-17

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	317.18'	649+31.39	382.39 Rt	8/7/2008

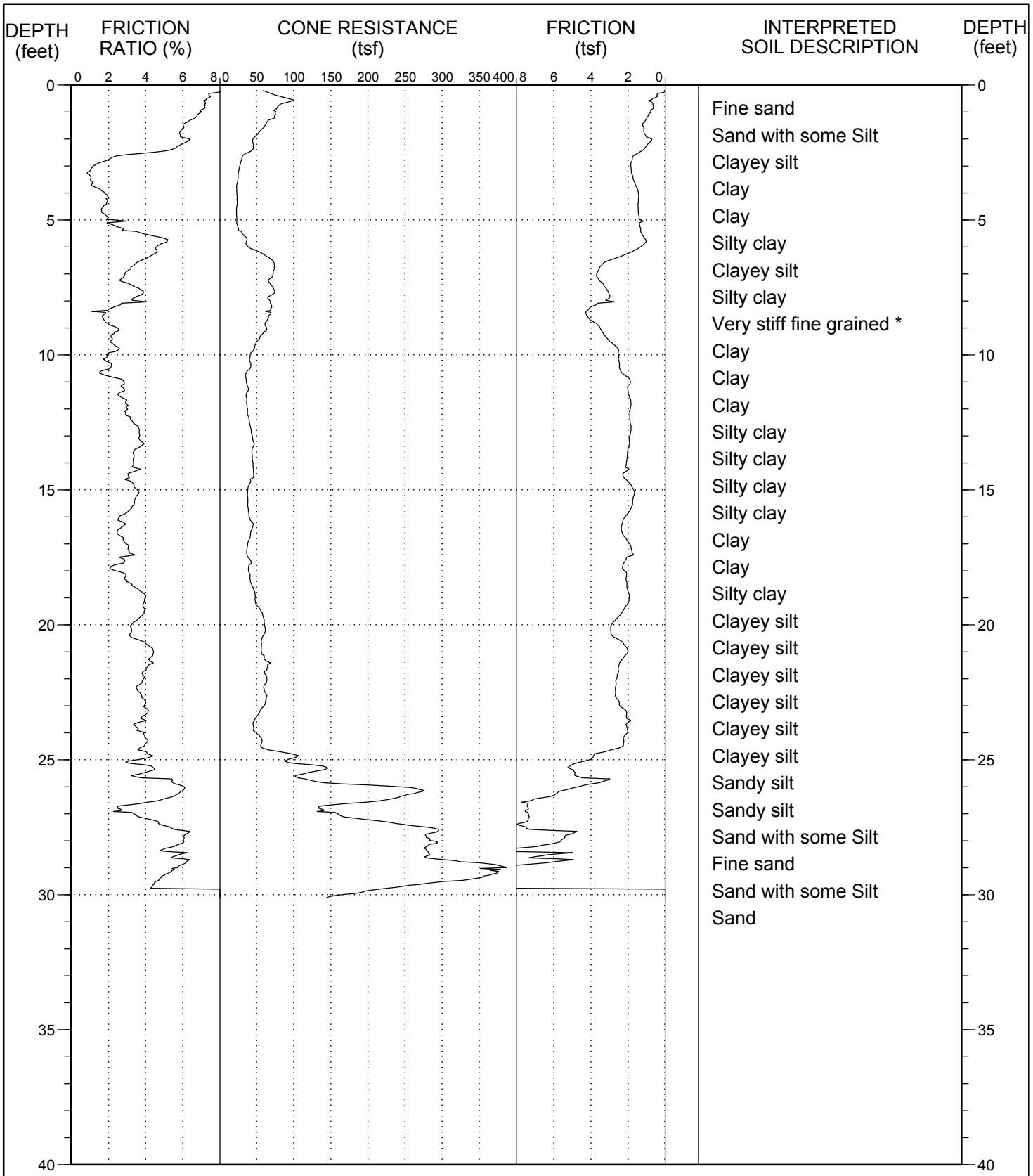


CH2MHILL

LOG OF CPT NO. CPT-08-18

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	332.29'	662+83.37	133.25 Rt	10/7/2008

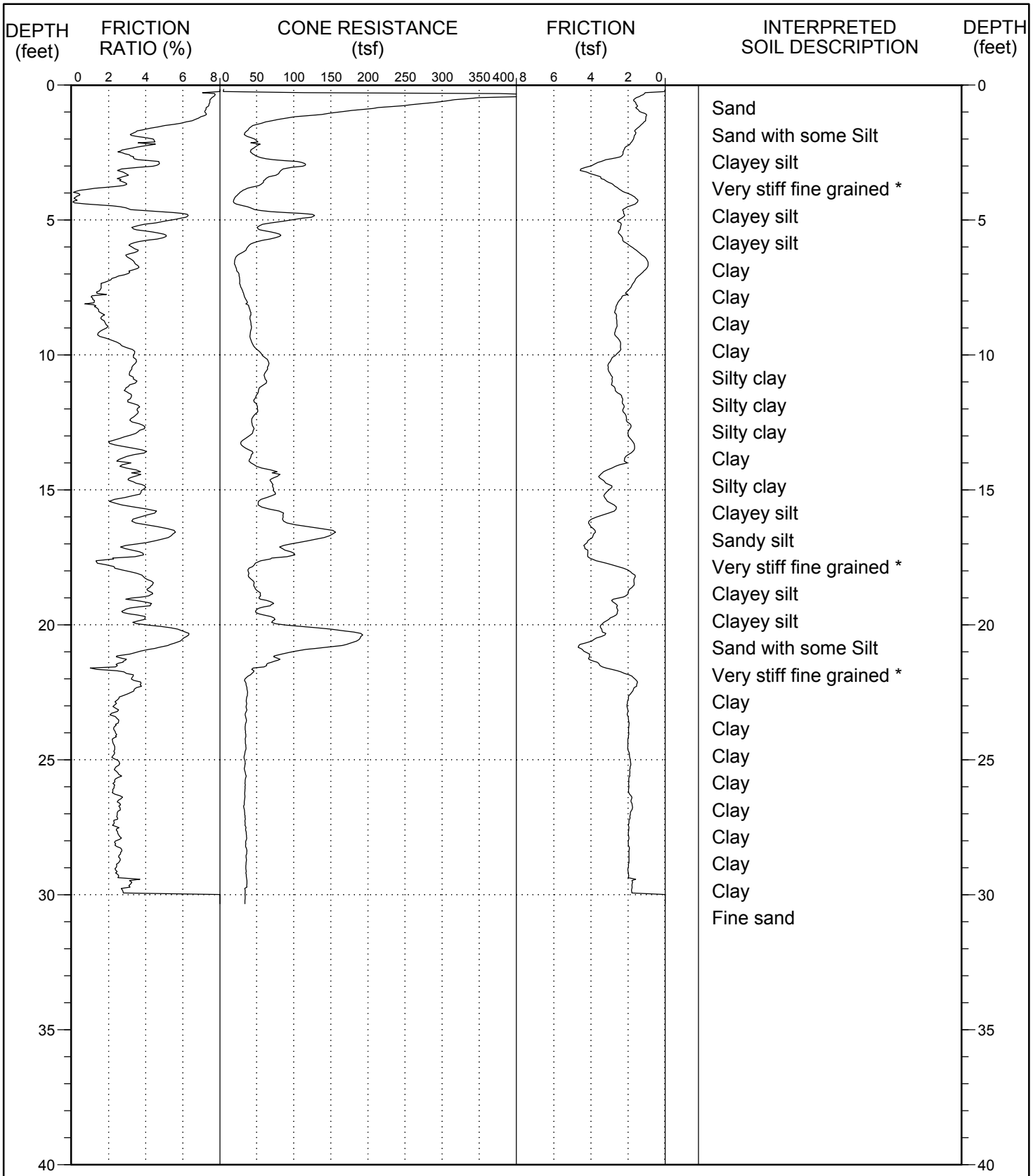


CH2MHILL

LOG OF CPT NO. CPT-08-19

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	353.99'	671+42.67	86.88 Rt	10/7/2008

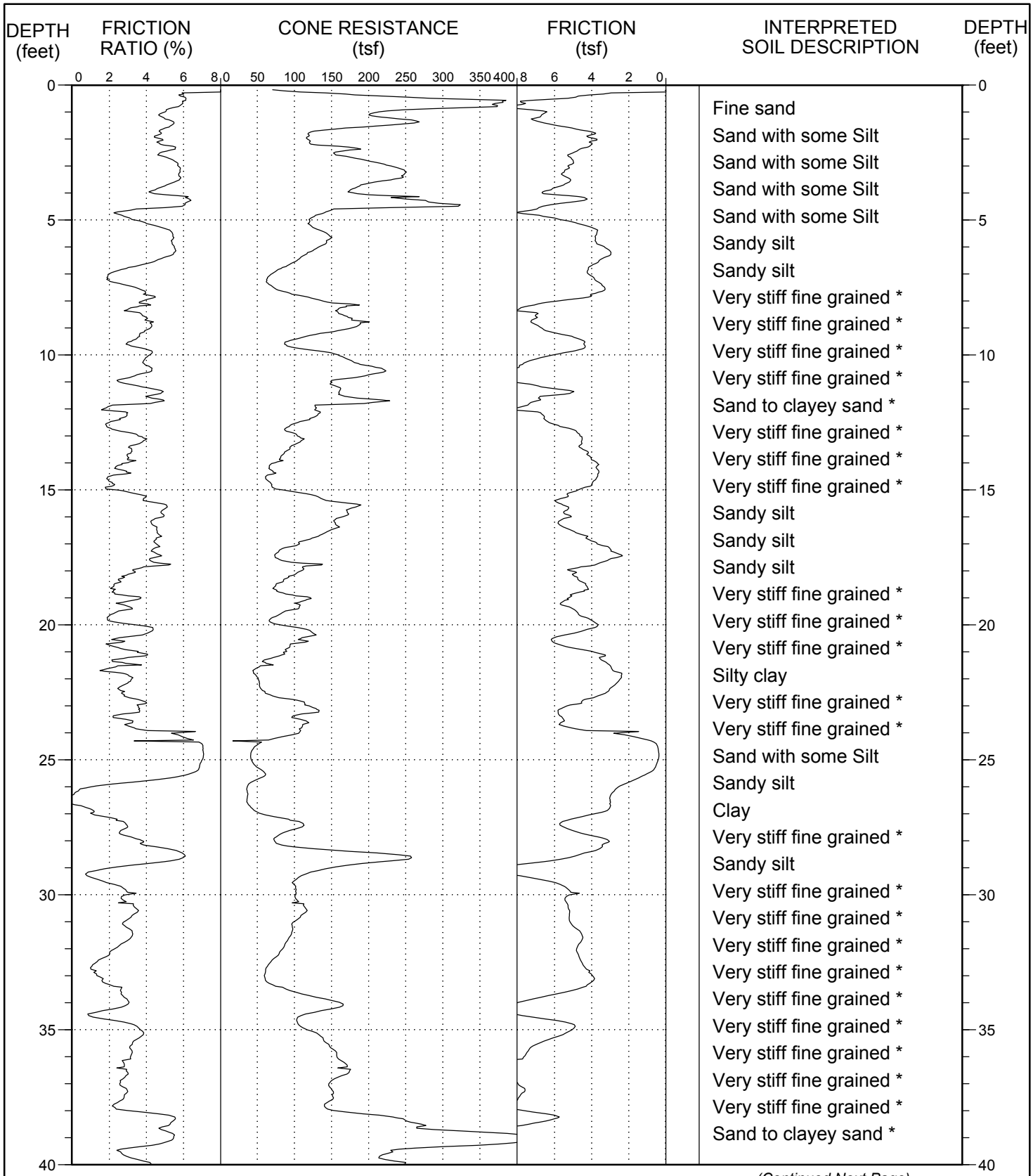


CH2MHILL

LOG OF CPT NO. CPT-08-20

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	366.42'	676+09.05	72.26 Rt	10/7/2008



(Continued Next Page)

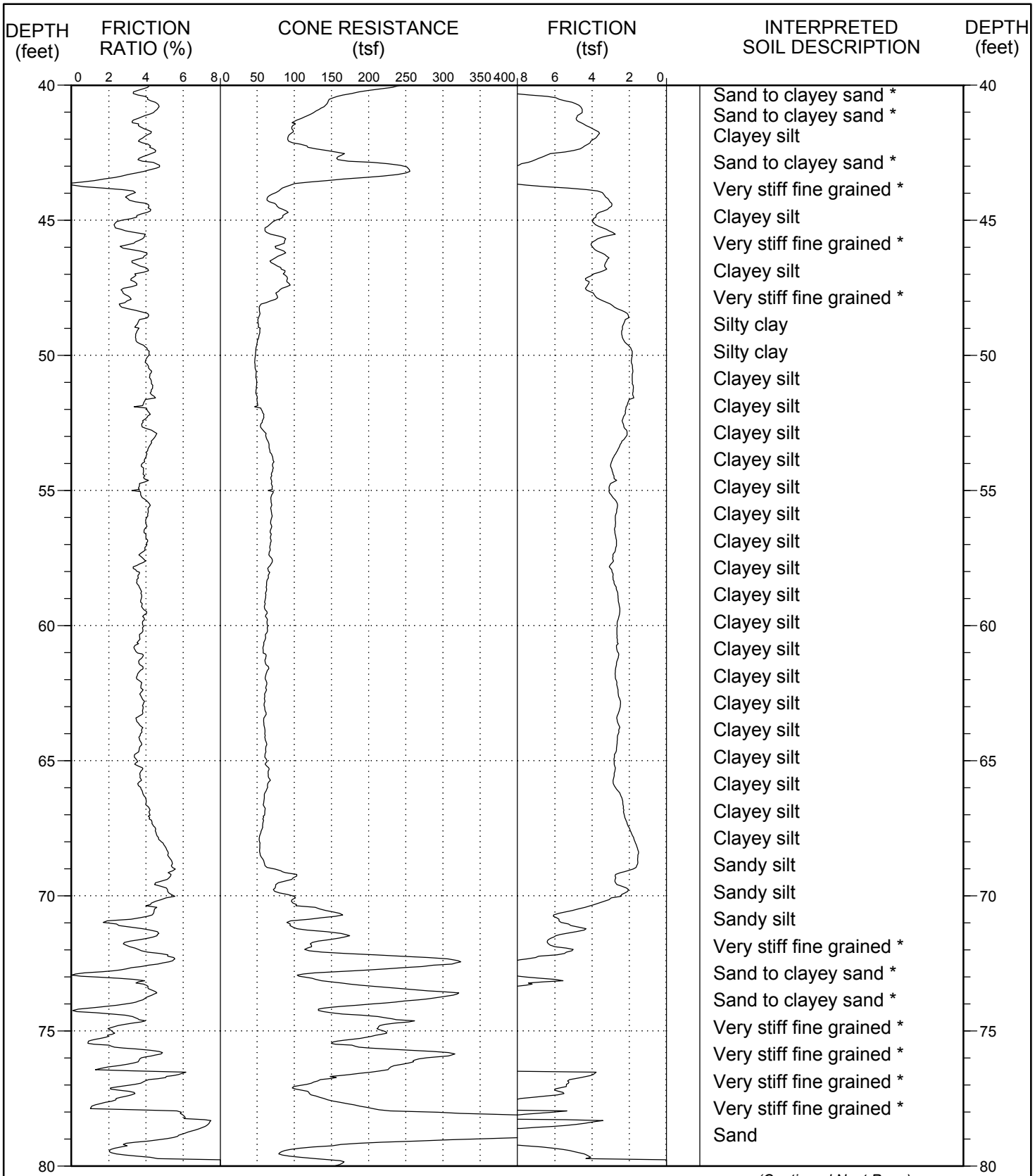
CH2MHILL

LOG OF CPT NO. CPT-08-21

SR-57 NORTHBOUND WIDENING

Birch Street UC, Bridge No. 55-0485

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	382.73'	681+36.85	70.01 Rt	7/13/2008



(Continued Next Page)

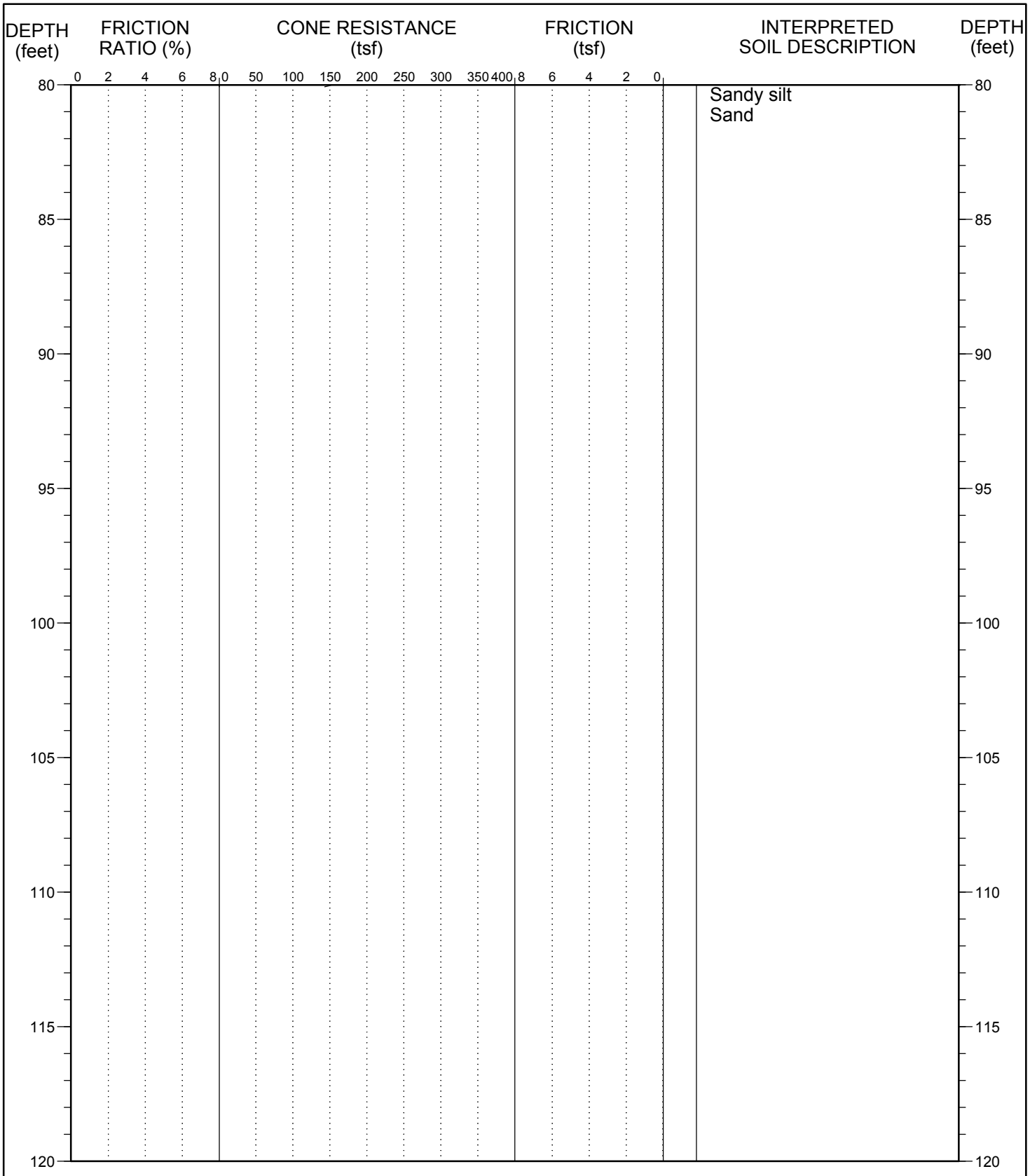
CH2MHILL

LOG OF CPT NO. CPT-08-21

SR-57 NORTHBOUND WIDENING

Birch Street UC, Bridge No. 55-0485

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	382.73'	681+36.85	70.01 Rt	7/13/2008



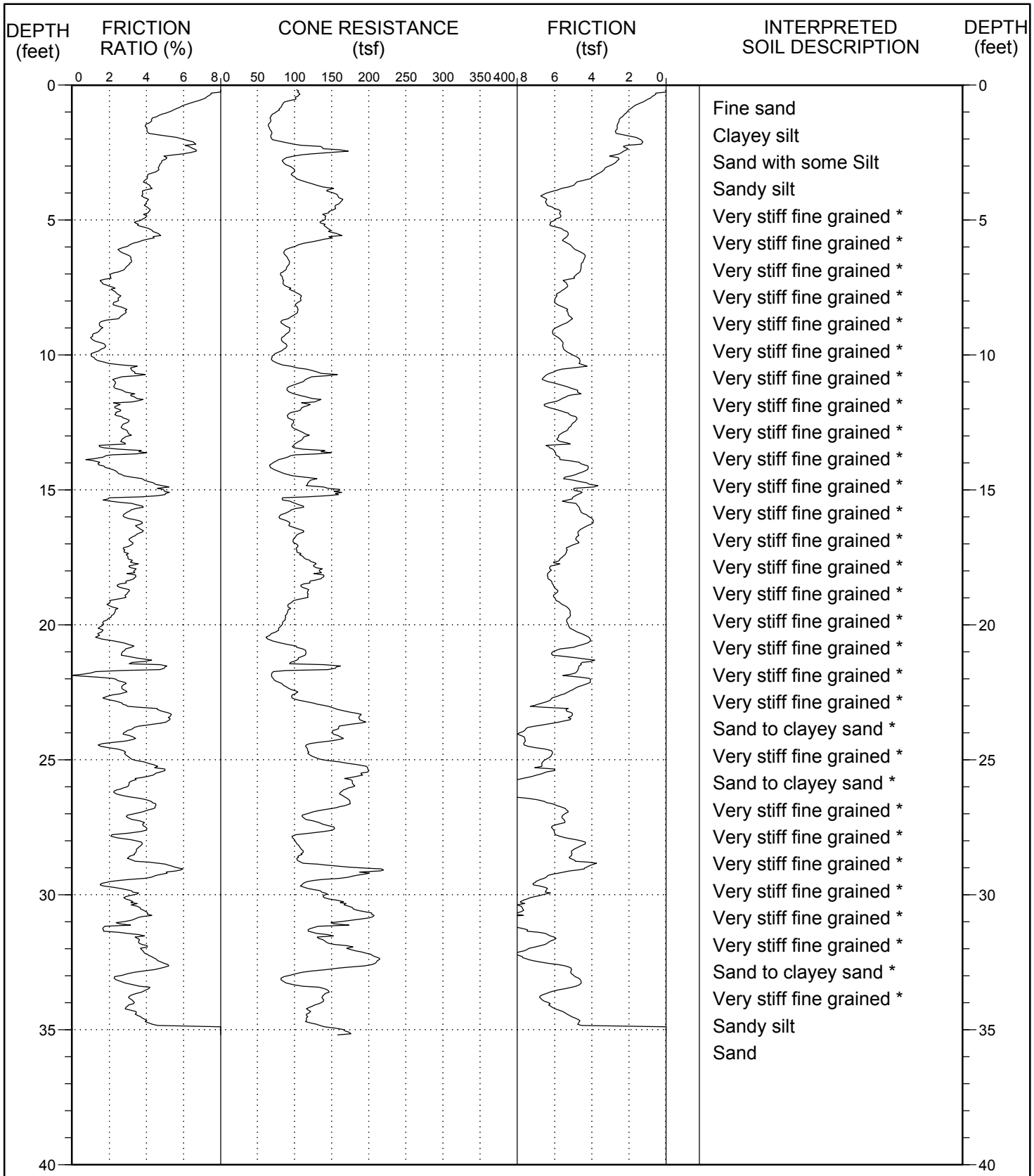
CH2MHILL

LOG OF CPT NO. CPT-08-21

SR-57 NORTHBOUND WIDENING

Birch Street UC, Bridge No. 55-0485

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	382.73'	681+36.85	70.01 Rt	7/13/2008

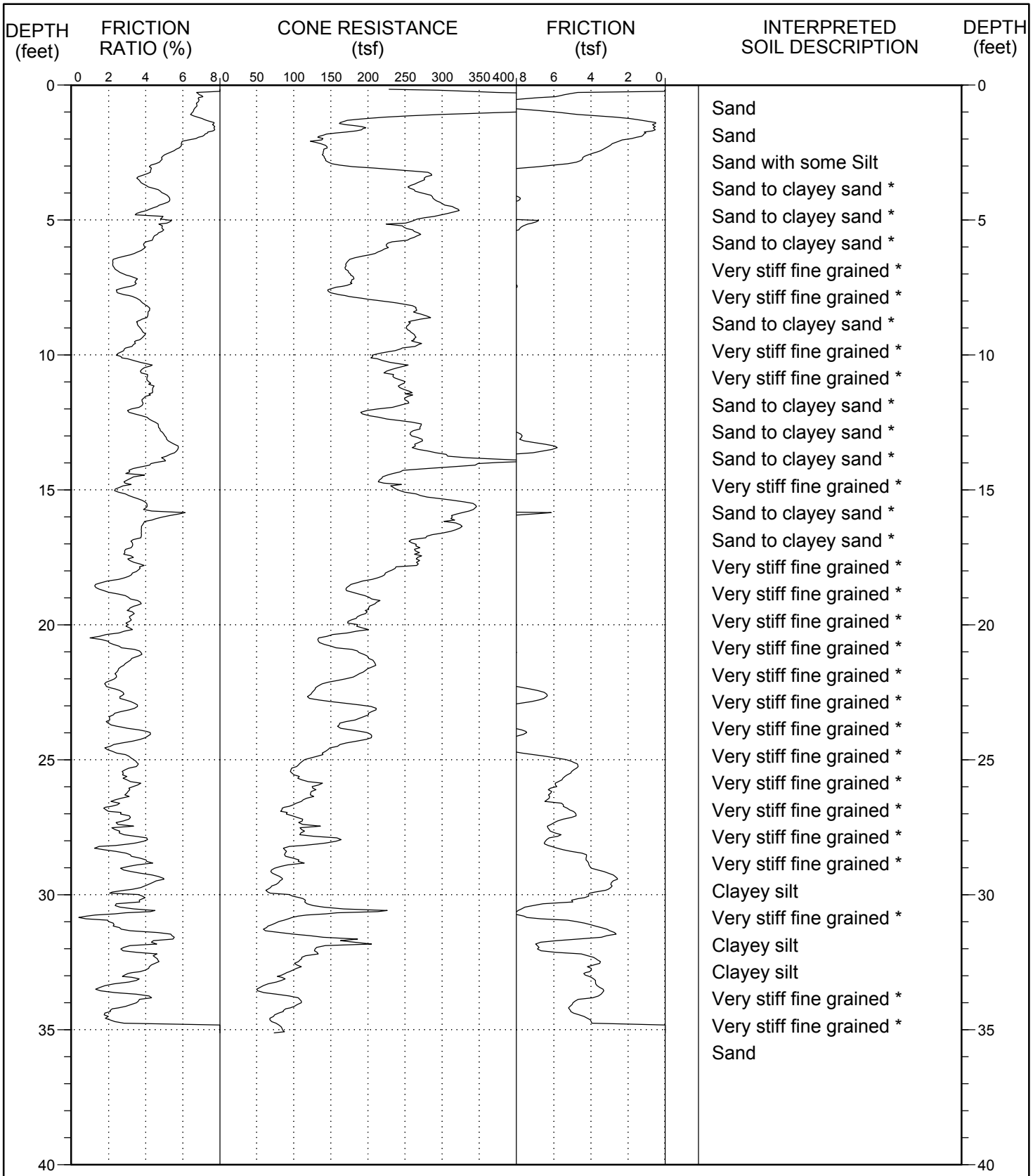


CH2MHILL

LOG OF CPT NO. CPT-08-22

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	402.67'	689+41.32	68.37 Rt	10/7/2008



CH2MHILL

LOG OF CPT NO. CPT-08-23

SR-57 NORTHBOUND WIDENING

PROJECT NO.:	ELEVATION:	STATION:	OFFSET:	DATE DRILLED:
370900.03.GE.FR	421.85'	696+89.44	70.65 Rt	7/13/2008

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-001.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-001.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   138.340     1.399     1.011     8         33        50          9E9
    1.500   174.905     1.743     0.997     9         34        51          9E9
    2.500    49.225     1.737     3.528     5         24        36        3.272
    3.500    29.617     1.449     4.893     3         28        42        1.959
    4.500    25.092     1.073     4.283     4         16        24        1.651
    5.500    42.042     0.500     1.189     7         13        20          9E9
    6.500    16.127     0.095     0.587     6          6         9          9E9
    7.500    28.947     0.143     0.493     7          9        14          9E9
    8.500    60.408     0.322     0.534     8         14        21          9E9
    9.500    52.744     0.284     0.539     8         13        20          9E9
   10.500    39.892     0.221     0.554     7         13        18          9E9
   11.500    37.550     0.186     0.495     7         12        16          9E9
   12.500    34.367     0.207     0.601     7         11        13          9E9
   13.500    44.581     0.362     0.812     7         14        16          9E9
   14.500    30.462     0.529     1.737     6         12        13          9E9
   15.500    31.333     0.693     2.211     6         12        12          9E9
   16.500    30.785     0.653     2.121     6         12        12          9E9
```

17.500	11.150	0.372	3.333	4	7	7	0.672
18.500	11.838	0.311	2.628	5	6	5	0.713
19.500	26.088	0.429	1.644	6	10	9	9E9
20.500	31.954	0.309	0.968	7	10	8	9E9
21.500	17.491	0.404	2.309	5	8	6	1.078
22.500	21.325	0.414	1.943	6	8	6	9E9
23.500	73.818	0.555	0.751	8	18	14	9E9
24.500	154.207	1.071	0.694	9	30	22	9E9
25.500	197.606	1.277	0.646	9	38	27	9E9
26.500	259.439	1.696	0.654	9	50	34	9E9
27.500	78.333	0.560	0.715	8	19	13	9E9
28.500	21.504	0.376	1.745	6	8	5	9E9
29.500	29.019	0.614	2.114	6	11	7	9E9
30.500	49.800	0.000	0.000	8	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-002.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-002.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500    65.380     0.636     0.973     8        16        24          9E9
    1.500   206.878     2.741     1.325     8        50        75          9E9
    2.500   102.478     3.612     3.524     6        39        59          9E9
    3.500   136.152     4.785     3.513     6        52        78          9E9
    4.500    84.083     4.273     5.079    11        81        122         9E9
    5.500    53.105     2.815     5.301     3        51        77        3.517
    6.500    61.888     2.082     3.364     6        24        36          9E9
    7.500    71.320     1.412     1.980     7        23        35          9E9
    8.500   195.622     3.136     1.603     8        47        71          9E9
    9.500   126.263     2.041     1.616     8        30        45          9E9
   10.500   128.895     2.386     1.851     7        41        57          9E9
   11.500    79.906     0.572     0.716     8        19        24          9E9
   12.500    83.347     0.466     0.560     8        20        24          9E9
   13.500    96.444     0.672     0.697     8        23        26          9E9
   14.500    84.850     1.061     1.251     8        20        22          9E9
   15.500    75.319     0.619     0.822     8        18        18          9E9
   16.500    67.362     0.992     1.472     7        22        21          9E9
```

17.500	82.608	1.110	1.344	8	20	19	9E9
18.500	101.771	1.862	1.830	7	32	29	9E9
19.500	115.524	1.072	0.928	8	28	24	9E9
20.500	80.113	0.887	1.107	8	19	16	9E9
21.500	67.353	1.092	1.621	7	22	18	9E9
22.500	65.328	1.674	2.562	6	25	19	9E9
23.500	70.838	1.128	1.593	7	23	17	9E9
24.500	85.492	4.709	5.507	11	82	59	9E9
25.500	166.455	3.780	2.270	7	53	37	9E9
26.500	201.255	8.657	4.301	11	193	131	9E9
27.500	180.458	3.305	1.831	8	43	29	9E9
28.500	184.477	2.125	1.152	9	35	23	9E9
29.500	157.122	2.876	1.830	7	50	32	9E9
30.500	156.280	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-003.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-003.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500    86.565     1.291     1.492     7        28        42          9E9
    1.500   107.515     1.920     1.786     7        34        51          9E9
    2.500   144.886     1.399     0.965     9        28        42          9E9
    3.500   163.350     1.468     0.899     9        31        47          9E9
    4.500   244.741     2.963     1.210     9        47        71          9E9
    5.500   364.886     8.128     2.226     8        87        131         9E9
    6.500   383.342    12.393     3.231    12        184       276         9E9
    7.500   350.877    11.365     3.237    12        168       252         9E9
    8.500   325.983     8.851     2.714    12        156       234         9E9
    9.500   283.514    10.463     3.689    12        136       200         9E9
   10.500   127.537     9.308     7.281    11        122       165         9E9
   11.500   109.924     6.983     6.328    11        106       133         9E9
   12.500   112.989     7.982     7.046    11        108       127         9E9
   13.500   101.536     6.494     6.382    11        97        107         9E9
   14.500    98.829     6.641     6.692    11        95        99          9E9
   15.500   147.600     6.694     4.521    11        142       141         9E9
   16.500   190.092     6.469     3.397    12        91        86          9E9
```

17.500	63.933	2.718	4.246	5	31	28	4.191
18.500	45.752	1.725	3.765	5	22	19	2.974
19.500	41.537	1.569	3.774	5	20	17	2.688
20.500	40.888	1.553	3.793	5	20	16	2.641
21.500	76.019	2.602	3.418	6	29	22	9E9
22.500	82.892	4.254	5.125	11	79	59	9E9
23.500	42.658	1.812	4.234	4	27	20	2.751
24.500	34.480	1.619	4.676	4	22	15	2.202
25.500	33.294	1.287	3.852	5	16	11	2.117
26.500	39.938	1.691	4.222	4	26	17	2.555
27.500	76.127	3.346	4.388	5	37	24	4.966
28.500	116.321	6.586	5.648	11	112	72	9E9
29.500	116.000	4.054	3.482	6	45	28	9E9
30.500	147.075	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-004.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                 0.830
"Value for Water Table (in m):           8.180
"Valid Zone Classification based on:     Rf
"Missing unit weight to start depth:     18.860
"Method for calculating Su:              Nkt
"Value of the constant Nkt:              15.000
"Define Zone 6 for Sand Parameters?      YES
"Vertical Flow Gradient, i (- up):       +0.000
"CPT to SPT N60 Conversion:              Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-004.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   197.322     0.989     0.501     9         38        57          9E9
    1.500   110.645     1.115     1.008     8         26        39          9E9
    2.500   173.125     1.736     1.003     9         33        50          9E9
    3.500   176.070     1.645     0.934     9         34        51          9E9
    4.500   181.693     1.791     0.986     9         35        53          9E9
    5.500   212.033     2.312     1.090     9         41        62          9E9
    6.500   231.506     2.767     1.195     9         44        66          9E9
    7.500   202.289     3.296     1.629     8         48        72          9E9
    8.500   123.105     3.204     2.602     7         39        59          9E9
    9.500   131.214     3.861     2.943     6         50        75          9E9
   10.500   134.000     3.964     2.959     6         51        71          9E9
   11.500   191.795     4.175     2.177     7         61        79          9E9
   12.500   157.500     4.384     2.784     7         50        61          9E9
   13.500   175.733     4.418     2.514     7         56        64          9E9
   14.500   215.617     3.793     1.759     8         52        57          9E9
   15.500   170.786     4.677     2.738     7         55        57          9E9
   16.500   272.850     6.449     2.363     7         87        86          9E9
```

17.500	233.989	6.781	2.898	7	75	71	9E9
18.500	172.692	6.837	3.960	12	83	75	9E9
19.500	191.244	8.058	4.214	11	183	158	9E9
20.500	109.970	5.071	4.611	11	105	87	9E9
21.500	131.342	5.363	4.083	11	126	100	9E9
22.500	165.295	5.315	3.216	6	63	48	9E9
23.500	108.946	4.946	4.536	11	104	77	9E9
24.500	94.788	4.101	4.324	11	91	65	9E9
25.500	133.881	5.787	4.322	11	128	89	9E9
26.500	115.200	5.075	4.404	11	110	74	9E9
27.500	109.632	5.266	4.800	11	105	69	9E9
28.500	111.372	4.096	3.674	6	43	28	9E9
29.500	157.500	5.304	3.367	6	60	38	9E9
30.500	189.900	0.000	0.000	10	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-005.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-005.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   132.033     0.864     0.655     9         25        38          9E9
    1.500   142.096     4.341     3.054     6         54        81          9E9
    2.500   209.378     5.291     2.527     7         67        101         9E9
    3.500   226.317     4.477     1.978     8         54        81          9E9
    4.500   262.925     4.638     1.764     8         63        95          9E9
    5.500   169.880     3.986     2.345     7         54        81          9E9
    6.500   151.567     3.483     2.294     7         48        72          9E9
    7.500   125.275     3.463     2.752     7         40        60          9E9
    8.500   144.718     4.811     3.303     6         56        84          9E9
    9.500   268.947     7.952     2.952    12         129       194         9E9
   10.500   346.404     6.786     1.958     8         83        115         9E9
   11.500   261.092     4.536     1.736     8         63        82          9E9
   12.500   315.265     6.875     2.176     8         76        92          9E9
   13.500   208.864     6.166     2.947     7         67        77          9E9
   14.500   435.560     9.058     2.077     8         104       113         9E9
   15.500   597.933    10.697     1.788     9         115       119         9E9
   16.500   166.962     5.290     3.126     6         65        64          9E9
```

17.500	79.286	1.920	2.348	7	26	24	9E9
18.500	223.509	5.974	2.661	7	72	65	9E9
19.500	344.596	8.602	2.495	12	165	143	9E9
20.500	468.341	9.961	2.126	8	112	93	9E9
21.500	364.552	10.475	2.867	12	175	140	9E9
22.500	204.574	6.349	3.069	7	66	51	9E9
23.500	149.905	4.940	3.248	6	58	43	9E9
24.500	163.557	6.100	3.699	12	79	57	9E9
25.500	99.755	2.719	2.666	6	39	27	9E9
26.500	136.735	3.798	2.715	7	45	31	9E9
27.500	96.805	2.391	2.374	7	32	21	9E9
28.500	105.309	2.871	2.637	7	35	23	9E9
29.500	105.709	2.083	1.920	7	35	23	9E9
30.500	131.000	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-006.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                 0.830
"Value for Water Table (in m):           8.180
"Valid Zone Classification based on:     Rf
"Missing unit weight to start depth:     18.860
"Method for calculating Su:              Nkt
"Value of the constant Nkt:              15.000
"Define Zone 6 for Sand Parameters?      YES
"Vertical Flow Gradient, i (- up):       +0.000
"CPT to SPT N60 Conversion:              Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-006.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   140.271     0.624     0.444     9         27        41          9E9
    1.500   209.954     1.586     0.755     9         40        60          9E9
    2.500   177.080     2.930     1.654     8         42        63          9E9
    3.500   190.550     4.277     2.244     7         61        92          9E9
    4.500   133.957     3.551     2.649     7         43        65          9E9
    5.500    70.241     2.739     3.887     5         34        51        4.675
    6.500   230.438     4.096     1.777     8         55        83          9E9
    7.500   119.250     3.959     3.316     6         46        69          9E9
    8.500    81.800     2.496     3.048     6         31        47          9E9
    9.500   145.711     2.810     1.928     7         47        71          9E9
   10.500   140.890     5.940     4.206    11         135       188         9E9
   11.500    82.823     3.092     3.676     5         40        52        5.561
   12.500   101.800     4.226     4.101     5         49        59        6.817
   13.500    98.252     3.840     3.858     5         48        55        6.580
   14.500   113.070     4.318     3.787     6         44        48          9E9
   15.500   125.822     4.567     3.598     6         49        50          9E9
   16.500   110.194     4.640     4.190    11         106       103         9E9
```

17.500	104.268	3.965	3.793	5	50	47	6.896
18.500	138.256	5.607	4.043	11	133	119	9E9
19.500	134.576	5.178	3.818	12	65	55	9E9
20.500	166.955	6.635	3.946	12	81	66	9E9
21.500	125.325	5.492	4.329	11	122	96	9E9
22.500	97.661	2.914	2.863	6	39	30	9E9
23.500	116.667	4.303	3.558	6	46	34	9E9
24.500	102.875	4.261	3.992	5	51	36	7.013
25.500	83.786	3.314	3.810	5	42	29	5.692
26.500	129.322	3.674	2.735	7	43	29	9E9
27.500	155.971	5.297	3.320	6	61	40	9E9
28.500	78.840	2.794	3.425	6	31	20	9E9
29.500	80.750	1.943	2.338	7	27	17	9E9
30.500	79.380	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-007.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-007.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   218.722     1.313     0.600     9         42        63          9E9
    1.500    96.794     2.641     2.729     6         37        56          9E9
    2.500   120.695     4.170     3.455     6         46        69          9E9
    3.500   151.100     5.407     3.578     6         58        87          9E9
    4.500    94.961     4.295     4.521    11         91        137         9E9
    5.500    80.153     4.051     5.051    11         77        116         9E9
    6.500   105.033     5.304     5.049    11         101       152         9E9
    7.500   167.248     5.452     3.259     6         64        96          9E9
    8.500   104.914     4.511     4.299    11         101       152         9E9
    9.500   100.010     4.988     4.987    11         96        139         9E9
   10.500   181.309     7.397     4.079    12         87        117         9E9
   11.500   122.648     6.316     5.147    11         118       147         9E9
   12.500   135.061     7.131     5.279    11         129       150         9E9
   13.500   131.510     7.366     5.601    11         126       138         9E9
   14.500   126.775     5.407     4.263    11         121       125         9E9
   15.500   106.520     5.369     5.037    11         102       100         9E9
   16.500    87.847     4.687     5.334    11         84        79          9E9
```

17.500	85.100	4.489	5.271	11	82	73	9E9
18.500	65.412	3.360	5.134	11	63	54	9E9
19.500	108.827	5.259	4.832	11	104	85	9E9
20.500	88.033	4.854	5.511	11	84	66	9E9
21.500	77.226	4.059	5.253	11	74	56	9E9
22.500	116.085	5.399	4.649	11	111	81	9E9
23.500	103.467	5.582	5.395	11	99	70	9E9
24.500	76.940	3.927	5.096	11	74	51	9E9
25.500	75.090	4.011	5.337	11	72	48	9E9
26.500	61.990	3.097	4.989	4	40	26	4.021
27.500	67.314	3.854	5.721	11	65	41	9E9
28.500	68.975	3.212	4.649	4	44	28	4.480
29.500	84.872	3.246	3.821	5	41	25	5.533
30.500	67.950	0.000	0.000	8	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-008.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-008.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   141.012     1.215     0.862     9         27        41          9E9
    1.500   226.519     6.962     3.073     7         72        108         9E9
    2.500    98.147     3.713     3.782     5         47        71        6.534
    3.500   125.265     3.808     3.040     6         48        72          9E9
    4.500   101.350     4.201     4.145     5         49        74        6.738
    5.500   118.167     5.292     4.479    11         113       170         9E9
    6.500    90.536     4.535     5.009    11         87        131         9E9
    7.500   197.130     7.241     3.673    12         94        141         9E9
    8.500   136.475     6.355     4.654    11         131       197         9E9
    9.500   134.376     5.037     3.748     6         51        74          9E9
   10.500    93.332     4.155     4.451    11         89        120         9E9
   11.500    85.781     3.534     4.119     5         41        52        5.671
   12.500    71.247     3.155     4.428     5         34        40        4.697
   13.500    79.983     3.335     4.169     5         38        42        5.276
   14.500    67.484     3.271     4.844    11         65        69          9E9
   15.500   108.161     4.107     3.795     5         52        52        7.148
   16.500   104.895     4.246     4.047     5         50        48        6.924
```

17.500	93.790	4.286	4.569	11	90	82	9E9
18.500	54.558	2.864	5.246	3	52	46	3.560
19.500	74.244	3.171	4.270	5	36	30	4.868
20.500	67.605	3.046	4.505	5	32	26	4.420
21.500	57.875	2.984	5.154	4	37	29	3.767
22.500	61.212	2.788	4.553	4	39	29	3.987
23.500	70.880	3.459	4.878	11	68	50	9E9
24.500	65.791	3.313	5.035	11	63	44	9E9
25.500	63.259	2.949	4.660	4	40	27	4.110
26.500	49.143	2.279	4.629	4	31	21	3.169
27.500	38.147	1.779	4.656	4	24	16	2.430
28.500	33.689	1.224	3.621	5	16	10	2.131
29.500	41.107	1.687	4.093	5	20	13	2.622
30.500	53.531	2.310	4.306	5	26	16	3.446
31.500	70.956	2.931	4.123	5	34	21	4.605
32.500	94.942	3.438	3.615	6	36	22	9E9
33.500	91.548	3.850	4.199	5	44	27	5.970
34.500	50.865	2.379	4.669	4	33	20	3.250
35.500	189.171	6.425	3.395	12	91	53	9E9
36.500	67.557	2.732	4.041	5	32	19	4.352
37.500	67.788	3.195	4.707	4	43	25	4.367
38.500	140.091	4.477	3.192	6	54	31	9E9
39.500	65.232	2.803	4.290	5	31	17	4.188
40.500	49.691	2.027	4.072	5	24	13	3.146
41.499	60.454	2.652	4.384	5	29	16	3.858
42.499	51.332	2.638	5.136	3	49	27	3.244
43.499	37.224	1.581	4.244	4	24	13	2.299
44.499	51.217	1.829	3.569	5	25	13	3.228
45.499	78.787	1.164	1.477	7	25	13	9E9
46.499	55.000	1.230	2.234	6	21	11	9E9
47.499	19.009	0.432	2.262	5	9	5	1.072
48.499	16.944	0.496	2.913	5	8	4	0.931
49.499	11.436	0.182	1.575	5	6	3	0.560
50.499	13.829	0.000	0.000	6	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-009.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                0.830
"Value for Water Table (in m):          8.180
"Valid Zone Classification based on:    Rf
"Missing unit weight to start depth:    18.860
"Method for calculating Su:             Nkt
"Value of the constant Nkt:             15.000
"Define Zone 6 for Sand Parameters?     YES
"Vertical Flow Gradient, i (- up):      +0.000
"CPT to SPT N60 Conversion:             Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"-----------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-009.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   228.109     1.087     0.476     9        44        66          9E9
    1.500   268.975     6.983     2.596     7        86        129         9E9
    2.500   128.020     3.961     3.093     6        49        74          9E9
    3.500    97.155     4.116     4.235     5        47        71        6.465
    4.500   119.619     4.991     4.171    11        115       173         9E9
    5.500    81.145     4.137     5.095    11        78        117         9E9
    6.500   142.819     6.133     4.293    11        137       206         9E9
    7.500   132.186     3.403     2.572     7        42        63          9E9
    8.500    65.161     1.974     3.029     6        25        38          9E9
    9.500    65.441     2.358     3.602     5        31        46        4.323
   10.500    65.579     2.941     4.486     5        31        42        4.327
   11.500    80.608     3.474     4.310     5        39        50        5.325
   12.500    67.765     3.216     4.744     4        43        51        4.466
   13.500    64.165     2.914     4.538     4        41        46        4.223
   14.500    64.595     3.003     4.645     4        41        44        4.249
   15.500    61.456     2.784     4.527     4        39        40        4.035
   16.500    65.114     2.885     4.427     5        31        30        4.275
```

17.500	50.336	2.676	5.313	3	48	44	3.284
18.500	42.579	2.111	4.951	3	41	36	2.764
19.500	35.426	1.973	5.562	3	34	29	2.282
20.500	47.294	1.844	3.898	5	23	19	3.068
21.500	52.700	1.029	1.953	7	17	13	9E9
22.500	36.053	0.688	1.908	6	14	11	9E9
23.500	37.781	1.377	3.643	5	18	13	2.421
24.500	46.995	2.628	5.590	3	45	32	3.032
25.500	76.675	3.620	4.721	11	73	51	9E9
26.500	83.661	4.824	5.764	11	80	54	9E9
27.500	112.093	3.761	3.354	6	43	28	9E9
28.500	124.088	4.501	3.626	6	48	31	9E9
29.500	196.042	4.725	2.410	7	63	40	9E9
30.500	361.625	0.000	0.000	10	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-010.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                0.830
"Value for Water Table (in m):          8.180
"Valid Zone Classification based on:    Rf
"Missing unit weight to start depth:    18.860
"Method for calculating Su:             Nkt
"Value of the constant Nkt:             15.000
"Define Zone 6 for Sand Parameters?     YES
"Vertical Flow Gradient, i (- up):      +0.000
"CPT to SPT N60 Conversion:             Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-010.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500    79.935     0.481     0.602     8         19        29          9E9
    1.500   181.577     2.741     1.510     8         43        65          9E9
    2.500    94.300     2.249     2.385     7         30        45          9E9
    3.500    66.448     2.564     3.859     5         32        48        4.416
    4.500    82.495     2.663     3.228     6         32        48          9E9
    5.500    92.820     3.200     3.447     6         36        54          9E9
    6.500   118.671     3.404     2.868     6         45        68          9E9
    7.500   309.646     4.020     1.298     9         59        89          9E9
    8.500   308.135     4.361     1.415     9         59        89          9E9
    9.500   157.260     2.867     1.823     8         38        57          9E9
   10.500   210.737     3.553     1.686     8         50        69          9E9
   11.500   104.932     3.426     3.264     6         40        52          9E9
   12.500    64.968     2.089     3.215     6         25        30          9E9
   13.500    52.141     1.950     3.738     5         25        29        3.423
   14.500    86.016     2.396     2.783     6         33        36          9E9
   15.500   192.167     5.045     2.625     7         61        63          9E9
   16.500   160.708     5.028     3.128     6         62        61          9E9
```

17.500	211.613	6.605	3.121	7	68	64	9E9
18.500	186.774	6.152	3.293	6	72	65	9E9
19.500	132.609	4.466	3.367	6	51	44	9E9
20.500	153.176	4.122	2.691	7	49	41	9E9
21.500	144.512	3.648	2.523	7	46	37	9E9
22.500	367.446	5.579	1.518	9	70	54	9E9
23.500	478.011	12.436	2.601	12	229	171	9E9
24.500	495.885	6.808	1.373	9	95	69	9E9
25.500	451.967	6.646	1.470	9	87	61	9E9
26.500	401.404	6.316	1.573	9	77	52	9E9
27.500	200.477	5.449	2.718	7	64	43	9E9
28.500	99.024	3.068	3.096	6	38	25	9E9
29.500	86.178	2.854	3.307	6	33	21	9E9
30.500	83.800	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-011.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-011.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   247.143     4.959     2.007     8         59        89          9E9
    1.500   185.225     6.120     3.304     6         71        107         9E9
    2.500    76.164     1.543     2.025     7         24        36          9E9
    3.500    63.542     1.367     2.150     7         20        30          9E9
    4.500    75.680     1.882     2.485     6         29        44          9E9
    5.500    80.300     2.277     2.836     6         31        47          9E9
    6.500    83.929     3.119     3.717     5         40        60        5.567
    7.500    99.617     3.848     3.863     5         48        72        6.609
    8.500    92.169     4.507     4.889    11         88        132         9E9
    9.500    73.581     3.460     4.697    11         71        106         9E9
   10.500   135.206     4.831     3.570     6         52        71          9E9
   11.500   158.821     5.934     3.732    12         76        97          9E9
   12.500   107.519     3.913     3.634     6         41        49          9E9
   13.500   103.153     3.651     3.535     6         40        45          9E9
   14.500   100.529     3.795     3.770     5         48        51        6.649
   15.500    87.140     3.353     3.842     5         42        43        5.753
   16.500    70.310     2.722     3.867     5         34        33        4.624
```

17.500	64.228	2.084	3.243	6	25	23	9E9
18.500	108.907	3.287	3.010	6	42	37	9E9
19.500	102.370	3.356	3.216	6	40	34	9E9
20.500	73.614	1.939	2.548	6	29	24	9E9
21.500	76.738	2.438	3.081	6	30	24	9E9
22.500	69.617	2.111	2.946	6	27	21	9E9
23.500	88.847	2.470	2.700	6	35	26	9E9
24.500	91.192	2.542	2.703	6	36	26	9E9
25.500	74.006	2.287	3.015	6	29	20	9E9
26.500	124.458	4.271	3.404	6	48	32	9E9
27.500	90.128	2.844	3.098	6	35	23	9E9
28.500	96.085	3.900	4.006	5	47	31	6.371
29.500	87.960	2.691	3.008	6	34	22	9E9
30.500	69.767	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-012.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-012.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500    43.100     0.214     0.497     8        10        15          9E9
    1.500    67.285     0.749     1.113     8        16        24          9E9
    2.500   114.005     2.771     2.406     7        37        56          9E9
    3.500   138.392     3.683     2.650     7        44        66          9E9
    4.500   146.700     5.549     3.762    12        71        107         9E9
    5.500   226.565     6.328     2.791     7        72        108         9E9
    6.500   128.648     4.714     3.660     6        49        74          9E9
    7.500    99.974     3.868     3.860     5        48        72        6.650
    8.500    82.343     3.001     3.643     5        39        59        5.456
    9.500    82.971     3.225     3.880     5        40        60        5.501
   10.500    89.705     3.578     3.969     5        43        60        5.967
   11.500   114.050     3.791     3.291     6        44        57          9E9
   12.500   201.954     6.559     3.222     6        78        95          9E9
   13.500   118.309     5.136     4.243    11       116       132          9E9
   14.500    85.467     3.382     3.843     5        42        45        5.807
   15.500    70.861     3.102     4.315     5        34        35        4.727
   16.500    75.931     2.853     3.629     5        38        37        5.172
```

17.500	90.635	3.118	3.298	6	36	34	9E9
18.500	90.739	3.310	3.502	6	36	32	9E9
19.500	82.250	2.930	3.401	6	33	28	9E9
20.500	82.282	3.136	3.658	5	41	34	5.629
21.500	80.400	3.202	3.807	5	40	32	5.518
22.500	66.435	2.609	3.767	5	33	25	4.524
23.500	70.127	2.393	3.291	6	28	21	9E9
24.500	96.006	3.080	3.065	6	38	27	9E9
25.500	104.725	3.614	3.250	6	43	30	9E9
26.500	96.827	3.612	3.502	6	40	27	9E9
27.500	84.233	3.264	3.643	6	34	23	9E9
28.500	73.576	2.838	3.641	5	37	24	5.077
29.500	69.376	2.344	3.212	6	28	18	9E9
30.500	64.675	0.000	0.000	8	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-013.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-013.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500     8.690     0.398     4.586     3         8         12         0.577
    1.500    72.162     0.973     1.349     7        23         35           9E9
    2.500    78.072     2.860     3.661     5        37         56         5.198
    3.500    84.764     3.251     3.830     5        41         62         5.644
    4.500    84.217     3.144     3.727     5        40         60         5.605
    5.500    91.547     3.614     3.943     5        44         66         6.088
    6.500    87.443     3.720     4.249     5        42         63         5.810
    7.500    99.973     4.069     4.066     5        48         72         6.641
    8.500   139.822     6.466     4.622    11       134        201           9E9
    9.500   113.448     4.960     4.364    11       109        162           9E9
   10.500   110.241     4.378     3.963     5        53         73         7.320
   11.500   167.052     7.400     4.426    11       160        205           9E9
   12.500    81.572     3.681     4.502    11        78         93           9E9
   13.500    73.424     2.731     3.709     5        35         39         4.852
   14.500    86.142     2.706     3.134     6        33         35           9E9
   15.500   129.270     4.443     3.429     6        50         51           9E9
   16.500   236.908     9.584     4.038    12       114        110           9E9
```

17.500	81.623	2.610	3.167	6	32	29	9E9
18.500	78.000	2.795	3.549	6	30	26	9E9
19.500	82.619	2.687	3.222	6	32	27	9E9
20.500	93.208	3.277	3.485	6	36	29	9E9
21.500	87.028	2.542	2.890	6	34	27	9E9
22.500	93.604	2.937	3.105	6	36	27	9E9
23.500	89.619	3.347	3.697	5	43	32	5.937
24.500	82.248	2.685	3.228	6	32	23	9E9
25.500	82.418	2.352	2.819	6	32	22	9E9
26.500	133.123	4.492	3.346	6	51	34	9E9
27.500	100.684	3.403	3.302	6	39	26	9E9
28.500	96.257	2.515	2.537	7	32	21	9E9
29.500	101.864	3.095	2.952	6	40	26	9E9
30.500	107.628	3.542	3.196	6	42	27	9E9
31.500	90.950	3.314	3.536	6	36	22	9E9
32.500	84.767	2.957	3.391	6	33	20	9E9
33.500	112.372	4.404	3.854	5	55	33	7.478
34.500	80.048	2.168	2.648	6	31	19	9E9
35.500	78.300	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-014.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                 0.830
"Value for Water Table (in m):           8.180
"Valid Zone Classification based on:     Rf
"Missing unit weight to start depth:     18.860
"Method for calculating Su:              Nkt
"Value of the constant Nkt:              15.000
"Define Zone 6 for Sand Parameters?      YES
"Vertical Flow Gradient, i (- up):       +0.000
"CPT to SPT N60 Conversion:              Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-014.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   140.927     1.040     0.738     9         27        41          9E9
    1.500   107.412     1.615     1.504     8         26        39          9E9
    2.500    51.543     2.484     4.820     4         33        50        3.426
    3.500    51.989     2.439     4.692     4         33        50        3.451
    4.500    48.112     2.132     4.427     4         31        47        3.192
    5.500    71.675     3.895     5.429    11         69        104         9E9
    6.500    70.769     4.728     6.677    11         68        102         9E9
    7.500    95.393     4.872     5.100    11         92        138         9E9
    8.500    69.950     4.188     5.972    11         67        101         9E9
    9.500    57.888     4.209     7.265     3         55        80        3.821
   10.500    63.193     4.097     6.476    11         61        82          9E9
   11.500    82.950     5.380     6.482    11         79        99          9E9
   12.500    75.171     5.470     7.270    11         72        84          9E9
   13.500    93.390     2.660     2.848     6         36        40          9E9
   14.500   123.819     1.339     1.081     8         30        31          9E9
   15.500   119.571     1.744     1.458     8         29        29          9E9
   16.500   132.390     7.159     5.399    11         127       121         9E9
```

17.500	164.300	9.315	5.667	11	157	142	9E9
18.500	183.836	6.739	3.665	12	88	76	9E9
19.500	168.921	3.340	1.977	7	54	45	9E9
20.500	181.071	2.870	1.584	8	43	35	9E9
21.500	156.963	3.948	2.511	7	50	39	9E9
22.500	121.629	4.286	3.521	6	47	35	9E9
23.500	65.680	3.076	4.682	4	42	31	4.279
24.500	62.275	2.723	4.372	5	30	21	4.047
25.500	66.026	2.646	4.005	5	32	22	4.294
26.500	71.488	2.818	3.935	5	34	23	4.661
27.500	137.416	6.698	4.862	11	132	86	9E9
28.500	100.038	6.802	6.774	11	96	62	9E9
29.500	60.196	2.070	3.403	5	29	18	3.929
30.500	63.533	0.000	0.000	8	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-015.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                 0.830
"Value for Water Table (in m):           8.180
"Valid Zone Classification based on:     Rf
"Missing unit weight to start depth:     18.860
"Method for calculating Su:              Nkt
"Value of the constant Nkt:              15.000
"Define Zone 6 for Sand Parameters?      YES
"Vertical Flow Gradient, i (- up):       +0.000
"CPT to SPT N60 Conversion:              Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-015.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   379.876     1.327     0.349    10        61        92          9E9
    1.500    59.930     0.586     0.977     8        14        21          9E9
    2.500    87.843     2.120     2.414     7        28        42          9E9
    3.500   103.125     2.450     2.375     7        33        50          9E9
    4.500    93.047     2.393     2.572     6        36        54          9E9
    5.500    78.850     1.926     2.443     6        30        45          9E9
    6.500    81.553     2.559     3.138     6        31        47          9E9
    7.500    90.112     2.920     3.241     6        35        53          9E9
    8.500   105.217     3.361     3.194     6        40        60          9E9
    9.500   123.640     3.724     3.012     6        47        70          9E9
   10.500   120.826     3.494     2.892     6        46        64          9E9
   11.500    92.583     3.280     3.543     6        35        45          9E9
   12.500    80.236     3.470     4.326     5        38        46        5.296
   13.500    76.175     3.327     4.368     5        36        41        5.022
   14.500    78.527     3.305     4.210     5        38        41        5.174
   15.500    88.295     3.348     3.793     5        42        43        5.821
   16.500    89.868     3.405     3.790     5        43        42        5.922
```

17.500	128.300	4.205	3.278	6	49	46	9E9
18.500	76.419	2.469	3.232	6	29	26	9E9
19.500	78.663	2.849	3.622	5	38	33	5.162
20.500	128.233	5.447	4.249	11	123	102	9E9
21.500	140.630	7.503	5.336	11	135	107	9E9
22.500	97.975	3.688	3.765	5	47	36	6.435
23.500	95.296	2.755	2.891	6	37	27	9E9
24.500	86.346	4.159	4.817	11	83	59	9E9
25.500	120.309	3.566	2.964	6	46	32	9E9
26.500	45.464	2.041	4.491	4	29	20	2.919
27.500	49.574	2.322	4.687	4	32	21	3.188
28.500	48.053	2.622	5.457	3	46	30	3.084
29.500	47.006	2.600	5.531	3	45	29	3.010
30.500	48.757	2.438	4.997	4	31	20	3.125
31.500	52.879	2.673	5.053	4	34	21	3.395
32.500	50.794	2.406	4.729	4	32	20	3.256
33.500	44.500	2.108	4.733	4	28	17	2.829
34.500	40.015	1.634	4.077	4	26	16	2.528
35.500	35.757	1.214	3.386	5	17	10	2.242
36.500	38.830	1.276	3.273	5	19	11	2.445
37.500	42.205	1.508	3.560	5	20	12	2.667
38.500	40.206	1.767	4.379	4	26	15	2.528
39.500	38.030	1.519	3.982	5	18	10	2.378
40.500	36.253	1.020	2.801	6	14	8	9E9
41.499	49.416	1.497	3.017	6	19	11	9E9
42.499	51.021	1.691	3.298	5	25	14	3.241
43.499	51.068	1.650	3.215	6	20	11	9E9
44.499	55.224	1.810	3.263	6	21	11	9E9
45.499	41.455	1.286	3.084	5	20	11	2.590
46.499	43.035	1.372	3.169	5	21	11	2.692
47.499	38.311	1.378	3.573	5	18	9	2.373
48.499	31.963	0.998	3.100	5	15	8	1.944
49.499	34.783	0.813	2.317	6	13	7	9E9
50.499	36.050	0.000	0.000	8	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-016.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-016.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500     8.887     0.190     2.132     4         6         9         0.591
    1.500   164.118     1.265     0.771     9        31        47           9E9
    2.500    41.629     1.340     3.217     5        20        30         2.767
    3.500    24.553     0.986     4.021     4        16        24         1.621
    4.500    13.319     0.583     4.376     3        13        20         0.870
    5.500    15.108     0.672     4.457     3        14        21         0.983
    6.500    15.995     0.738     4.620     3        15        23         1.038
    7.500    16.718     1.031     6.167     3        16        24         1.083
    8.500    15.524     0.901     5.807     3        15        23         1.000
    9.500    18.986     1.054     5.553     3        18        27         1.226
   10.500    24.020     1.088     4.535     3        23        32         1.556
   11.500    36.229     1.573     4.339     4        23        30         2.369
   12.500    34.611     1.564     4.516     4        22        27         2.257
   13.500    27.440     1.288     4.690     3        26        30         1.775
   14.500    26.250     1.129     4.292     4        17        18         1.693
   15.500    29.431     1.415     4.802     3        28        29         1.900
   16.500    32.344     1.463     4.506     4        21        21         2.096
```

17.500	52.162	1.926	3.671	5	25	23	3.426
18.500	37.606	1.156	3.030	5	18	16	2.466
19.500	34.325	0.831	2.371	6	13	11	9E9
20.500	50.600	1.935	3.773	5	25	21	3.334
21.500	50.465	2.039	3.981	5	25	20	3.325
22.500	29.806	1.403	4.634	3	29	22	1.925
23.500	33.274	1.242	3.666	5	16	12	2.161
24.500	29.741	0.992	3.252	5	15	11	1.933
25.500	34.826	1.309	3.678	5	17	12	2.268
26.500	35.700	1.292	3.529	5	18	12	2.330
27.500	47.638	1.572	3.235	5	23	15	3.126
28.500	60.033	1.823	2.964	6	24	16	9E9
29.500	140.648	6.047	4.268	11	136	88	9E9
30.500	183.204	5.488	2.990	7	59	38	9E9
31.500	49.084	1.940	3.948	5	24	15	3.145
32.500	49.225	1.616	3.275	5	24	15	3.155
33.500	88.976	2.944	3.298	6	34	21	9E9
34.500	47.261	1.757	3.685	5	23	14	3.034
35.500	55.300	2.112	3.767	5	27	16	3.590
36.500	72.974	2.595	3.488	6	29	17	9E9
37.500	93.982	3.685	3.893	5	45	26	6.154
38.500	185.285	4.124	2.225	7	59	34	9E9
39.500	226.781	3.756	1.656	8	54	31	9E9
40.500	355.096	1.548	0.436	10	57	32	9E9
41.499	424.421	1.948	0.459	10	68	38	9E9
42.499	406.726	2.331	0.573	10	65	36	9E9
43.499	266.707	2.683	1.006	9	51	28	9E9
44.499	323.517	2.387	0.738	10	52	28	9E9
45.499	189.944	5.827	3.068	7	61	32	9E9
46.499	179.616	4.590	2.556	7	57	30	9E9
47.499	232.726	2.723	1.168	9	45	23	9E9
48.499	148.657	3.163	2.127	7	47	24	9E9
49.499	74.036	2.257	3.033	6	29	15	9E9
50.499	127.400	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-017.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                 0.830
"Value for Water Table (in m):           8.180
"Valid Zone Classification based on:     Rf
"Missing unit weight to start depth:     18.860
"Method for calculating Su:              Nkt
"Value of the constant Nkt:              15.000
"Define Zone 6 for Sand Parameters?      YES
"Vertical Flow Gradient, i (- up):       +0.000
"CPT to SPT N60 Conversion:              Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-017.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500    13.055     0.365     2.791     5         6         9         0.869
    1.500   153.470     1.518     0.989     9        29        44           9E9
    2.500    56.110     1.288     2.293     6        22        33           9E9
    3.500    38.000     1.179     3.106     5        18        27         2.517
    4.500    36.376     1.086     2.990     5        17        26         2.404
    5.500    44.289     1.502     3.391     5        21        32         2.929
    6.500    45.306     1.475     3.256     5        22        33         2.993
    7.500    40.074     0.628     1.567     7        13        20           9E9
    8.500    35.776     1.592     4.451     4        23        35         2.350
    9.500   111.090     4.320     3.889     5        53        80         7.367
   10.500   143.783     7.394     5.142    11       138       191           9E9
   11.500   120.506     6.116     5.064    11       116       149           9E9
   12.500   110.965     4.722     4.205    11       108       130           9E9
   13.500   110.691     4.628     4.097    11       108       122           9E9
   14.500    91.313     3.943     4.232     5        45        48         6.151
   15.500   110.443     4.669     4.158    11       108       109           9E9
   16.500   106.757     3.845     3.508     6        42        40           9E9
```

17.500	125.300	4.534	3.575	6	49	45	9E9
18.500	103.015	4.374	4.223	11	99	87	9E9
19.500	105.114	4.869	4.571	11	102	86	9E9
20.500	74.246	3.947	5.292	11	71	58	9E9
21.500	44.200	2.214	4.997	3	42	33	2.863
22.500	38.205	1.888	4.929	3	37	28	2.458
23.500	36.574	1.553	4.226	4	23	17	2.349
24.500	35.828	1.414	3.909	5	17	12	2.307
25.500	51.125	2.036	3.938	5	25	17	3.337
26.500	44.594	1.782	3.926	5	22	15	2.912
27.500	45.407	1.801	3.900	5	22	14	2.961
28.500	39.873	1.716	4.241	4	26	17	2.576
29.500	45.195	1.979	4.364	4	29	18	2.898
30.500	32.487	1.509	4.633	4	21	13	2.042
31.500	42.907	1.414	3.278	5	21	13	2.741
32.500	126.876	3.044	2.398	7	41	25	9E9
33.500	73.729	2.977	4.029	5	35	21	4.786
34.500	36.445	1.619	4.395	4	24	14	2.309
35.500	32.133	1.436	4.424	4	21	12	2.013
36.500	51.912	2.126	4.038	5	25	15	3.355
37.500	202.882	3.574	1.762	8	49	28	9E9
38.500	257.044	3.891	1.514	8	62	35	9E9
39.500	213.788	2.556	1.196	9	41	23	9E9
40.500	327.816	1.751	0.534	10	52	29	9E9
41.499	397.372	2.066	0.520	10	63	35	9E9
42.499	309.015	2.659	0.861	9	59	32	9E9
43.499	71.023	2.325	3.229	6	28	15	9E9
44.499	66.009	2.532	3.759	5	32	17	4.303
45.499	57.327	1.941	3.268	6	23	12	9E9
46.499	83.121	2.680	3.155	6	33	17	9E9
47.499	214.737	5.413	2.517	7	69	36	9E9
48.499	80.857	2.601	3.118	6	32	16	9E9
49.499	77.589	1.948	2.438	6	31	16	9E9
50.499	77.180	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-018.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                0.830
"Value for Water Table (in m):          8.180
"Valid Zone Classification based on:    Rf
"Missing unit weight to start depth:    18.860
"Method for calculating Su:             Nkt
"Value of the constant Nkt:             15.000
"Define Zone 6 for Sand Parameters?     YES
"Vertical Flow Gradient, i (- up):      +0.000
"CPT to SPT N60 Conversion:             Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-018.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   111.182     1.256     1.130     8         27        41          9E9
    1.500   176.668     3.849     2.179     7         56        84          9E9
    2.500   172.787     5.039     2.915     7         55        83          9E9
    3.500   163.632     5.281     3.225     6         63        95          9E9
    4.500   165.905     3.463     2.086     7         53        80          9E9
    5.500   227.230     5.307     2.334     7         73        110         9E9
    6.500   234.718     5.879     2.503     7         75        113         9E9
    7.500   225.326     6.412     2.843     7         72        108         9E9
    8.500   291.359     8.855     3.037    12         140       210         9E9
    9.500   284.300     6.752     2.374     7         91        137         9E9
   10.500   197.192     8.176     4.140    11         189       264         9E9
   11.500   172.958     6.583     3.798    12         83        108         9E9
   12.500   184.355     5.959     3.224     6         71        86          9E9
   13.500   422.356     7.477     1.769     8         101       115         9E9
   14.500   346.616     8.036     2.317     8         83        90          9E9
   15.500   377.636     7.733     2.046     8         90        92          9E9
   16.500   187.708     8.348     4.441    11         180       176         9E9
```

17.500	251.964	7.728	3.062	12	121	113	9E9
18.500	81.341	3.576	4.383	5	39	35	5.362
19.500	70.378	1.778	2.515	6	27	23	9E9
20.500	72.071	1.969	2.721	6	28	23	9E9
21.500	89.680	3.663	4.059	5	43	34	5.926
22.500	112.512	4.119	3.629	6	43	33	9E9
23.500	112.921	4.900	4.285	11	110	81	9E9
24.500	88.700	4.008	4.448	11	86	61	9E9
25.500	93.928	3.804	3.986	5	46	32	6.255
26.500	96.155	3.997	4.090	5	47	32	6.405
27.500	85.752	3.620	4.153	5	42	28	5.695
28.500	91.276	3.646	3.931	5	44	29	6.064
29.500	96.867	2.903	2.943	6	38	24	9E9
30.500	115.500	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-019.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-019.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500    76.374     0.545     0.714     8         18        27          9E9
    1.500    62.191     1.062     1.707     7         20        30          9E9
    2.500    37.255     1.380     3.705     5         18        27        2.473
    3.500    24.524     1.684     6.863     3         23        35        1.621
    4.500    23.384     1.444     6.177     3         22        33        1.540
    5.500    30.064     1.245     4.143     4         19        29        1.981
    6.500    66.531     2.939     4.415     5         32        48        4.411
    7.500    69.405     3.287     4.727     4         44        66        4.605
    8.500    66.120     3.898     5.891    11         63        95          9E9
    9.500    51.442     2.949     5.721     3         49        73        3.397
   10.500    38.957     2.331     5.970     3         37        51        2.559
   11.500    36.923     1.928     5.201     3         36        46        2.424
   12.500    39.993     1.885     4.684     4         26        31        2.631
   13.500    44.250     1.991     4.457     4         29        33        2.922
   14.500    42.807     2.044     4.721     4         28        30        2.825
   15.500    38.071     1.821     4.735     4         25        26        2.500
   16.500    41.571     2.235     5.324     3         40        39        2.730
```

17.500	38.527	2.058	5.293	3	37	34	2.519
18.500	42.529	2.060	4.771	4	28	25	2.802
19.500	53.640	2.338	4.253	5	26	22	3.583
20.500	56.650	2.539	4.356	5	28	23	3.800
21.500	60.419	2.416	3.889	5	30	24	4.052
22.500	60.237	2.628	4.247	5	30	23	4.031
23.500	48.579	2.089	4.186	5	24	18	3.228
24.500	67.927	2.797	4.018	5	33	24	4.539
25.500	128.143	4.481	3.420	6	50	35	9E9
26.500	206.981	6.662	3.204	6	80	54	9E9
27.500	250.788	6.600	2.628	7	80	53	9E9
28.500	305.355	6.871	2.245	8	73	48	9E9
29.500	293.974	7.816	2.658	7	94	61	9E9
30.500	149.900	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-020.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-020.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   236.829     1.229     0.519     9        45        68          9E9
    1.500    67.795     1.344     1.982     7        22        33          9E9
    2.500    62.359     2.542     4.071     5        30        45        4.153
    3.500    60.830     3.250     5.339    11        58        87          9E9
    4.500    56.085     1.955     3.482     5        27        41        3.724
    5.500    63.145     2.340     3.701     5        30        45        4.192
    6.500    25.318     1.187     4.684     3        24        36        1.662
    7.500    30.036     1.911     6.356     3        29        44        1.973
    8.500    40.532     2.629     6.479     3        39        59        2.669
    9.500    44.987     2.549     5.652     3        43        64        2.966
   10.500    62.643     2.945     4.682     4        40        55        4.149
   11.500    51.628     2.494     4.816     4        33        42        3.405
   12.500    45.456     2.043     4.476     4        29        35        2.991
   13.500    37.069     1.879     5.050     3        36        41        2.424
   14.500    67.965     3.121     4.585     4        43        46        4.478
   15.500    67.250     3.038     4.503     5        32        33        4.433
   16.500   120.573     3.973     3.291     6        46        45          9E9
```

17.500	71.472	3.687	5.139	11	69	64	9E9
18.500	46.504	1.827	3.888	5	22	20	3.054
19.500	62.255	2.779	4.428	5	30	26	4.102
20.500	155.958	3.884	2.488	7	50	41	9E9
21.500	61.529	3.288	5.307	11	59	47	9E9
22.500	35.800	1.787	4.926	3	35	27	2.324
23.500	35.080	1.991	5.643	3	34	25	2.254
24.500	34.574	1.981	5.704	3	33	24	2.212
25.500	34.378	1.922	5.568	3	33	23	2.194
26.500	33.550	1.855	5.510	3	32	22	2.133
27.500	34.991	1.950	5.556	3	34	23	2.225
28.500	35.758	1.966	5.479	3	34	22	2.272
29.500	35.672	1.762	4.923	3	34	22	2.262
30.500	34.300	0.000	0.000	8	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-021.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-021.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   251.291     5.356     2.131     8         60        90          9E9
    1.500   186.577     5.587     2.994     7         60        90          9E9
    2.500   167.096     4.642     2.777     7         53        80          9E9
    3.500   217.471     5.610     2.579     7         69        104         9E9
    4.500   204.929     6.144     2.995     7         66        99          9E9
    5.500   135.530     3.961     2.920     6         52        78          9E9
    6.500   101.159     3.602     3.558     6         39        59          9E9
    7.500    82.596     3.854     4.664    11         79        119         9E9
    8.500   169.485     7.140     4.205    11         163       245         9E9
    9.500   121.161     5.161     4.245    11         116       173         9E9
   10.500   187.628     8.055     4.284    11         180       247         9E9
   11.500   166.605     6.687     4.006    12         80        102         9E9
   12.500   109.864     6.101     5.522    11         106       126         9E9
   13.500    92.521     4.325     4.657    11         89        99          9E9
   14.500    67.011     3.824     5.680    11         64        67          9E9
   15.500   153.126     5.400     3.521     6         59        59          9E9
   16.500   139.312     4.890     3.505     6         53        51          9E9
```

17.500	94.304	3.451	3.655	6	36	33	9E9
18.500	88.577	4.705	5.291	11	85	74	9E9
19.500	90.088	4.773	5.286	11	87	73	9E9
20.500	105.255	5.118	4.844	11	101	81	9E9
21.500	58.104	2.957	5.071	4	37	29	3.795
22.500	74.143	3.549	4.774	11	71	53	9E9
23.500	113.735	5.269	4.621	11	109	79	9E9
24.500	53.370	0.799	1.494	7	17	12	9E9
25.500	49.012	1.149	2.343	6	19	13	9E9
26.500	39.133	2.993	7.624	3	38	25	2.503
27.500	89.238	4.728	5.277	11	86	56	9E9
28.500	160.755	4.825	2.998	6	62	40	9E9
29.500	108.711	6.682	6.083	11	105	66	9E9
30.500	106.065	5.281	4.901	11	103	64	9E9
31.500	91.769	4.729	5.062	11	89	54	9E9
32.500	68.722	4.482	6.455	11	67	40	9E9
33.500	95.859	5.275	5.477	11	92	55	9E9
34.500	121.694	6.894	5.607	11	118	69	9E9
35.500	140.538	6.664	4.629	11	138	80	9E9
36.500	158.511	8.446	5.185	11	156	89	9E9
37.500	145.847	7.892	5.334	11	142	80	9E9
38.500	285.690	7.940	2.773	12	137	76	9E9
39.500	286.568	11.554	4.004	12	138	76	9E9
40.500	162.239	6.507	3.920	12	79	43	9E9
41.499	101.228	4.280	4.158	5	49	26	6.681
42.499	149.867	5.782	3.848	12	72	38	9E9
43.499	163.967	8.416	5.128	11	157	82	9E9
44.499	76.544	3.371	4.395	5	37	19	4.919
45.499	73.388	3.589	4.878	11	70	36	9E9
46.499	79.082	3.434	4.330	5	38	19	5.084
47.499	83.341	4.065	4.869	11	80	40	9E9
48.499	53.011	2.426	4.560	4	34	17	3.335
49.499	50.400	2.166	4.284	4	32	16	3.155
50.499	47.778	1.848	3.855	5	23	12	2.976
51.499	49.488	1.923	3.872	5	24	12	3.087
52.499	57.506	2.254	3.907	5	28	14	3.618
53.499	67.250	2.622	3.887	5	32	16	4.265
54.499	69.444	2.945	4.226	5	33	17	4.410
55.499	69.139	2.781	4.007	5	33	17	4.385
56.499	68.250	2.745	4.008	5	33	17	4.322
57.499	67.067	2.882	4.283	5	32	16	4.237
58.499	63.017	2.763	4.368	5	30	15	3.963
59.499	61.541	2.573	4.165	5	30	15	3.862
60.499	60.476	2.662	4.384	5	29	15	3.786
61.499	61.795	2.681	4.323	5	30	15	3.870
62.499	60.616	2.569	4.220	5	29	15	3.790
63.499	60.039	2.588	4.293	5	29	15	3.744
64.499	61.088	2.702	4.408	5	29	15	3.809
65.499	64.338	2.812	4.355	5	31	16	4.023
66.499	59.856	2.406	4.001	5	29	15	3.722
67.499	56.130	2.022	3.583	5	27	14	3.471
68.499	55.763	1.577	2.811	6	21	11	9E9
69.499	84.035	2.424	2.869	6	32	16	9E9
70.499	120.389	4.682	3.868	6	46	23	9E9
71.499	130.095	5.599	4.280	11	125	63	9E9
72.499	219.578	8.697	3.948	12	106	53	9E9
73.499	229.250	9.443	4.092	12	111	56	9E9
74.499	194.512	10.863	5.537	11	188	94	9E9
75.499	220.735	11.230	5.074	11	212	106	9E9
76.499	194.170	8.394	4.296	11	187	94	9E9
77.499	145.127	8.166	5.535	11	141	71	9E9
78.499	574.674	7.996	1.388	9	110	55	9E9
79.499	143.213	4.807	3.332	6	55	28	9E9

80.499	144.700	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-022.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-022.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500    89.205     1.026     1.150     8        21        32          9E9
    1.500    68.000     2.436     3.581     5        33        50        4.528
    2.500   109.750     2.343     2.135     7        35        53          9E9
    3.500   114.340     4.377     3.825     6        44        66          9E9
    4.500   152.788     6.153     4.025    11        146       219         9E9
    5.500   139.033     5.640     4.054    11        133       200         9E9
    6.500    88.460     4.601     5.192    11        85        128         9E9
    7.500    94.158     5.510     5.850    11        90        135         9E9
    8.500    97.062     5.493     5.656    11        93        140         9E9
    9.500    85.552     5.692     6.649    11        82        119         9E9
   10.500   104.658     5.532     5.277    11        100       134         9E9
   11.500   109.190     5.667     5.178    11        105       130         9E9
   12.500    99.913     5.273     5.256    11        96        112         9E9
   13.500   105.100     5.797     5.511    11        101       111         9E9
   14.500   101.043     4.566     4.512    11        97        100         9E9
   15.500   110.861     4.793     4.313    11        106       104         9E9
   16.500    96.718     4.459     4.574    11        93        87          9E9
```

17.500	115.520	5.676	4.902	11	111	99	9E9
18.500	122.940	6.142	4.988	11	118	101	9E9
19.500	92.105	5.438	5.903	11	88	72	9E9
20.500	84.953	4.878	5.740	11	81	64	9E9
21.500	105.559	4.883	4.625	11	101	77	9E9
22.500	98.930	5.415	5.469	11	95	70	9E9
23.500	170.250	6.222	3.653	12	82	58	9E9
24.500	132.889	7.046	5.295	11	127	87	9E9
25.500	181.659	7.380	4.058	12	87	58	9E9
26.500	161.346	7.254	4.492	11	155	100	9E9
27.500	122.000	5.665	4.637	11	117	74	9E9
28.500	114.650	4.691	4.085	11	110	68	9E9
29.500	154.332	6.238	4.036	11	148	91	9E9
30.500	174.577	7.901	4.519	11	167	101	9E9
31.500	142.045	7.030	4.918	11	137	82	9E9
32.500	178.595	6.589	3.683	12	86	51	9E9
33.500	122.485	5.731	4.675	11	117	68	9E9
34.500	125.595	4.594	3.655	6	48	27	9E9
35.500	168.600	0.000	0.000	9	9E9	9E9	9E9

```
"
"Output file from CPTINT - Version 5.2
"=====================================
"INPUT FILE: c:\temp\CPT-023.CSV
"-------------------------------
"
"Developed by: UBC In-Situ Testing FREEWARE
"     Program: Piezocone Interpretation
"    Web Site: www.civil.ubc.ca/home/in-situ
"
"Interpreter Name:
"
"
"SUMMARY SHEET
"-------------
"'a' for calculating Qt:                  0.830
"Value for Water Table (in m):            8.180
"Valid Zone Classification based on:      Rf
"Missing unit weight to start depth:      18.860
"Method for calculating Su:               Nkt
"Value of the constant Nkt:               15.000
"Define Zone 6 for Sand Parameters?       YES
"Vertical Flow Gradient, i (- up):        +0.000
"CPT to SPT N60 Conversion:               Robertson & Campanella
"
"Soil Behavior Type Zone Numbers
"For Rf Zone & Bq Zone Classification
"------------------------------------
"Zone #1=Sensitive fine grained     Zone #7 =Sand with some Silt
"Zone #2=Organic material           Zone #8 =Fine sand
"Zone #3=Clay                       Zone #9 =Sand
"Zone #4=Silty clay                 Zone #10=Gravelly sand
"Zone #5=Clayey silt                Zone #11=Very stiff fine grained *
"Zone #6=Sandy silt                 Zone #12=Sand to clayey sand *
"   * Overconsolidated and/or cemented
"
"NOTE:
"-----
"For soil classification, Rf values > 8 are assumed to be 8.
"
"( Note: 9E9 means Out Of Range )
"
NPUT FILE: c:\temp\CPT-023.CSV  |-------------------------------------------------
" Depth     Qc(avg)   Fs(avg)   Rf        Rf Zone   Spt N     Spt N1    Su
" (feet)    (TSF)     (TSF)     (%)       (zone #)  (blow/ft) (blow/ft) (TSF)
"-----------------------------------------------------------------------------------
    0.500   551.427     6.225     1.128     9         106       159         9E9
    1.500   194.084     1.677     0.864     9         37        56          9E9
    2.500   141.368     3.792     2.682     7         45        68          9E9
    3.500   259.395    10.132     3.904    12         124       186         9E9
    4.500   297.442     9.969     3.351    12         142       213         9E9
    5.500   249.989     8.430     3.371    12         120       180         9E9
    6.500   189.088     9.675     5.115    11         181       272         9E9
    7.500   171.774     8.321     4.843    11         165       248         9E9
    8.500   257.996    10.627     4.118    12         124       186         9E9
    9.500   254.620    11.560     4.539    11         244       351         9E9
   10.500   229.160     9.897     4.317    11         220       292         9E9
   11.500   249.228     9.733     3.905    12         119       147         9E9
   12.500   238.635     8.802     3.687    12         114       132         9E9
   13.500   302.200     8.303     2.747    12         145       158         9E9
   14.500   250.982    11.844     4.715    11         241       248         9E9
   15.500   309.494    12.343     3.985    12         148       145         9E9
   16.500   298.735    12.389     4.140    12         143       133         9E9
```

17.500	260.971	12.337	4.725	11	250	222	9E9
18.500	195.124	10.942	5.605	11	187	159	9E9
19.500	195.183	9.226	4.725	11	187	153	9E9
20.500	161.119	8.796	5.458	11	154	121	9E9
21.500	196.312	9.998	5.092	11	188	142	9E9
22.500	138.135	7.506	5.433	11	132	97	9E9
23.500	185.667	9.702	5.224	11	178	126	9E9
24.500	160.894	7.987	4.963	11	154	105	9E9
25.500	109.859	5.249	4.778	11	105	70	9E9
26.500	106.900	5.804	5.429	11	102	66	9E9
27.500	116.963	5.829	4.983	11	112	71	9E9
28.500	104.041	5.078	4.881	11	100	62	9E9
29.500	74.650	3.187	4.269	5	36	22	4.845
30.500	127.521	6.530	5.120	11	122	74	9E9
31.500	115.444	4.479	3.880	5	55	33	7.557
32.500	108.300	4.419	4.081	5	52	31	7.076
33.500	77.894	3.812	4.894	11	75	44	9E9
34.500	84.053	3.874	4.608	11	81	46	9E9
35.500	82.133	0.000	0.000	9	9E9	9E9	9E9

APPENDIX D

Laboratory Test Results

Boring No.	Sample No.	Sample Depth (ft)	Geologic Unit	USCS	Type of Sampler	Blow Count	Water Content (%)	Dry Density (pcf)	Particle-Size Analysis[1] (%)			Atterberg's Limits[2]			Compaction		Expansion Index	R Value	Undrained Shear Strength (ksf)	Direct Shear Test[4]		Consolidation Test[5]		Corrosion Tests			
									G	S	F	LL	PL	PI	Max. Dry Density (pcf)	OMC[3] (%)				Friction Angle (°)	Cohesion (psf)	C_{ce}	C_{re}	pH	Resistivity (ohm-cm)	Chlorides (ppm[6])	Sulfates (ppm)
A-08-001	D-1	5	Qvof	s(CL)	RING	74			0	43	57									33	0						
	S-2	10	Qvof	s(CL)	SPT	88/11"			0	41	59																
	D-3	15	Qvof	SM	RING	50/5"	4.4	108.4																			
	D-5	25	Qvof	SP-SM	RING	83			0	93	7									34	0						
	S-6	30	Qvof	SW-SM	SPT	26			2	88	10																
	BAG-1	0 - 7	Qvof	s(CL)	BULK		8.5		1	48	51				122.5	11								7.55	1525	77	40
A-08-002	D-1	5	Qvof	s(CL)	RING	34																					
	S-2	10	Qvof	s(CL)	SPT	7			0	30	70																
	D-3	15	Qvof	CH	RING	45	15.7	109.7				60	26	34								0.1	0.03				
	S-4	20	Qvof	s(CL)	SPT	20			0	49	51	28	15	13													
	BAG-1	2 - 7	Qvof	s(CL)	BULK		7.5		0	42	58	32	17	15	120.5	12	50	45		27	420			6.93	1100	76	71
A-08-003	D-1	5	Qvof	s(CL-ML)	RING	57			0	38	62									32	80						
	S-2	10	Qvof	SM	SPT	19			2	81	17																
	D-3	15	Qvof	SM	RING	89	4.5	109.6																			
	S-6	30	Qvof	s(CL)	SPT	27						43	19	24													
	BAG-1	0 - 7	Qvof	s(CL)	BULK		9.3		1	41	58				117	13.5								7.53	1315	55	73
A-08-004	D-1	5	Qvof	(SW-SM)g	RING	50/4"			37	54	9									54	0						
	S-2	10	Qvof	SC	SPT	34			13	38	49																
	S-4	20	Qvof	s(CL)	SPT	28			0	39	61																
	D-5	25	Qvof	(CL)s	RING	93/8"			0	19	81									29	900						
	BAG-1	0 - 7	Qvof	(SP-SM)g	BULK		3.4		21	72	7	NP	NP	NP	124.5	9.5	0			41	250			7.9	10080	31	77
A-08-005	D-1	5	Qvof	s(ML)	RING	50/4"			0	49	51									42	0						
	S-2	10	Qvof	(GM)s	SPT	98/11"			41	38	21																
	D-3	15	Qvof	SM	RING	87/11"						NP	NP	NP						37	0						
	S-4	20	Qvof	s(CL)	SPT	42			0	34	66	41	21	20													
	D-5	25	Qvof	CL	RING	50/5"						37	17	20						32	1400						
	BAG-1	0 - 7	Qvof	s(CL)	BULK		3.7		1	48	51				114.5	13.5				29	400			7.46	1218	42	60
A-08-007	D-1	5	Qvof	SM	RING	66			0	86	14									38	0						
	S-2	10	Qvof	SM	SPT	41			0	83	17																
A-08-008	D-1	5	Qvof	(CL)s	RING	52	22.0	107.2												39	750	0.06	0.019				
	S-2	10	Qvof	CH	SPT	20			0	10	90	75	28	47													
	D-3	15	Qvof	CL	RING	50/4"	14.1	119.4												40	1000						
	S-4	20	Qvof	SM	SPT	50			0	63	37																
	D-5	25	Qvof	CL	RING	50/6"	22.5	102.5	0	2	98																
	BAG-1	0 - 7	Qvof	(CH)s	BULK		4.7		0	15	85	56	22	34	113	13.5	102			27	80			8.05	1070	31	95
A-08-009	D-1	5	Qvof	SC-SM	RING	77			1	50	49									44	0						
	S-2	10	Qvof	s(CL)	SPT	32			1	49	50																
	D-3	15	Qvof	s(CL)	RING	50/4"	9.3	121.5																			
	D-5	25	Qvof	s(CL-ML)	RING	78	12.7	110.4	3	44	53																
	BAG-1	0 - 7	Qvof	SC	BULK		8.2		5	50	45				121	11		45						7.86	1140	76	108
A-08-010	S-2	10	Af	SM	SPT	13			0	58	42																
	D-3	15	Qvof	CL	RING	73						31	17	14						31	850						
	S-4	20	Qvof	s(CL)	SPT	22			0	49	51	33	17	16													
	D-5	25	Qvof	SC	RING	42													12.2								
	BAG-1	0 - 7	Af	SC	BULK		4.9		3	53	44	33	16	17	122.5	10.5	34			33	190			7.82	1012	116	121
A-08-011	D-1	5	Qvof	SM	RING	14			0	78	22									35	100						
	D-3	15	Qvof	SC-SM	RING	53			0	64	36									35	250						
	S-4	20	Qvof	SM	SPT	14	4.1																				
	D-5	25	Qvof	SM	RING	63	4.7	102.3																			
	S-6	30	Qvof	CL	SPT	28	16.9					46	18	28													
	BAG-1	0 - 7	Qvof	SC	BULK		12.2		2	55	43				121.5	10				28	500			7.48	1410	34	84

Boring No.	Sample No.	Sample Depth (ft)	Geologic Unit	USCS	Type of Sampler	Blow Count	Water Content (%)	Dry Density (pcf)	Particle-Size Analysis[1] (%)			Atterberg's Limits[2]			Compaction		Expansion Index	R Value	Undrained Shear Strength (ksf)	Direct Shear Test[4]		Consolidation Test[5]		Corrosion Tests			
									G	S	F	LL	PL	PI	Max. Dry Density (pcf)	OMC[3] (%)				Friction Angle (°)	Cohesion (psf)	C_{ce}	C_{re}	pH	Resistivity (ohm-cm)	Chlorides (ppm[6])	Sulfates (ppm)
A-08-012	S-2	10	Qvof	CH	SPT	18	21.7		0	10	90	67	26	41													
	D-3	15	Qlh	Claystone	RING	50/6"	12.9	107				42	21	21						43	0						
	S-4	20	Qlh	Claystone	SPT	37	20.6																				
	D-5	25	Qlh	Claystone	RING	50/4"						53	23	30					13.8								
	D-7	35	Qlh	Claystone	RING	86	16.8	117				41	18	23						31	2000	0.11	0.02				
	D-9	45	Qlh	Claystone	RING	50/5"	18.6	113				46	20	26													
	D-11	55	Qlh	Claystone	RING	50/5"	16.0	117.5				36	17	19													
	D-13	65	Qlh	Claystone	RING	50/4"	18.1	113.5				50	20	30													
	BAG-1	35 - 40	Qvof	Claystone	BULK		9.4					44	17	27			71							7.88	484	453	41
A-08-013	D-1	5	Qlh	Claystone	RING	61	20.7	107.2																			
	S-2	10	Qlh	Claystone	SPT	38	17.1					48	20	28													
	D-3	15	Qlh	Claystone	RING	50/5"	23.8	103.2				69	31	38						43	200						
	S-4	20	Qlh	Claystone	SPT	53	14.4																				
	D-5	25	Qlh	Claystone	RING	95/9"						49	23	26						21	3500						
	S-6	30	Qlh	Claystone	SPT	40	19.2		0	13	87																
	D-7	35	Qlh	Claystone	RING	50/5"	19.0	111.8				52	22	30						31	2100	0.1	0.03				
	S-8	40	Qlh	Claystone	SPT	26	24.5																				
	D-9	45	Qlh	Claystone	RING	50/4"													11.7								
	S-10	50	Qlh	Claystone	SPT	34	19.0																				
	D-11	55	Qlh	Claystone	RING	50/4"						32	20	12						33	650						
	S-12	60	Qlh	Claystone	SPT	34			0	41	59	36	19	17													
	S-14	70	Qlh	Claystone	SPT	53						38	20	18													
	BAG-1	15 - 20	Qlh	Claystone	BULK		11.2					64	23	41			116							7.83	606	180	46
	BAG-2	25 - 30	Qlh	Claystone	BULK		6.0					55	20	35			89							8.17	1079	64	96
A-08-014	D-1	5	Qvof	(SP)g	RING	50/2"	8.1	78																			
	S-2	10	Qvof	(SM)g	SPT	64	12.3																				
	D-3	15	Qvof	SP-SM	RING	50/3"														51	0						
	S-4	20	Qvof	CL	SPT	36	19.9		0	10	90																
	S-6	30	Qvof	CH	SPT	33	24.1					64	24	40													
	BAG-1	0 - 7	Qvof	SC	BULK		7.6		8	51	41				120.5	11				34	0			7.19	1180	87	85
A-08-015	D-1	5	Af	CH	RING	32			0	5	95	60	27	33						37	200						
	S-2	10	Qvof	CL	SPT	25	14.7																				
	D-3	15	Qvof	CL	RING	50/5"						37	20	17						49	300						
	S-4	20	Qvof	s(CL)	SPT	36	14.2					36	21	15													
	D-5	25	Qvof	CH	RING	73	22.5	105.5				69	27	42								0.07	0.03				
	S-6	30	Qvof	CH	SPT	22	21.9																				
	BAG-1	0 - 7	Af	(CL)s	BULK		8.0					47	21	26	112	13.5	85			38	0			7.96	860	54	43
A-08-016	D-1	5	Af	CL	RING	40	12.8	120.5																			
	S-2	10	Af	s(CL)	SPT	15	12.6					34	17	17													
	D-3	15	Af	(CL)s	RING	54	16.3	111.1				48	19	29						35	800						
	S-4	20	Af	CL	SPT	21	17.2																				
	D-5	25	Af	(CL)s	RING	74						32	16	16						32	900						
	S-6	30	Af	CL	SPT	18	16.7																				
	D-7	35	Qyf	CL	RING	44													2.3								
	S-8	40	Qyf	CL	SPT	13	18.3																				
	D-9	45	Qyf	CL	RING	28						48	15	33						14	1300						
	S-10	50	Qyf	CL	SPT	9	26.0																				
	D-11	55	Qyf	(CL)s	RING	9	28.4	97.2	0	28	72	37	18	19													
	S-12	60	Qyf	s(CL)	SPT	5	24.2		0	42	58	34	17	17													
	D-13	65	Qvof	SC	RING	68						37	21	16						29	500						
	S-14	70	Qvof	s(CL)	SPT	46	22.9		2	41	57	31	21	10													

Boring No.	Sample No.	Sample Depth (ft)	Geologic Unit	USCS	Type of Sampler	Blow Count	Water Content (%)	Dry Density (pcf)	Particle-Size Analysis[1] (%)			Atterberg's Limits[2]			Compaction		Expansion Index	R Value	Undrained Shear Strength (ksf)	Direct Shear Test[4]		Consolidation Test[5]		Corrosion Tests			
									G	S	F	LL	PL	PI	Max. Dry Density (pcf)	OMC[3] (%)				Friction Angle (°)	Cohesion (psf)	C_{ce}	C_{re}	pH	Resistivity (ohm-cm)	Chlorides (ppm[6])	Sulfates (ppm)
	D-15	75	Qvof	CL	RING	50/3"													6.3								
	S-16	80	Qvof	CL	SPT	56	23.1																				
	BAG-1	15 - 20	Af	(CL)s	BULK		6.3								117.5	11				28	200			7.22	660	214	79
	BAG-2	25 - 30	Af	(CL)s	BULK		4.7																	7.86	720	168	82
	D-2	10	Qyf	(CL)s	RING	32	22.0	104.2				38	20	18						26	900						
	D-4	20	Qyf	(CL)s	RING	51						36	23	13													
	D-6	30	Qyf	CH	RING	32	24.6	100.5				55	25	30					4.7								
	D-8	40	Qvof	CL	RING	64	22.7	106.1				47	25	22						30	400						
A-08-017	D-10	50	Qvof	CH	RING	50/4"	22.0	105.1				51	21	30					8.6								
	D-12	60	Qvof	CL	RING	82/11"	23.5	102.9																			
	D-14	70	Qvof	CL	RING	68/11"	24.4	100.2																			
	S-15	75	Qvof	CH	SPT	29						54	26	28													
	D-16	80	Qvof	CL	RING	50/6"	26.0	97.8																			
	D-1	5	Af	s(CL)	RING	36	16.3	115.6																			
A-08-018	S-2	10	Af	s(CL)	SPT	12			0	46	54	34	17	17													
	BAG-1	0 - 7	Af	s(CL)	BULK				0	47	53	32	15	17	118	9.5	37	20		29	150						
	D-1	5	Qvof	(CL)s	RING	50/5"			1	25	74									51	0						
	S-2	10	Qvof	SP-SM	SPT	58			0	92	8																
A-08-021	D-3	15	Qvof	SP-SM	RING	50/5"	3.3	96.5	0	94	6																
	D-5	25	Qvof	SC	RING	62	17.7	116.1	0	55	45	31	16	15													
	BAG-1	2 - 7	Qvof	s(CL)	BULK		14.8		2	28	70	44	20	24	109.5	13.5								8.02	705	94	68
	D-1	5	Af	SC	RING	70			0	57	43									39	950						
	S-2	10	Af	SC	SPT	29			1	59	40																
	D-3	15	Qvof	SM	RING	50/6"	8.5	111	0	74	26																
A-08-022	S-4	20	Qvof	s(CL)	SPT	19	18.5					44	18	26													
	D-5	25	Qvof	SM	RING	50/4"	6.2	100.6																			
	S-6	30	Qvof	s(CL)	SPT	35	13.8																				
	BAG-1	2 - 7	Af	SC	BULK		6.6		1	52	47	30	16	14	119.5	9		44						8.22	1075	107	150
	D-1	5	Af	s(CL)	RING	83			11	30	59	31	19	12													
	D-3	15	Af	s(ML)	RING	50/5"	10.1	116.3																			
	S-4	20	Af	SC	SPT	27			2	56	42																
	D-5	25	Af	SC	RING	87						34	19	15						37	1000						
	D-7	35	Qvof	(CL-ML)s	RING	31						22	15	7					2.2								
A-08-023	D-9	45	Qvof	SM	RING	50/6"			0	67	33									45	0						
	S-10	50	Qvof	SP-SM	SPT	50/6"			1	92	7																
	D-11	55	Qvof	CL	RING	75						40	19	21					7.1								
	D-13	65	Qvof	CL	RING	50/6"														16	2300						
	D-15	75	Qvof	CL	RING	82						39	16	23					5.7								
	BAG-1	20 - 25	Af	SC	BULK		13.6					32	17	15										8.14	1615	46	81
	D-1	5	Af	s(CL)	RING	50/6"			4	30	66									47	900						
	S-2	10	Af	SC	SPT	26	10.1		6	50	44																
	D-3	15	Af	SM	RING	94/11"	8.7	120.2																			
A-08-024	S-4	20	Af	SC	SPT	27	12.3																				
	D-5	25	Af	s(ML)	RING	90/9"	10.6	117.2																			
	S-6	30	Af	SC	SPT	35	14.7		3	54	43																
	BAG-1	2 - 7	Af	(CL)s	BULK		13.0		2	24	74	43	20	23	113	11	69			27	0			7.19	575	115	251
	D-1	5	Af	(CL)s	RING	78	14.8	118.2	1	21	78	43	19	24													
	D-3	15	Af	CL	RING	62	18.7	113.2																			
	S-4	20	Af	CL	SPT	20	15.4					38	18	20													
	D-5	25	Af	CL	RING	51						49	21	28						29	1250						
	D-7	35	Af	CL	RING	65						47	19	28					6.2								

Boring No.	Sample No.	Sample Depth (ft)	Geologic Unit	USCS	Type of Sampler	Blow Count	Water Content (%)	Dry Density (pcf)	Particle-Size Analysis[1] (%)			Atterberg's Limits[2]			Compaction		Expansion Index	R Value	Undrained Shear Strength (ksf)	Direct Shear Test[4]		Consolidation Test[5]		Corrosion Tests			
									G	S	F	LL	PL	PI	Max. Dry Density (pcf)	OMC[3] (%)				Friction Angle (°)	Cohesion (psf)	C_{ce}	C_{re}	pH	Resistivity (ohm-cm)	Chlorides (ppm[6])	Sulfates (ppm)
A-08-025	S-8	40	Af	CL	SPT	15	18.2																				
	D-9	45	Qvof	(SW-SM)g	RING	50/6"			44	49	7									55	170						
	D-11	55	Qvof	s(CL)	RING	36						28	18	10					8.9								
	D-13	65	Qvof	s(CL)	RING	50/6"			3	44	53									38	130						
	D-15	75	Qvof	s(CL)	RING	50/4"						32	16	16					10.8								
	BAG-1	20 - 25	Qvof	CL	BULK		8.3					44	19	25										7.79	742	76	148
	BAG-2	25 - 30	Qvof	CL	BULK		16.1					44	17	27										7.96	980	83	83
A-08-026	S-3	15	Qvof	(SM)g	SPT	92/11"			27	51	22																
	D-4	20	Qvof	CL	RING	62						41	18	23													
	S-5	25	Qvof	s(CL)	SPT	28			0	45	55																
	D-6	30	Qvof	CL	RING	50/4"	13.1	122.43				33	18	15						41	0						
	D-8	40	Qvof	SC	RING	45	16.9	111.83	4	54	42									35	0						
	D-10	50	Qvof	CL	RING	36	32.2	90.4				37	23	14					0.8								
	D-12	60	Qvof	CL	RING	56/9"	24.6	101.9												27	230	0.09	0.01				
	S-13	65	Qvof	SP-SM	SPT	64			0	89	11																
	D-14	70	Qvof	CL	RING	50/4"	20.0	109.6																			
	S-15	75	Qvof	(CL)s	SPT	25						34	18	16													
	D-16	80	Qvof	CL	RING	96/11"	16.2	116.2																			
	BAG-1	5 - 10	Qvof	s(CL)	BULK		12.7		2	31	67	41	20	21										7.87	780	57	127
A-08-027	S-2	10	Af	SC-SM	SPT	37			6	51	43																
	D-3	15	Af	s(CL)	RING	50/6"	9.9	120.1	0	42	58									46	120						
	S-4	20	Af	(SC)g	SPT	39			20	38	42	32	19	13													
	D-5	25	Af	s(CL)g	RING	50/6"	13.3	117.7												25	1150						
	BAG-1	0 - 7	Af	s(CL)	BULK		10.7		8	39	53	36	17	19	122	11	63			30	150			7.32	860	78	216
A-08-028	D-1	5	Af	(CL)s	RING	78			1	24	75																
	S-2	10	Af	s(CL)	SPT	33			0	36	64	42	20	22													
	D-3	15	Af	SC	RING	50/5"	12.3	116.4	2	50	48									53	0						
	S-4	20	Af	SC	SPT	44			14	41	45	32	18	14													
	D-5	25	Af	CL	RING	91/11"	14.3	115.3																			
	BAG-1	0 - 7	Af	s(CL)g	BULK		8.7		16	23	61	40	19	21	117.5	10.5		21		24	250			7.8	1079	66	41
A-08-030	D-1	5	Qvof	(CH)s	RING	80						50	19	31													
	D-3	15	Qvof	SC	RING	50/3"														41	200						
	S-4	20	Qvof	SC	SPT	36			0	58	42																
	D-5	25	Qvof	SC	RING	50/5"	11.1	110.7																			
	S-6	30	Qvof	s(CL)	SPT	33						41	21	20													
	D-7	35	Qvof	(CL)s	RING	50/5"			0	15	85	47	24	23					6.7								
	S-8	40	Qvof	s(CL)	SPT	46			0	30	70	35	18	17													
	D-9	45	Qvof	s(CL)	RING	50/5"	16.6	106.1												34	210						
	D-11	55	Qvof	(CL)s	RING	50/4"			0	15	85									33	910						
	S-12	60	Qvof	s(CL)	SPT	60			2	41	57																
	BAG-2	25 - 30	Qvof	s(CL)	BULK		5.9		1	43	56						40							8.21	1600	74	70

Notes:

1. G = % Gravel, S = % Sand, F = % Fines
2. LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index
3. OMC = Optimum Moisture Content
4. Peak Shear Strength Parameters
5. Consolidation parameters are in terms of the compression and recompression ratios
6. ppm = particle per million

Leighton

MOISTURE CONTENT

ASTM D 2216

Project Name: **SR-57 Widening**
Project No.: **370900.02.GE.0S**

Tested By: S. Felter
Date: 08/07/08
Checked By: LF
Date: 08/12/08

Boring No.	A-08-009	A-08-011	A-08-011	A-08-012	A-08-012
Sample No.	S-4	S-4	S-6	S-2	S-4
Depth (ft)	20	20	30	10	20
Sample Type	SPT	SPT	SPT	SPT	SPT
Sample Description	NO SAMPLE	Brown silty sand (SM)	Brown lean clay (CL)	Olive fat clay (CH)	Olive gray lean clay (CL)
Wt. wet soil + container (g)		200.97	320.37	240.59	288.23
Wt. dry soil + container (g)		194.61	279.74	204.64	245.66
Weight of container (g)		38.36	38.97	38.74	39.47
Moisture Content (%)		**4.1**	**16.9**	**21.7**	**20.6**

Boring No.	A-08-013	A-08-013	A-08-013	A-08-013	A-08-013
Sample No.	S-2	S-4	S-6	S-8	S-10
Depth (ft)	10	20	30	40	50
Sample Type	SPT	SPT	SPT	SPT	SPT
Sample Description	Gray lean clay (CL)	Gray lean clay (CL)	Olive gray lean clay (CL)	Olive lean clay (CL)	Brown lean clay (CL)
Wt. wet soil + container (g)	271.93	331.18	571.35	240.69	277.94
Wt. dry soil + container (g)	237.95	294.37	504.15	201.01	239.80
Weight of container (g)	39.42	38.97	154.60	38.88	38.74
Moisture Content (%)	**17.1**	**14.4**	**19.2**	**24.5**	**19.0**

Leighton

MOISTURE CONTENT

ASTM D 2216

Project Name: **SR-57 Widening**
Project No.: **370900.02.GE.0S**

Tested By: S. Felter
Date: 08/07/08
Checked By: LF
Date: 08/12/08

Boring No.	A-08-014	A-08-014	A-08-014	A-08-015	A-08-015
Sample No.	S-2	S-4	S-6	S-2	S-4
Depth (ft)	10	20	30	10	20
Sample Type	SPT	SPT	SPT	SPT	SPT
Sample Description	Light brown silty sand (SM)	Brown lean clay (CL)	Olive fat clay (CH)	Brown lean clay (CL)	Light olive sandy lean clay s(CL)
Wt. wet soil + container (g)	233.79	239.88	278.81	361.36	331.32
Wt. dry soil + container (g)	212.51	206.59	232.27	320.24	294.89
Weight of container (g)	39.16	39.23	39.21	39.72	38.20
Moisture Content (%)	**12.3**	**19.9**	**24.1**	**14.7**	**14.2**

Boring No.	A-08-015	A-08-016	A-08-016	A-08-016	A-08-016
Sample No.	S-6	S-2	S-4	S-6	S-8
Depth (ft)	30	10	20	30	40
Sample Type	SPT	SPT	SPT	SPT	SPT
Sample Description	Olive gray lean clay (CL)	Brown sandy lean clay s(CL)	Brown lean clay (CL)	Dark brown lean clay (CL)	Dark brown lean clay (CL)
Wt. wet soil + container (g)	262.62	233.85	273.39	274.94	279.04
Wt. dry soil + container (g)	222.42	212.07	238.88	241.05	241.85
Weight of container (g)	38.93	39.10	38.13	38.62	39.07
Moisture Content (%)	**21.9**	**12.6**	**17.2**	**16.7**	**18.3**

Leighton

MOISTURE CONTENT

ASTM D 2216

Project Name: **SR-57 Widening**
Project No.: **370900.02.GE.0S**

Tested By: S. Felter
Date: 08/07/08
Checked By: LF
Date: 08/12/08

Boring No.	A-08-016	A-08-016	A-08-016	A-08-016	A-08-022
Sample No.	S-10	S-12	S-14	S-16	S-4
Depth (ft)	50	60	70	80	20
Sample Type	SPT	SPT	SPT	SPT	SPT
Sample Description	Dark gray lean clay (CL)	Olive sandy lean clay s(CL)	Olive sandy lean clay s(CL)	Olive gray silty / clayey sand (SM/SC)	Brown sandy lean clay s(CL)
Wt. wet soil + container (g)	340.68	359.07	462.05	294.04	320.51
Wt. dry soil + container (g)	278.51	296.78	383.17	246.13	276.65
Weight of container (g)	39.13	38.97	38.84	38.95	38.93
Moisture Content (%)	**26.0**	**24.2**	**22.9**	**23.1**	**18.5**

Boring No.	A-08-022	A-08-024	A-08-024	A-08-024	A-08-025
Sample No.	S-6	S-2	S-4	S-6	S-4
Depth (ft)	30	10	20	30	20
Sample Type	SPT	SPT	SPT	SPT	SPT
Sample Description	Brown lean clay (CL)	Olive gray clayey sand (SC)	Grayish brown clayey sand (SC)	Light gray clayey sand (SC)	Olive brown lean clay (CL)
Wt. wet soil + container (g)	259.09	468.80	278.18	657.52	334.45
Wt. dry soil + container (g)	232.30	439.00	251.85	591.10	295.06
Weight of container (g)	38.38	144.86	38.48	140.70	39.10
Moisture Content (%)	**13.8**	**10.1**	**12.3**	**14.7**	**15.4**

Leighton

MOISTURE CONTENT

ASTM D 2216

Project Name: **SR-57 Widening**
Project No.: **370900.02.GE.0S**

Tested By: S. Felter
Date: 08/07/08
Checked By: LF
Date: 08/12/08

Boring No.	A-08-025				
Sample No.	S-8				
Depth (ft)	40				
Sample Type	SPT				
Sample Description	Dark brown lean clay (CL)				
Wt. wet soil + container (g)	289.47				
Wt. dry soil + container (g)	250.86				
Weight of container (g)	38.95				
Moisture Content (%)	**18.2**				

Boring No.					
Sample No.					
Depth (ft)					
Sample Type					
Sample Description					
Wt. wet soil + container (g)					
Wt. dry soil + container (g)					
Weight of container (g)					
Moisture Content (%)					

Leighton

MOISTURE CONTENT

ASTM D 2216

Project Name: **SR-57 Widening**
Project No.: **370900.02.GE.0S**

Tested By: G. Bathala
Date: 09/04/08
Checked By: LF
Date: 09/10/08

Boring No.	A-08-020				
Sample No.	S-2				
Depth (ft)	10				
Sample Type	SPT				
Sample Description	Olive brown fat clay (CH)				
Wt. wet soil + container (g)	299.36				
Wt. dry soil + container (g)	242.60				
Weight of container (g)	39.27				
Moisture Content (%)	**27.9**				

Boring No.					
Sample No.					
Depth (ft)					
Sample Type					
Sample Description					
Wt. wet soil + container (g)					
Wt. dry soil + container (g)					
Weight of container (g)					
Moisture Content (%)					

Boring No.	A-08-001	A-08-003	A-08-009	A-08-009	A-08-011	A-08-012	A-08-012	A-08-012
Sample No.	D-3	D-3	D-3	D-5	D-5	D-3	D-9	D-11
Depth (ft.)	15.0	15.0	15.0	25.0	25.0	15.0	45.0	55.0
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	Drive
Soil Identification	Light brown silty sand (SM)	Light brown silty sand (SM)	Brown sandy lean clay s(CL)	Olive brown sandy silty clay s(CL-ML)	Light brown silty sand (SM)	Grayish brown lean clay (CL)	Brown lean clay (CL)	Yellow lean clay with sand (CL)s
Pocket Penetrometer (tons/ft^2)	>4.5	>4.5	>4.5	>4.5	>4.5	>4.5	>4.5	>4.5
Weight Soil + Rings / Tube (g)	896.51	1086.12	1218.37	1157.19	1032.38	1131.27	1023.02	1243.61
Weight of Rings / Tube (g)	216.00	259.20	259.20	259.20	259.20	259.20	216.00	259.20
Average Length (in.)	5.00	6.00	6.00	6.00	6.00	6.00	5.00	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)	324.41	194.20	219.33	697.21	177.77	255.15	357.12	368.03
Dry Wt. of Soil + Cont. (g)	312.47	187.55	203.93	643.50	171.57	230.44	307.06	322.50
Weight of Container (g)	39.38	38.83	38.99	220.51	39.09	39.02	38.64	38.81
Container No.								
Wet Density	113.1	114.5	132.8	124.4	107.1	120.8	134.1	136.3
Moisture Content (%)	**4.4**	**4.5**	**9.3**	**12.7**	**4.7**	**12.9**	**18.6**	**16.0**
Dry Density (pcf)	**108.4**	**109.6**	**121.5**	**110.4**	**102.3**	**107.0**	**113.0**	**117.5**
Degree of Saturation (%)	21.2	22.5	65.1	65.0	19.5	60.5	102.5	99.7

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Client Name: CH2M Hill
Tested By: S. Felter Date: 08/04/08

Boring No.	A-08-012	A-08-013	A-08-013	A-08-014	A-08-014	A-08-016	A-08-016	A-08-016
Sample No.	D-13	D-1	D-3	D-1	D-5	D-1	D-3	D-11
Depth (ft.)	65.0	5.0	15.0	5.0	25.0	5.0	15.0	55.0
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	Drive
Soil Identification	Olive brown fat clay (CH)	Olive gray lean clay (CL)	Olive gray fat clay with sand (CH)s and caliche	Brown poorly graded sand with gravel (SP)g and caliche / V LOOSE	NO SAMPLE	Dark brown lean clay (CL)	Yellowish brown lean clay with sand (CL)s	Pale olive lean clay with sand (CL)s
Pocket Penetrometer (tons/ft^2)	>4.5	>4.5	>4.5	0.00		>4.5	>4.5	0.75
Weight Soil + Rings / Tube (g)	1022.74	1193.05	1181.70	867.91		1240.79	1199.32	967.08
Weight of Rings / Tube (g)	216.00	259.20	259.20	259.20		259.20	266.40	216.00
Average Length (in.)	5.00	6.00	6.00	6.00		6.00	6.00	5.00
Average Diameter (in.)	2.416	2.416	2.416	2.416		2.416	2.416	2.416
Wet. Wt. of Soil + Cont. (g)	347.64	200.86	198.08	252.95		210.63	201.23	332.57
Dry Wt. of Soil + Cont. (g)	300.30	173.12	167.49	236.84		191.20	178.59	267.62
Weight of Container (g)	38.88	38.84	38.87	38.88		39.13	39.32	39.31
Container No.								
Wet Density	134.1	129.3	127.8	84.3		135.9	129.2	124.8
Moisture Content (%)	**18.1**	**20.7**	**23.8**	**8.1**		**12.8**	**16.3**	**28.4**
Dry Density (pcf)	**113.5**	**107.2**	**103.2**	**78.0**		**120.5**	**111.1**	**97.2**
Degree of Saturation (%)	100.8	97.4	101.4	18.9		86.6	84.9	104.6

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Client Name: CH2M Hill
Tested By: S. Felter Date: 08/04/08

Boring No.	A-08-021	A-08-021	A-08-022	A-08-022	A-08-023	A-08-024	A-08-024	A-08-025
Sample No.	D-3	D-5	D-3	D-5	D-3	D-3	D-5	D-1
Depth (ft.)	15.0	25.0	15.0	25.0	15.0	15.0	25.0	5.0
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	Drive
Soil Identification	Olive brown poorly graded sand with silt (SP-SM)	Yellowish brown clayey sand (SC)	Brown silty sand (SM)	Brown silty sand (SM)	Olive gray sandy silt s(ML)	Dark olive brown silty sand (SM) with caliche	Light brown sandy silt s(ML)	Olive lean clay with sand (CL)s
Pocket Penetrometer (tons/ft^2)	1.50	4.25	>4.5	3.50	>4.5	>4.5	>4.5	>4.5
Weight Soil + Rings / Tube (g)	978.75	1245.39	940.96	858.81	986.60	1202.94	1195.74	1032.53
Weight of Rings / Tube (g)	259.20	259.20	216.00	216.00	216.00	259.20	259.20	216.00
Average Length (in.)	6.00	6.00	5.00	5.00	5.00	6.00	6.00	5.00
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)	608.32	376.98	655.70	206.14	212.62	215.25	208.09	349.01
Dry Wt. of Soil + Cont. (g)	596.70	326.12	621.57	196.35	196.68	201.09	191.86	309.02
Weight of Container (g)	246.09	38.60	220.59	39.27	38.73	38.26	39.33	38.58
Container No.								
Wet Density	99.7	136.6	120.5	106.8	128.1	130.7	129.7	135.7
Moisture Content (%)	**3.3**	**17.7**	**8.5**	**6.2**	**10.1**	**8.7**	**10.6**	**14.8**
Dry Density (pcf)	**96.5**	**116.1**	**111.0**	**100.6**	**116.3**	**120.2**	**117.2**	**118.2**
Degree of Saturation (%)	12.0	105.6	44.4	24.9	60.7	58.4	65.6	93.8

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Client Name: CH2M Hill
Tested By: S. Felter Date: 08/04/08

Boring No.	A-08-025							
Sample No.	D-3							
Depth (ft.)	15.0							
Sample Type	Drive							
Soil Identification	Olive gray lean clay (CL)							
Pocket Penetrometer (tons/ft^2)	>4.5							
Weight Soil + Rings / Tube (g)	1213.68							
Weight of Rings / Tube (g)	259.20							
Average Length (in.)	6.00							
Average Diameter (in.)	2.416							
Wet. Wt. of Soil + Cont. (g)	204.46							
Dry Wt. of Soil + Cont. (g)	178.38							
Weight of Container (g)	39.21							
Container No.								
Wet Density	132.2							
Moisture Content (%)	**18.7**							
Dry Density (pcf)	**111.3**							
Degree of Saturation (%)	98.4							

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Client Name: CH2M Hill

Tested By: S. Felter Date: 08/04/08

Boring No.	A-08-017	A-08-017	A-08-017	A-08-026	A-08-026			
Sample No.	D-12	D-14	D-16	D-14	D-16			
Depth (ft.)	60.0	70.0	80.0	70.0	80.0			
Sample Type	Drive	Drive	Drive	Drive	Drive			
Soil Identification	Olive brown lean clay (CL)	Olive brown lean clay (CL)	Olive brown lean clay (CL)	Brown lean clay (CL)	Light brown lean clay (CL)			
Pocket Penetrometer (tons/ft^2)	>4.5	>4.5	4.00	4.00	>4.5			
Weight Soil + Rings / Tube (g)	1183.79	1165.92	1156.45	1215.82	1241.23			
Weight of Rings / Tube (g)	266.40	266.40	266.40	266.40	266.40			
Average Length (in.)	6.00	6.00	6.00	6.00	6.00			
Average Diameter (in.)	2.416	2.416	2.416	2.416	2.416			
Wet. Wt. of Soil + Cont. (g)	209.58	201.36	206.99	198.52	218.43			
Dry Wt. of Soil + Cont. (g)	177.06	169.52	172.32	172.03	193.44			
Weight of Container (g)	38.58	38.86	38.93	39.68	38.95			
Container No.								
Wet Density	127.1	124.6	123.3	131.5	135.0			
Moisture Content (%)	**23.5**	**24.4**	**26.0**	**20.0**	**16.2**			
Dry Density (pcf)	**102.9**	**100.2**	**97.8**	**109.6**	**116.2**			
Degree of Saturation (%)	99.3	96.4	97.1	100.4	97.0			

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Client Name: CH2M Hill
Tested By: S. Felter Date: 09/24/08

Boring No.	A-08-018	A-08-008	A-08-008	A-08-027	A-08-027	A-08-028	A-08-028	A-08-030
Sample No.	D-1	D-3	D-5	D-3	D-5	D-3	D-5	D-5
Depth (ft.)	5.0	15.0	25.0	15.0	25.0	15.0	25.0	25.0
Sample Type	Drive	Drive	Drive	Drive	Drive	Drive	Drive	Drive
Soil Identification	Brown lean clay (CL)	Yellowish brown lean clay (CL)	Olive brown lean clay (CL)	Yellowish brown silty sand with gravel (SM)g / Dark brown lean clay with sand (CL)s	Yellowish brown sandy lean clay with gravel s(CL)g	Grayish brown clayey sand (SC)	Brown lean clay (CL)	Light brown lean clay with sand (CL)s
Pocket Penetrometer (tons/ft^2)	>4.5	>4.5	>4.5	>4.5	>4.5	>4.5	>4.5	>4.5
Weight Soil + Rings / Tube (g)	1030.82	1249.70	1172.52	1016.10	1229.10	1008.50	1217.49	961.96
Weight of Rings / Tube (g)	222.00	266.40	266.40	222.00	266.40	222.00	266.40	222.00
Average Length (in.)	5.00	6.00	6.00	5.00	6.00	5.00	6.00	5.00
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)	352.09	207.17	218.44	204.88	206.04	247.18	361.18	204.79
Dry Wt. of Soil + Cont. (g)	308.23	186.42	185.42	189.95	186.45	224.40	320.89	188.24
Weight of Container (g)	39.45	39.10	38.58	39.02	39.20	39.19	38.93	39.21
Container No.								
Wet Density	134.4	136.2	125.5	132.0	133.3	130.7	131.7	123.0
Moisture Content (%)	**16.3**	**14.1**	**22.5**	**9.9**	**13.3**	**12.3**	**14.3**	**11.1**
Dry Density (pcf)	**115.6**	**119.4**	**102.5**	**120.1**	**117.7**	**116.4**	**115.3**	**110.7**
Degree of Saturation (%)	96.1	92.3	94.1	66.2	83.1	74.1	83.4	57.3

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Client Name: CH2M Hill
Tested By: S. Felter Date: 07/30/08

Boring No.	A-08-030							
Sample No.	D-9							
Depth (ft.)	45.0							
Sample Type	Drive							
Soil Identification	Yellowish brown lean clay (CL)							
Pocket Penetrometer (tons/ft^2)	>4.5							
Weight Soil + Rings / Tube (g)	1160.20							
Weight of Rings / Tube (g)	266.40							
Average Length (in.)	6.00							
Average Diameter (in.)	2.416							
Wet. Wt. of Soil + Cont. (g)	179.07							
Dry Wt. of Soil + Cont. (g)	159.11							
Weight of Container (g)	39.11							
Container No.								
Wet Density	123.8							
Moisture Content (%)	**16.6**							
Dry Density (pcf)	**106.1**							
Degree of Saturation (%)	76.4							

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Client Name: CH2M Hill

Tested By: S. Felter Date: 07/30/08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Exploration No.: A-08-001
Sample No.: Bag-1
Soil Identification: Olive brown sandy lean clay s(CL)

Tested By: S. Felter Date: 08/27/08
Checked By: LF Date: 08/29/08
Depth (feet): 0 - 7

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	979	VO	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	1713.60	756.40	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	110.80	234.80	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	1602.80	521.60	Moisture Content (%)	0.00	0.00

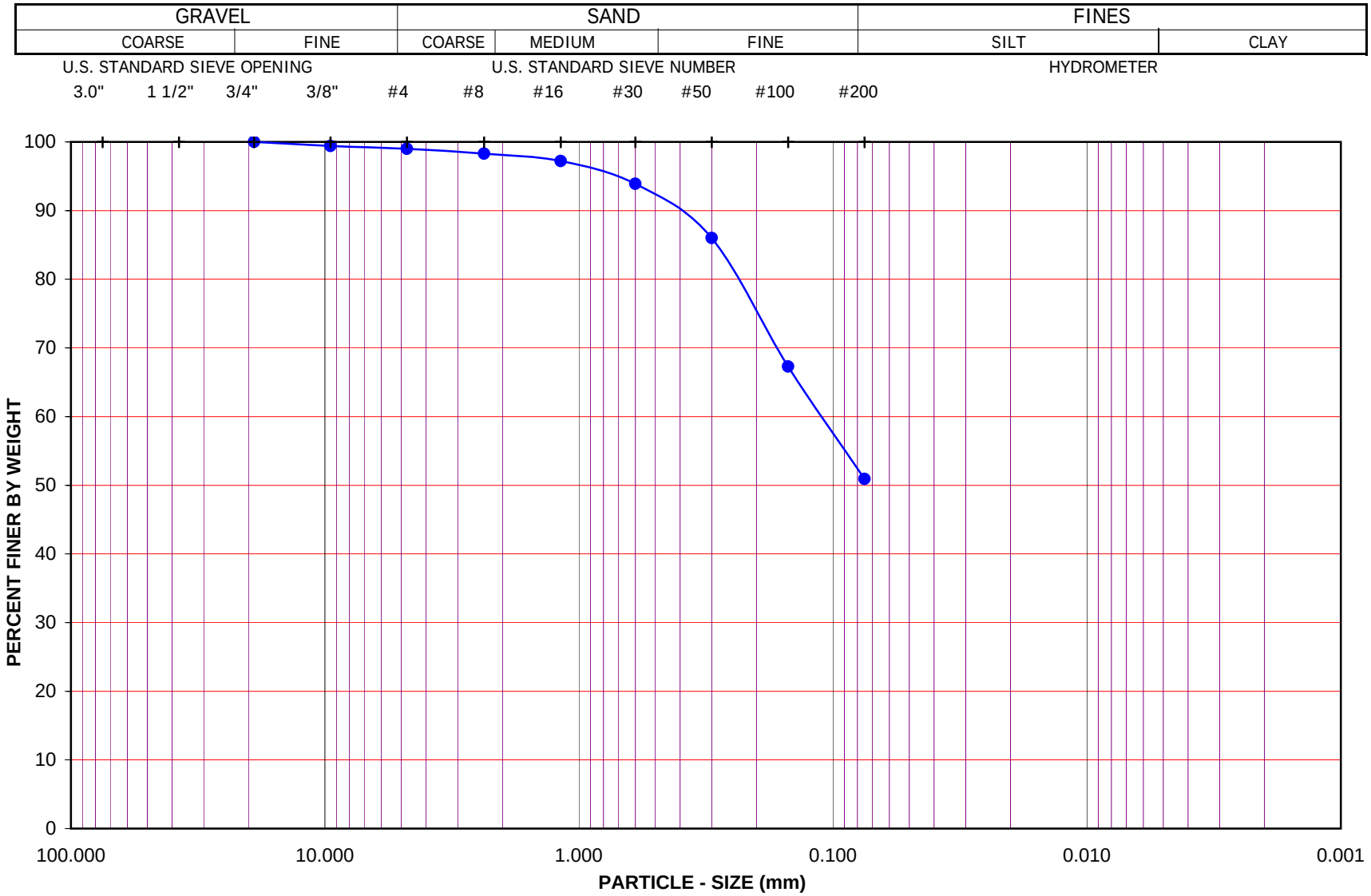
Passing #4 Material After Wet Sieve		
	Container No.	VO
	Wt. of Dry Soil + Container (g)	493.60
	Wt. of Container (g)	234.80
	Dry Wt. of Soil Retained on # 200 Sieve (g)	258.80

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	0.00		
1 1/2	37.500	0.00		
3/4"	19.000	0.00		100.0
3/8"	9.500	9.60		99.4
#4	4.750	15.80		99.0
#8	2.360		3.50	98.3
#16	1.180		9.30	97.2
#30	0.600		26.80	93.9
#50	0.300		68.40	86.0
#100	0.150		167.00	67.3
#200	0.075		253.40	50.9
PAN				

GRAVEL: **1 %**
SAND: **48 %**
FINES: **51 %**
GROUP SYMBOL **s(CL)**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-001 Sample No.: Bag-1

Depth (feet): 0 - 7 Soil Type : s(CL)

Soil Identification: Olive brown sandy lean clay s(CL)

GR:SA:FI : (%) 1 : 48 : 51

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-001, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/06/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Exploration No.:	A-08-001	Depth (feet):	5.0		
Sample No.:	D-1				
Soil Identification:	Brown sandy lean clay s(CL)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	923	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	613.90	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	108.20	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	505.70	Moisture Content (%)	0.00

After Wet Sieve	Container No.	923
	Wt. of Dry Soil + Container (g)	331.70
	Wt. of Container (g)	108.20
	Dry Wt. of Soil Retained on # 200 Sieve (g)	223.50

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.20	100.0
#8	2.360	0.50	99.9
#16	1.180	2.60	99.5
#30	0.600	18.30	96.4
#50	0.300	60.10	88.1
#100	0.150	143.30	71.7
#200	0.075	220.20	56.5
PAN			

GRAVEL: **0 %**

SAND: **43 %**

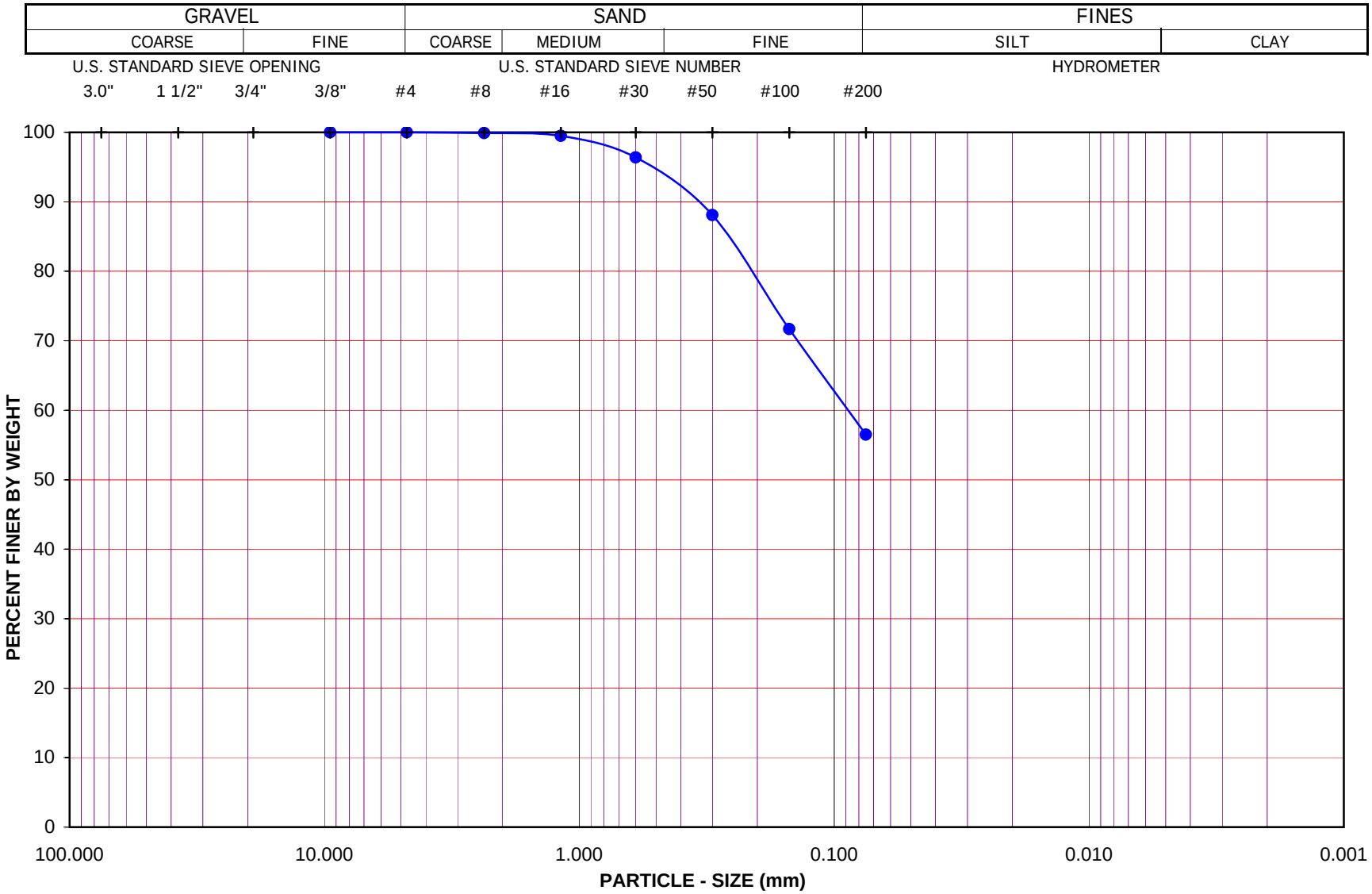
FINES: **57 %**

GROUP SYMBOL: **s(CL)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-001 Sample No.: D-1

Depth (feet): 5.0 Soil Type : s(CL)

Soil Identification: Brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 43 : 57

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-001	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Brown sandy lean clay s(CL)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	K	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	447.16	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	138.50	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	308.66	Moisture Content (%)	0.00

After Wet Sieve	Container No.	K
	Wt. of Dry Soil + Container (g)	315.90
	Wt. of Container (g)	138.50
	Dry Wt. of Soil Retained on # 200 Sieve (g)	177.40

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	100.0
#8	2.360	0.60	99.8
#16	1.180	2.80	99.1
#30	0.600	15.40	95.0
#50	0.300	41.40	86.6
#100	0.150	104.30	66.2
#200	0.075	127.70	58.6
PAN			

GRAVEL: **0 %**

SAND: **41 %**

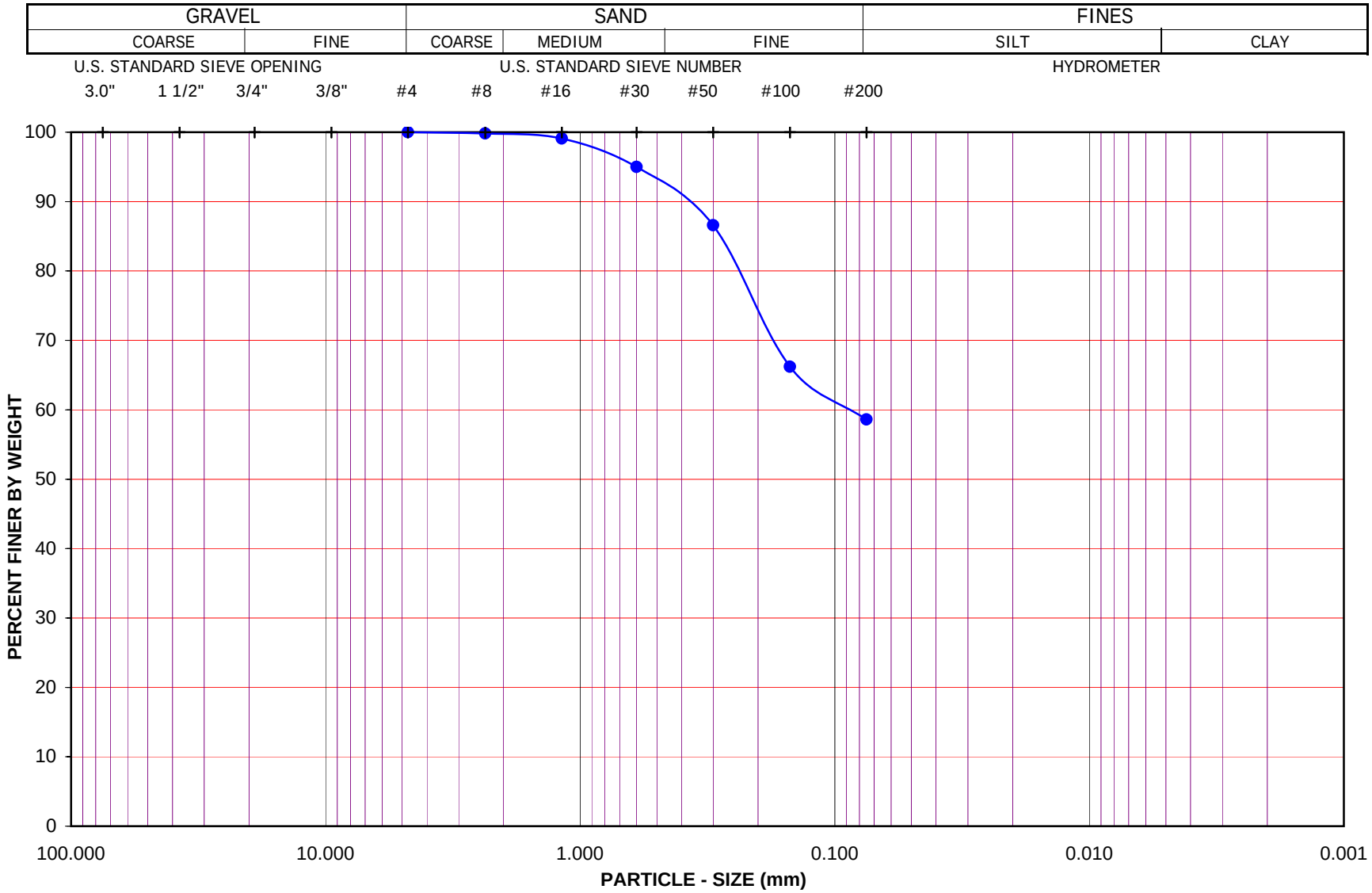
FINES: **59 %**

GROUP SYMBOL: **s(CL)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-001 Sample No.: S-2

Depth (feet): 10.0 Soil Type : s(CL)

Soil Identification: Brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 41 : 59

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/06/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Exploration No.:	A-08-001	Depth (feet):	25.0		
Sample No.:	D-5				
Soil Identification:	Yellowish brown poorly graded sand with silt (SP-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	XY	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	663.70	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	249.00	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	414.70	Moisture Content (%)	0.00

After Wet Sieve	Container No.	XY
	Wt. of Dry Soil + Container (g)	636.40
	Wt. of Container (g)	249.00
	Dry Wt. of Soil Retained on # 200 Sieve (g)	387.40

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	100.0
#8	2.360	0.30	99.9
#16	1.180	2.10	99.5
#30	0.600	35.10	91.5
#50	0.300	202.20	51.2
#100	0.150	362.80	12.5
#200	0.075	386.90	6.7
PAN			

GRAVEL: **0 %**

SAND: **93 %**

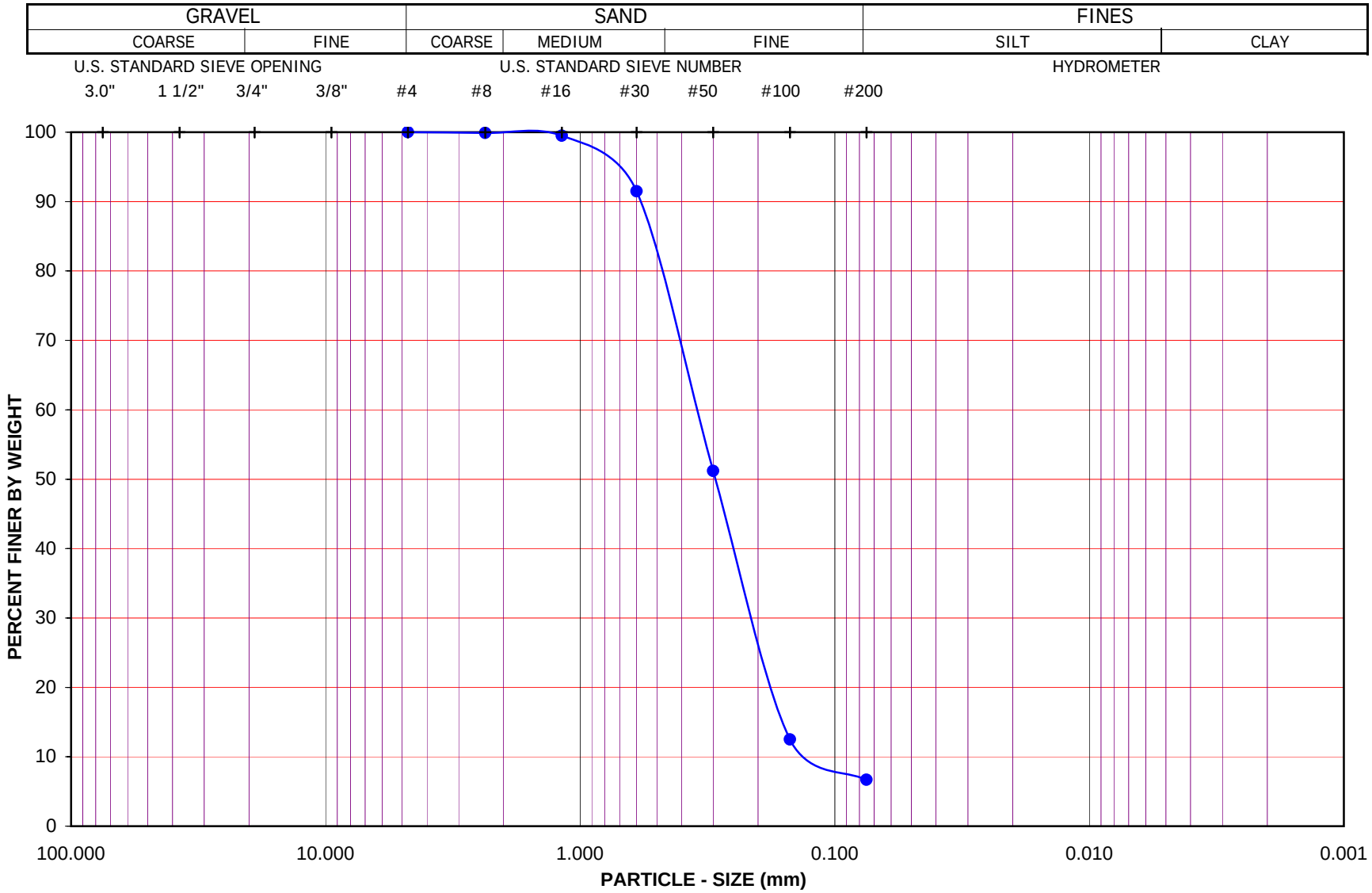
FINES: **7 %**

GROUP SYMBOL: **SP-SM**

Cu = D60/D10 = 2.48

Cc = $(D30)^2/(D60*D10)$ = 0.91

Remarks:



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-001 Sample No.: D-5

Depth (feet): 25.0 Soil Type : SP-SM

Soil Identification: Yellowish brown poorly graded sand with silt (SP-SM)

GR:SA:FI : (%) 0 : 93 : 7

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-001	Depth (feet):	30.0		
Sample No.:	S-6				
Soil Identification:	Brown well-graded sand with silt (SW-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	CT	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	705.10	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	244.31	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	460.79	Moisture Content (%)	0.00

After Wet Sieve	Container No.	CT
	Wt. of Dry Soil + Container (g)	660.00
	Wt. of Container (g)	244.31
	Dry Wt. of Soil Retained on # 200 Sieve (g)	415.69

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	2.40	99.5
#4	4.750	8.40	98.2
#8	2.360	21.50	95.3
#16	1.180	68.70	85.1
#30	0.600	196.70	57.3
#50	0.300	316.20	31.4
#100	0.150	391.00	15.1
#200	0.075	414.80	10.0
PAN			

GRAVEL: **2 %**

SAND: **88 %**

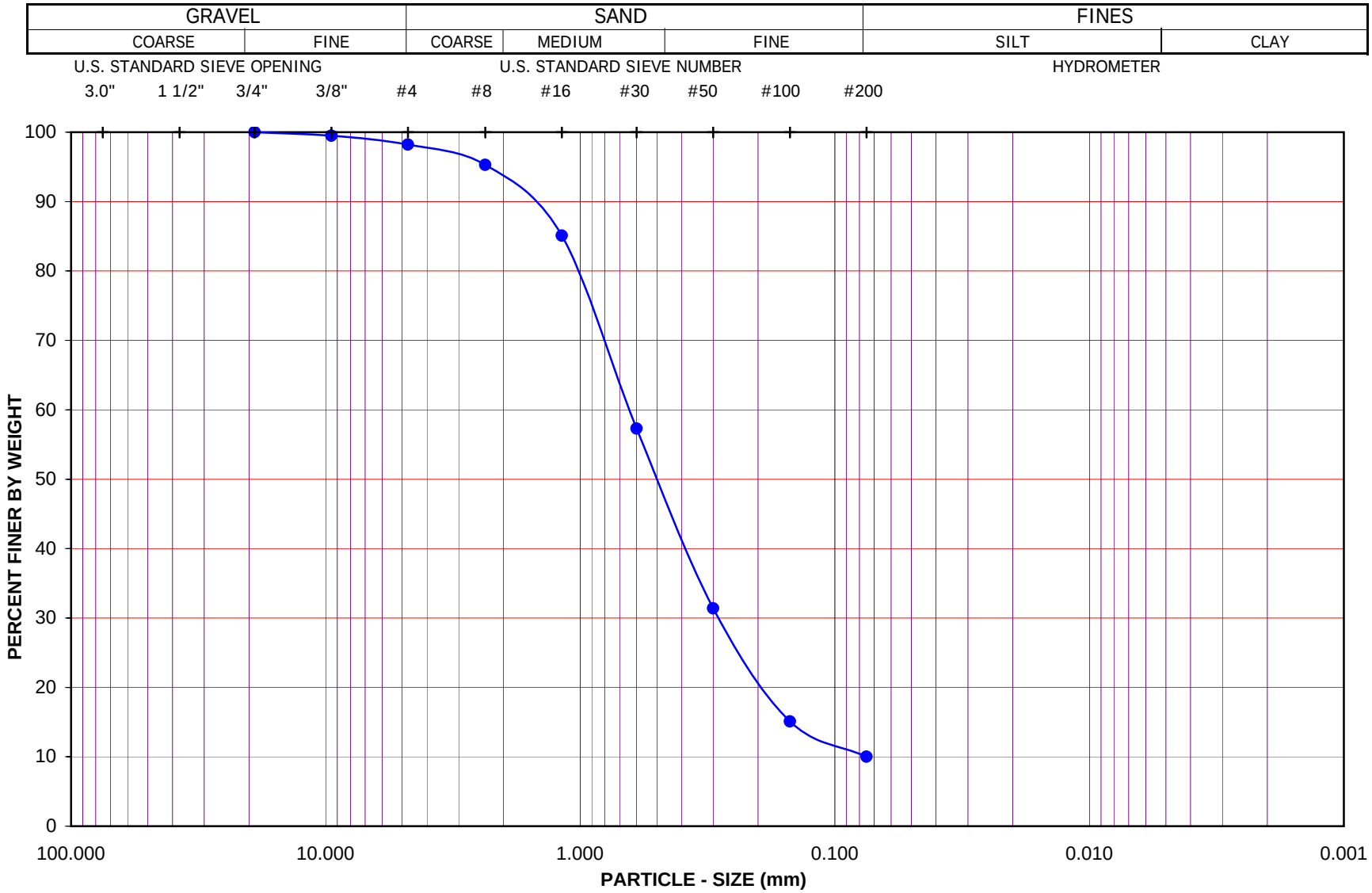
FINES: **10 %**

GROUP SYMBOL: **SW-SM**

Cu = D60/D10 = 8.53

Cc = $(D30)^2/(D60*D10)$ = 1.69

Remarks:



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-001 Sample No.: S-6

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

Soil Identification: Brown well-graded sand with silt (SW-SM)

GR:SA:FI : (%) 2 : 88 : 10

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-001, S-6

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/07/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/12/08

Exploration No.: A-08-002

Sample No.: BAG-1 | Depth (feet) : 2-7

Soil Identification: Dark grayish brown sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	42	s(CL)
% Fines	58	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	111.35
Wt.of Air-Dry Soil + Cont. (g)	743.30	Wt. of Container No.___ (g)	1.00	1.00	82.49
Wt. of Container	76.70	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	666.60	Wt. of Dry Soil (g)			28.86

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	1.40	99.8
No. 10	3.40	99.5
Pan		

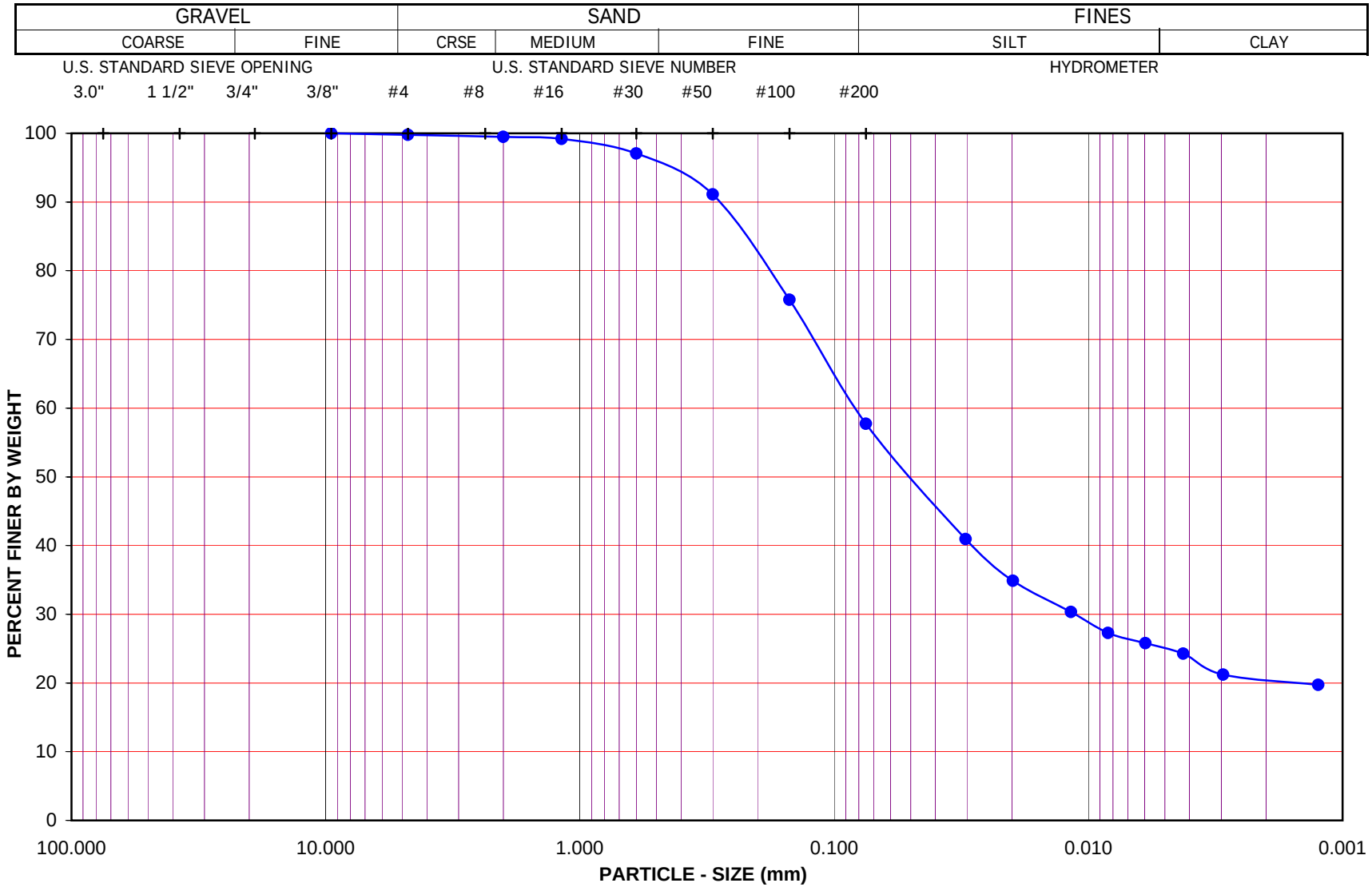
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.5
No. 16	0.21	99.7	99.2
No. 30	1.60	97.5	97.0
No. 50	5.49	91.6	91.1
No. 100	15.52	76.2	75.8
No. 200	27.33	58.0	57.7
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.10 Wt. of Dry Soil (g) 65.10

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
07-Aug-08	9:30	0		7.0			
	9:32	2	22.1	7.0	34.0	40.9	0.0304
	9:35	5	22.1	7.0	30.0	34.9	0.0198
	9:45	15	22.1	7.0	27.0	30.3	0.0117
	10:00	30	22.1	7.0	25.0	27.3	0.0084
	10:30	60	22.4	7.0	24.0	25.8	0.0060
	11:30	120	22.9	7.0	23.0	24.3	0.0042
	13:40	250	23.5	7.0	21.0	21.2	0.0029
08-Aug-08	9:30	1440	22.3	7.0	20.0	19.7	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-002 Sample No.: BAG-1

Depth (feet) : 2-7 Soil Type : s(CL)

Soil Identification: Dark grayish brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 42 : 58

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/07/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/12/08

Exploration No.: A-08-002

Sample No.: S-2 | Depth (feet) : 10.0

Soil Identification: Olive sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	30	s(CL)
% Fines	70	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	100.32
Wt.of Air-Dry Soil + Cont. (g)	277.60	Wt. of Container No.___ (g)	1.00	1.00	76.61
Wt. of Container	39.60	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	238.00	Wt. of Dry Soil (g)			23.71

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.00	100.0
Pan		

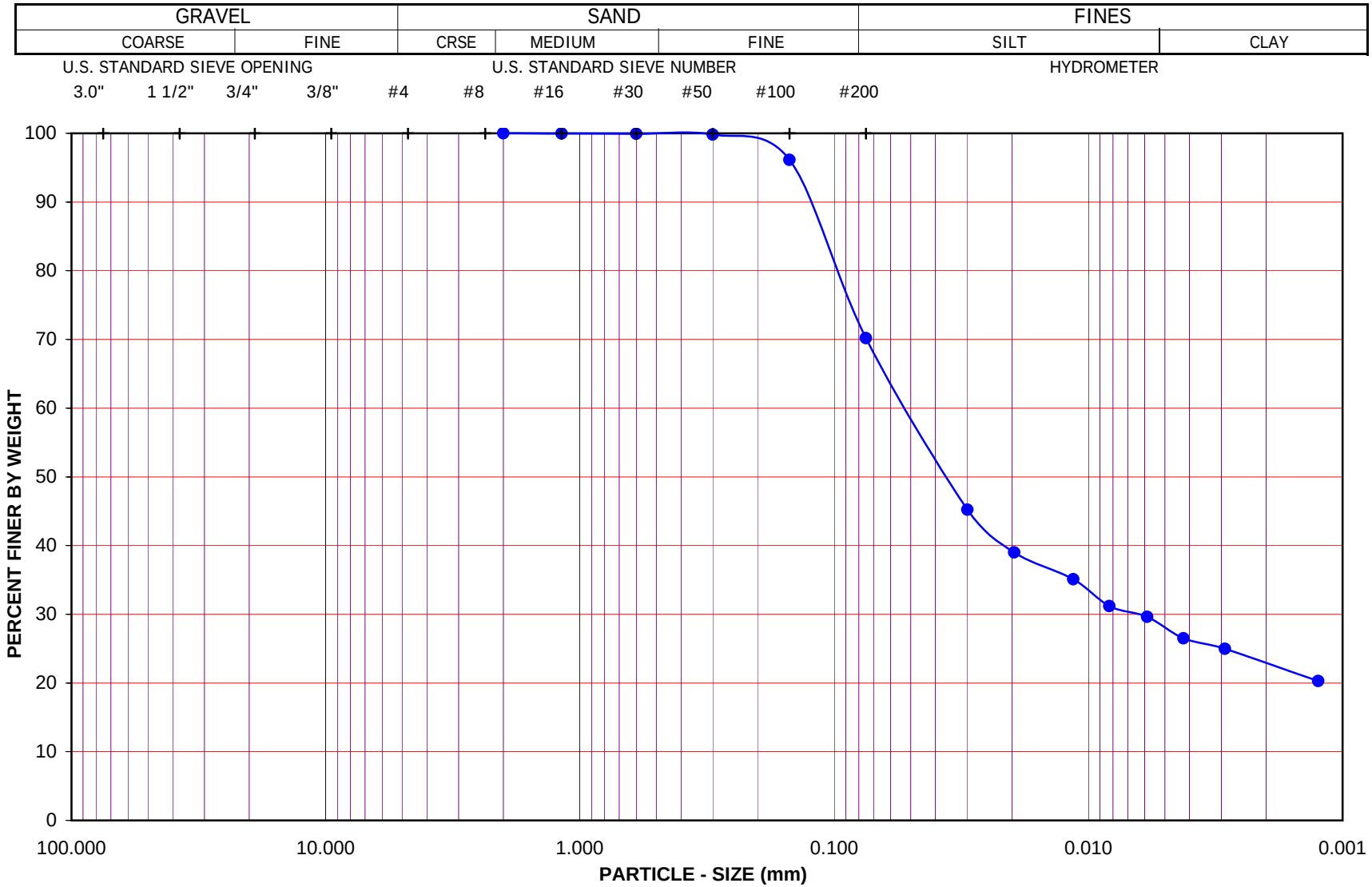
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.02	100.0	100.0
No. 30	0.04	99.9	99.9
No. 50	0.13	99.8	99.8
No. 100	2.47	96.1	96.1
No. 200	18.95	70.2	70.2
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 63.60 Wt. of Dry Soil (g) 63.60

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
07-Aug-08	9:34	0		7.0			
	9:36	2	22.1	7.0	36.0	45.2	0.0299
	9:39	5	22.1	7.0	32.0	39.0	0.0196
	9:49	15	22.1	7.0	29.5	35.1	0.0115
	10:04	30	22.1	7.0	27.0	31.2	0.0083
	10:34	60	22.4	7.0	26.0	29.6	0.0059
	11:34	120	22.9	7.0	24.0	26.5	0.0042
	13:44	250	23.5	7.0	23.0	25.0	0.0029
08-Aug-08	9:34	1440	22.3	7.0	20.0	20.3	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-002 Sample No.: S-2

Depth (feet) : 10.0 Soil Type : s(CL)

Soil Identification: Olive sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 30 : 70

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/20/08

Exploration No.: A-08-002

Sample No.: S-4 | Depth (feet) : 20.0

Soil Identification: Olive sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	49	s(CL)
% Fines	51	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	109.07
Wt.of Air-Dry Soil + Cont. (g)	376.60	Wt. of Container No.___ (g)	1.00	1.00	75.92
Wt. of Container	38.50	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	338.10	Wt. of Dry Soil (g)			33.15

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.20	99.9
No. 10	0.90	99.7
Pan		

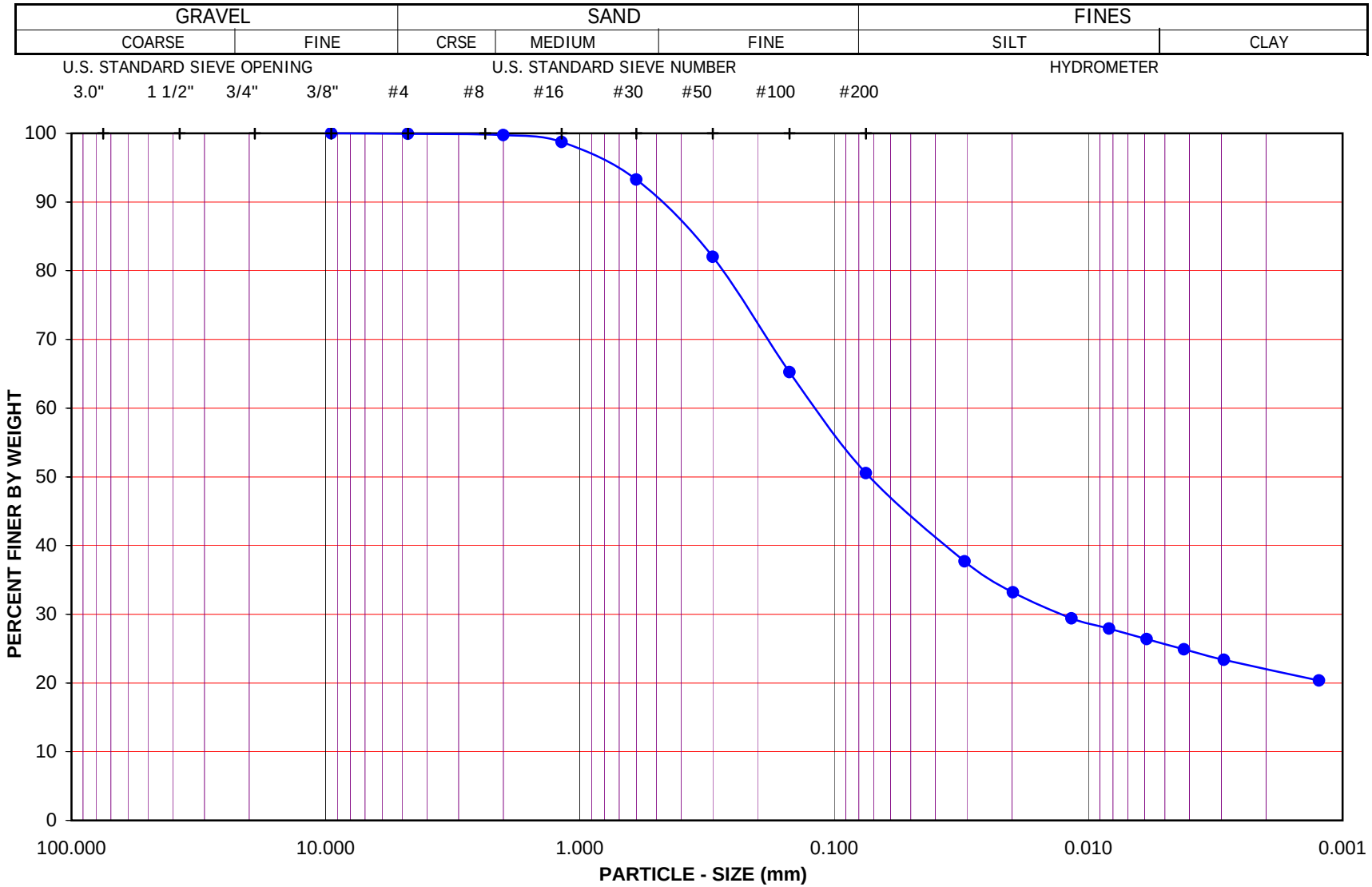
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.7
No. 16	0.65	99.0	98.7
No. 30	4.26	93.5	93.3
No. 50	11.64	82.3	82.0
No. 100	22.69	65.4	65.2
No. 200	32.35	50.7	50.6
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.60 Wt. of Dry Soil (g) 65.60

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	11:26	0		8.0			
	11:28	2	22.2	8.0	33.0	37.7	0.0306
	11:31	5	22.2	8.0	30.0	33.2	0.0198
	11:41	15	22.2	8.0	27.5	29.4	0.0116
	11:56	30	22.2	8.0	26.5	27.9	0.0083
	12:26	60	22.4	8.0	25.5	26.4	0.0059
	13:26	120	22.6	8.0	24.5	24.9	0.0042
	15:36	250	22.7	8.0	23.5	23.4	0.0029
12-Aug-08	11:26	1440	22.7	8.0	21.5	20.4	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-002 Sample No.: S-4

Depth (feet) : 20.0 Soil Type : s(CL)

Soil Identification: Olive sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 49 : 51

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Exploration No.: A-08-003
Sample No.: Bag-1
Soil Identification: Yellowish brown sandy lean clay s(CL)

Tested By: S. Felter Date: 08/27/08
Checked By: LF Date: 08/29/08
Depth (feet): 0 - 7

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	2	CT	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	1293.70	726.60	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	110.40	244.30	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	1183.30	482.30	Moisture Content (%)	0.00	0.00

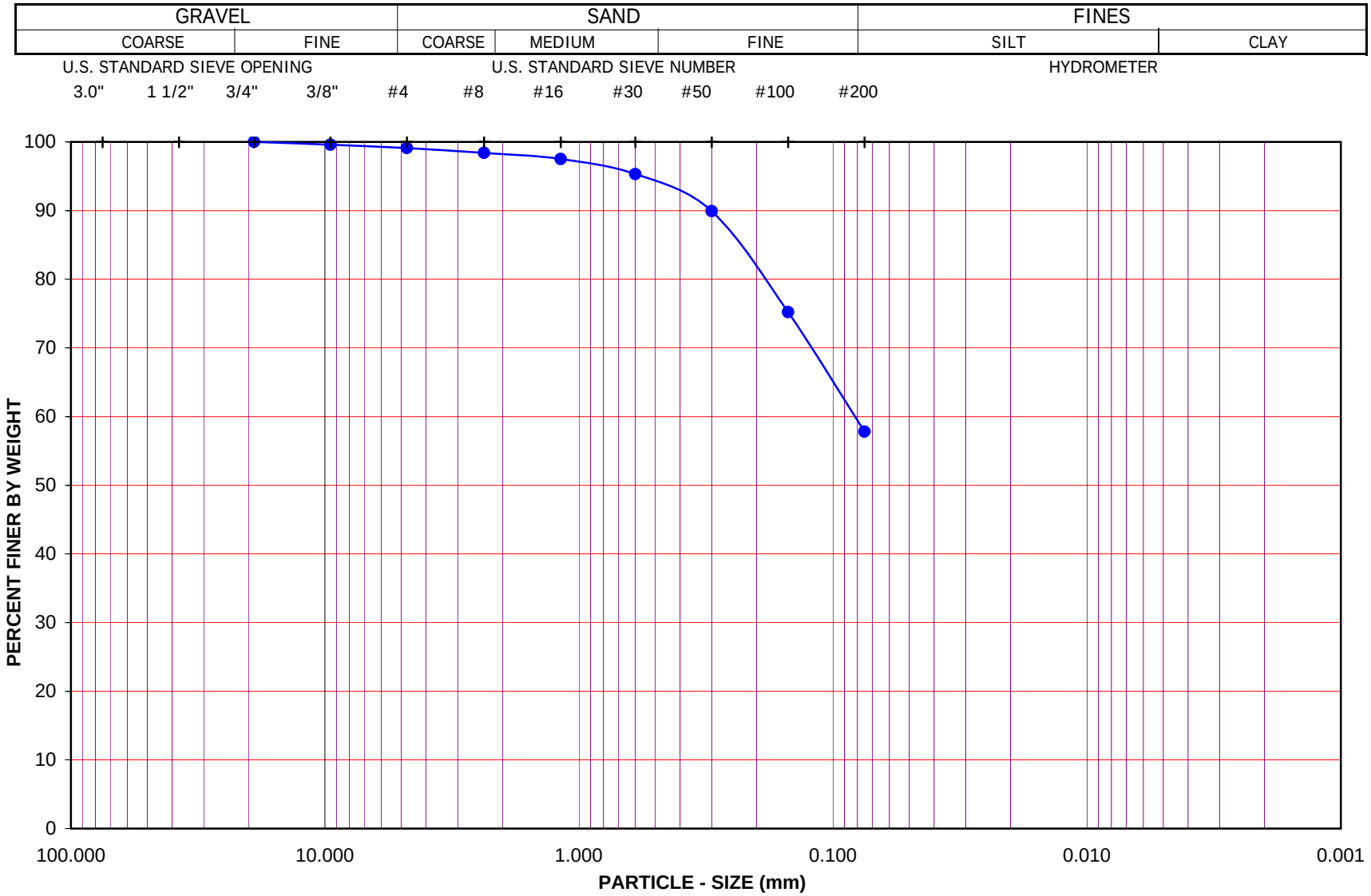
Passing #4 Material After Wet Sieve		
	Container No.	CT
	Wt. of Dry Soil + Container (g)	449.50
	Wt. of Container (g)	244.30
	Dry Wt. of Soil Retained on # 200 Sieve (g)	205.20

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	0.00		
1 1/2	37.500	0.00		
3/4"	19.000	0.00		100.0
3/8"	9.500	5.10		99.6
#4	4.750	11.10		99.1
#8	2.360		3.20	98.4
#16	1.180		8.00	97.5
#30	0.600		18.30	95.3
#50	0.300		44.60	89.9
#100	0.150		116.30	75.2
#200	0.075		200.80	57.8
PAN				

GRAVEL: **1 %**
SAND: **41 %**
FINES: **58 %**
GROUP SYMBOL **s(CL)**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-003 Sample No.: Bag-1

Depth (feet): 0 - 7 Soil Type : s(CL)

Soil Identification: Yellowish brown sandy lean clay s(CL)

GR:SA:FI : (%) 1 : 41 : 58

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-003, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/06/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Exploration No.:	A-08-003	Depth (feet):	5.0		
Sample No.:	D-1				
Soil Identification:	Yellowish brown sandy silty clay s(CL-ML)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	ZK	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	695.20	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	249.50	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	445.70	Moisture Content (%)	0.00

After Wet Sieve	Container No.	ZK
	Wt. of Dry Soil + Container (g)	431.40
	Wt. of Container (g)	249.50
	Dry Wt. of Soil Retained on # 200 Sieve (g)	181.90

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	1.10	99.8
#8	2.360	2.20	99.5
#16	1.180	3.30	99.3
#30	0.600	5.40	98.8
#50	0.300	6.50	98.5
#100	0.150	27.80	93.8
#200	0.075	170.80	61.7
PAN			

GRAVEL: **0 %**

SAND: **38 %**

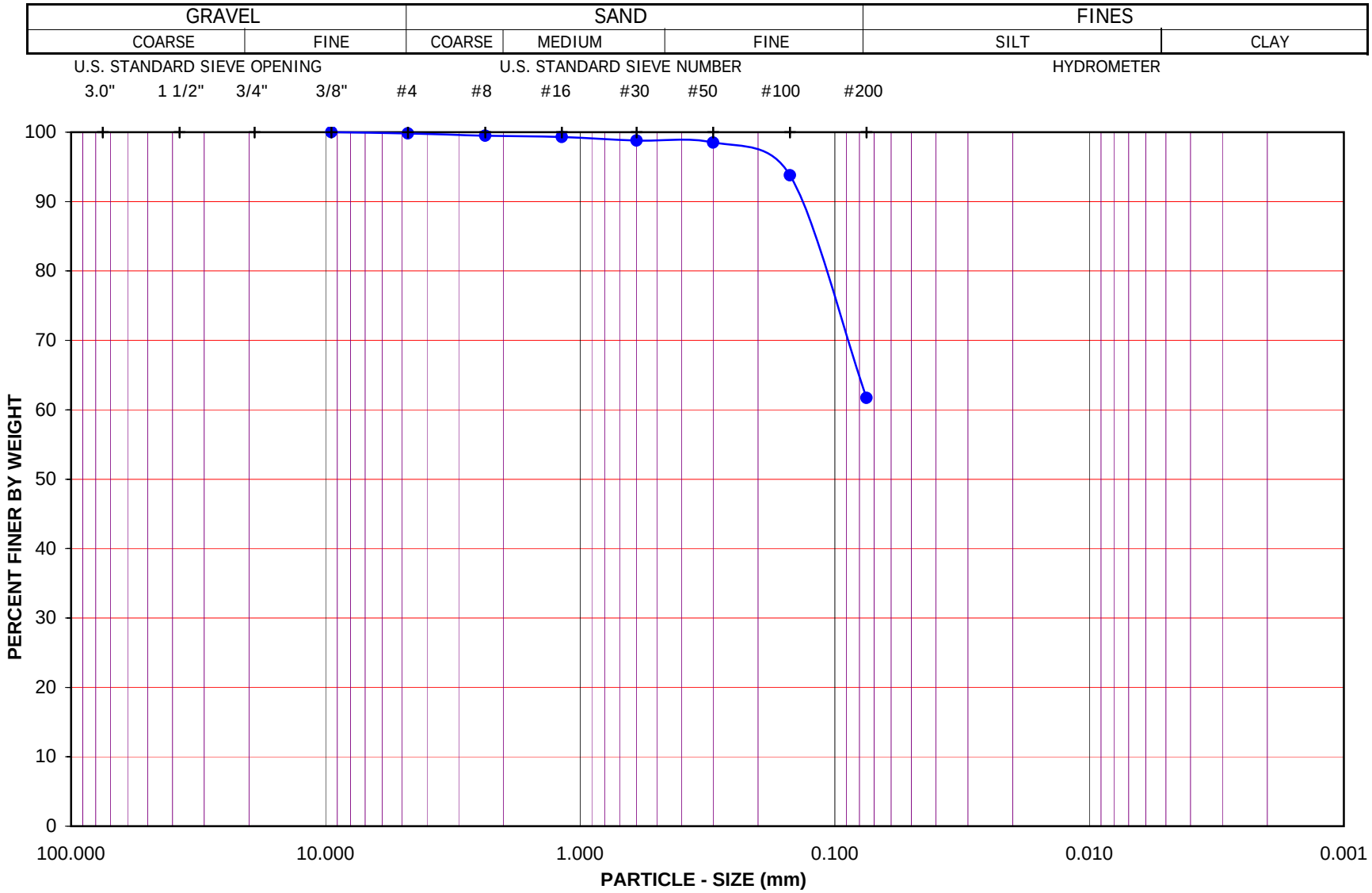
FINES: **62 %**

GROUP SYMBOL: **s(CL-ML)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-003 Sample No.: D-1

Depth (feet): 5.0 Soil Type : s(CL-ML)

Soil Identification: Yellowish brown sandy silty clay s(CL-ML)

GR:SA:FI : (%) 0 : 38 : 62

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-003	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Brown silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	YK	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	741.06	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	351.58	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	389.48	Moisture Content (%)	0.00

After Wet Sieve	Container No.	YK
	Wt. of Dry Soil + Container (g)	584.30
	Wt. of Container (g)	351.58
	Dry Wt. of Soil Retained on # 200 Sieve (g)	232.72

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	5.10	98.7
#4	4.750	8.20	97.9
#8	2.360	9.80	97.5
#16	1.180	10.90	97.2
#30	0.600	11.60	97.0
#50	0.300	18.20	95.3
#100	0.150	162.30	58.3
#200	0.075	323.40	17.0
PAN			

GRAVEL: **2 %**

SAND: **81 %**

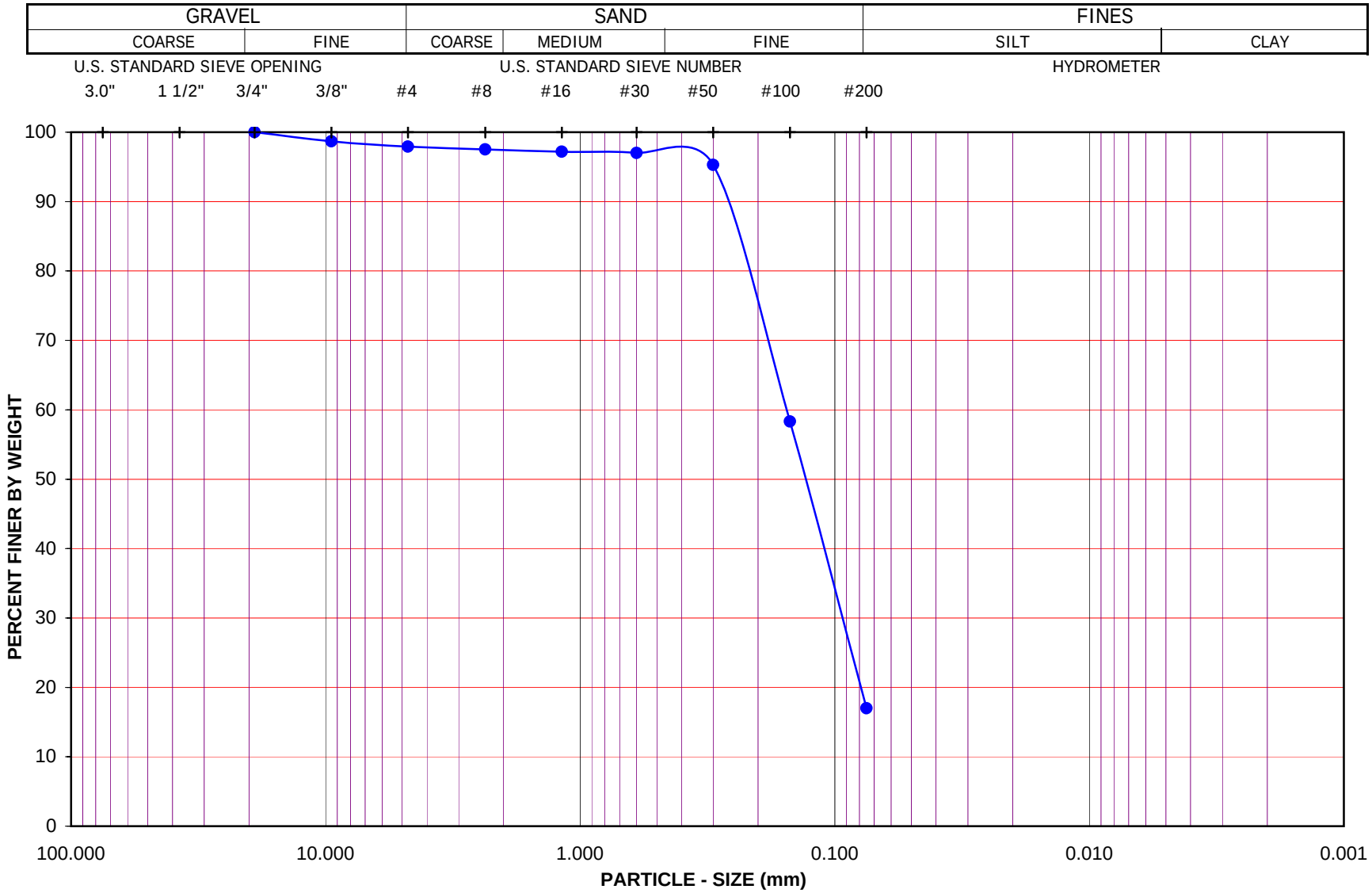
FINES: **17 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-003 Sample No.: S-2

Depth (feet): 10.0 Soil Type : SM

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 2 : 81 : 17

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-003, S-2

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Exploration No.: A-08-004
Sample No.: Bag-1
Soil Identification: Light olive brown poorly graded sand with silt and gravel (SP-SM)g

Tested By: S. Felter Date: 08/05/08
Checked By: LF Date: 08/07/08
Depth (feet): 0 - 7

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	M-1	N/A	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	7520.90	931.80	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	461.20	251.60	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	7059.70	680.20	Moisture Content (%)	0.00	0.00

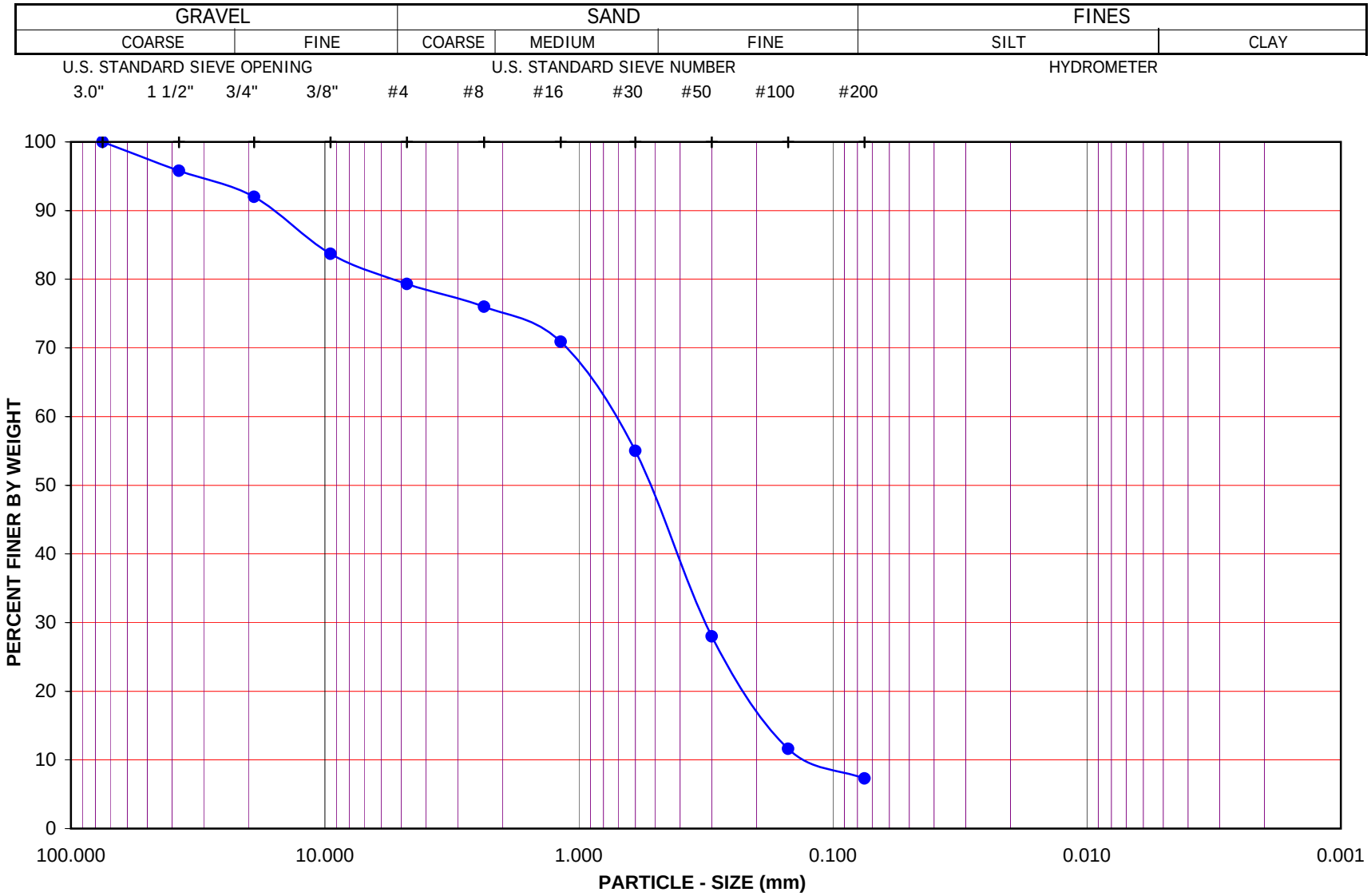
Passing #4 Material After Wet Sieve		
	Container No.	N/A
	Wt. of Dry Soil + Container (g)	868.50
	Wt. of Container (g)	251.60
	Dry Wt. of Soil Retained on # 200 Sieve (g)	616.90

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	0.00		100.0
1 1/2	37.500	297.40		95.8
3/4"	19.000	568.00		92.0
3/8"	9.500	1149.10		83.7
#4	4.750	1459.50		79.3
#8	2.360		28.60	76.0
#16	1.180		71.80	70.9
#30	0.600		208.60	55.0
#50	0.300		440.20	28.0
#100	0.150		580.40	11.6
#200	0.075		617.20	7.3
PAN				

GRAVEL: **21 %**
SAND: **72 %**
FINES: **7 %**
GROUP SYMBOL **(SP-SM)g**

Cu = D60/D10 = 5.00
Cc = $(D30)^2/(D60*D10)$ = 1.04

Remarks:



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-004 Sample No.: Bag-1

Depth (feet): 0 - 7 Soil Type : (SP-SM)g

Soil Identification: Light olive brown poorly graded sand with silt and gravel (SP-SM)g

GR:SA:FI : (%) 21 : 72 : 7

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-004, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	07/28/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Exploration No.:	A-08-004	Depth (feet):	5.0		
Sample No.:	D-1				
Soil Identification:	Yellowish brown well-graded sand with silt and gravel (SW-SM)g				

		Moisture Content of Total Air - Dry Soil	
Container No.:	YK	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	1010.70	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	252.20	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	758.50	Moisture Content (%)	0.00

After Wet Sieve	Container No.	YK
	Wt. of Dry Soil + Container (g)	945.60
	Wt. of Container (g)	252.20
	Dry Wt. of Soil Retained on # 200 Sieve (g)	693.40

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	100.0
3/4"	19.000	65.00	91.4
3/8"	9.500	194.80	74.3
#4	4.750	282.90	62.7
#8	2.360	357.90	52.8
#16	1.180	466.70	38.5
#30	0.600	593.80	21.7
#50	0.300	642.60	15.3
#100	0.150	674.80	11.0
#200	0.075	692.90	8.6
PAN			

GRAVEL: **37 %**

SAND: **54 %**

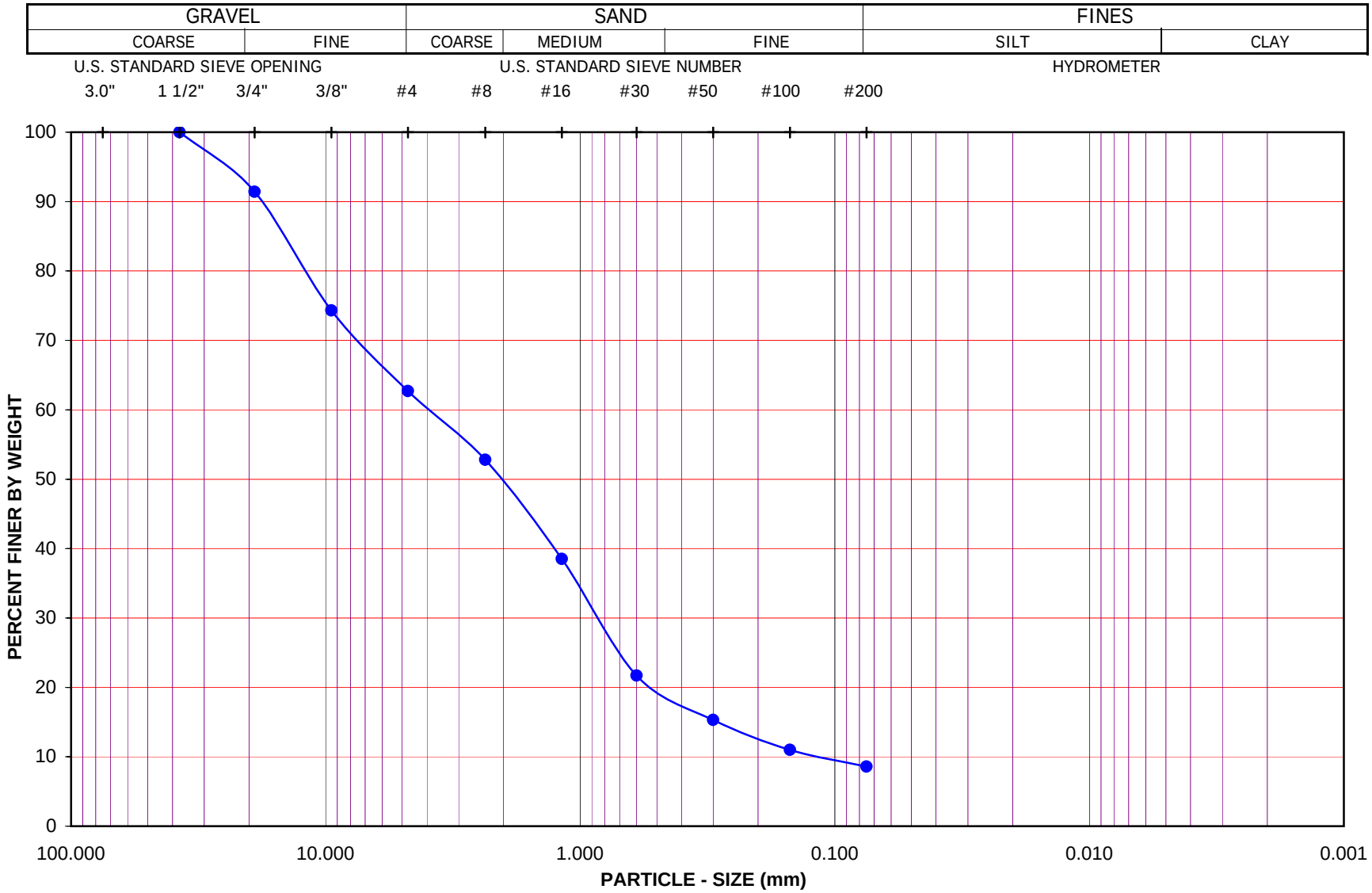
FINES: **9 %**

GROUP SYMBOL: **(SW-SM)g**

Cu = D60/D10 = 32.00

Cc = $(D30)^2/(D60*D10)$ = 1.53

Remarks: Insufficient sample mass available to meet the ASTM specification for this material



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-004 Sample No.: D-1

Depth (feet): 5.0 Soil Type : (SW-SM)g

Soil Identification: Yellowish brown well-graded sand with silt and gravel (SW-SM)g

GR:SA:FI : (%) 37 : 54 : 9

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jul-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/27/08

Exploration No.: A-08-004

Sample No.: S-2 | Depth (feet) : 10.0

Soil Identification: Olive clayey sand (SC)

% Gravel	13	Soil Type
% Sand	38	SC
% Fines	49	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	105.63
Wt.of Air-Dry Soil + Cont. (g)	386.60	Wt. of Container No.___ (g)	1.00	1.00	77.18
Wt. of Container	39.30	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	347.30	Wt. of Dry Soil (g)			28.45

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	28.10	91.9
No. 4	43.70	87.4
No. 10	56.80	83.6
Pan		

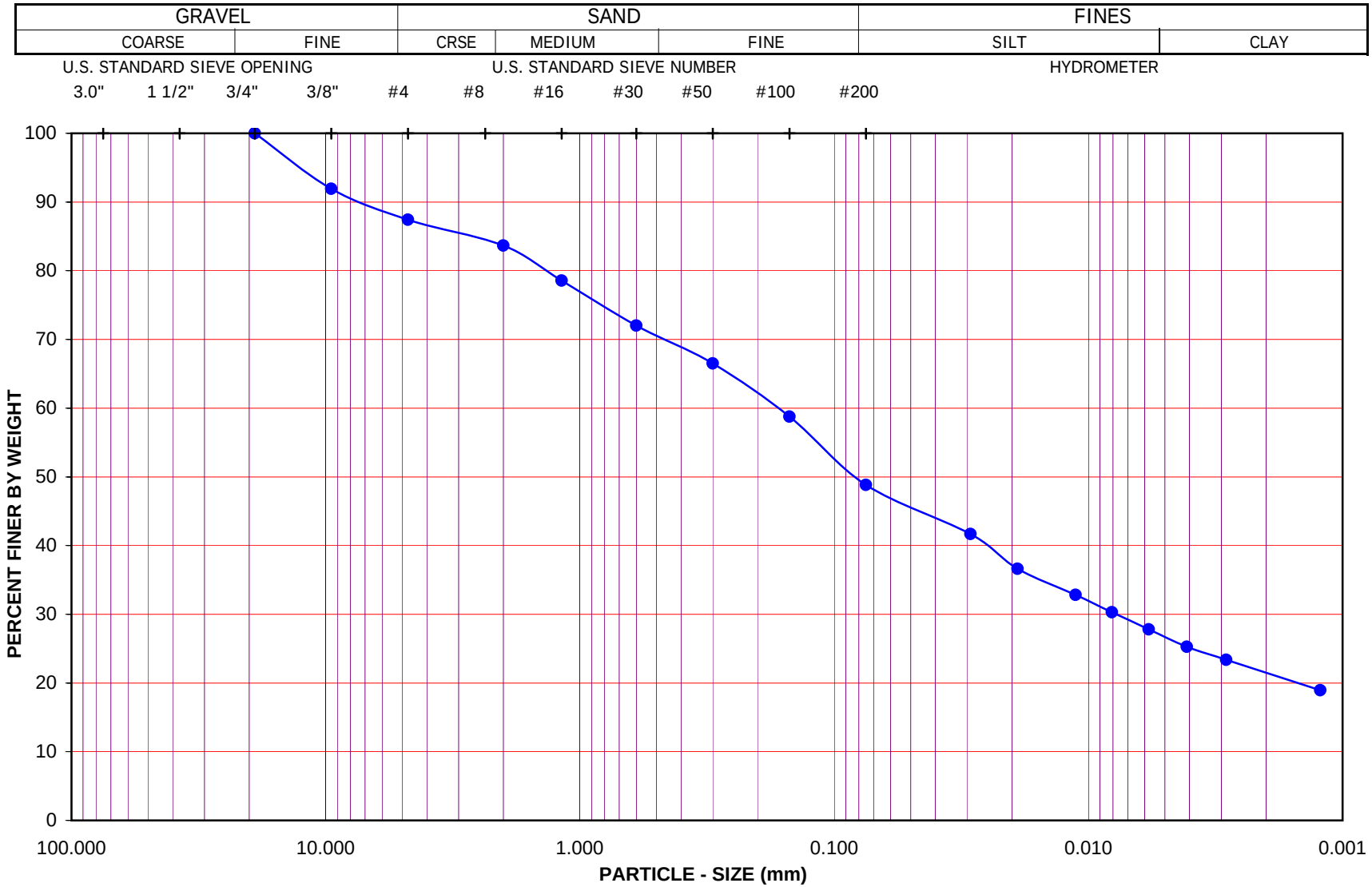
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	83.6
No. 16	3.99	93.9	78.6
No. 30	9.15	86.1	72.0
No. 50	13.45	79.5	66.5
No. 100	19.53	70.3	58.8
No. 200	27.35	58.4	48.8
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.70 Wt. of Dry Soil (g) 65.70

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	9:14	0		8.0			
	9:16	2	21.6	8.0	41.0	41.7	0.0291
	9:19	5	21.5	8.0	37.0	36.6	0.0190
	9:29	15	21.6	8.0	34.0	32.8	0.0112
	9:44	30	21.6	8.0	32.0	30.3	0.0081
	10:14	60	21.7	8.0	30.0	27.8	0.0058
	11:14	120	22.1	8.0	28.0	25.3	0.0041
	13:24	250	22.6	8.0	26.5	23.4	0.0029
12-Aug-08	9:14	1440	22.2	8.0	23.0	18.9	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-004 Sample No.: S-2

Depth (feet) : 10.0 Soil Type : SC

Soil Identification: Olive clayey sand (SC)

GR:SA:FI : (%) 13 : 38 : 49

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/15/08

Exploration No.: A-08-004

Sample No.: S-4 | Depth (feet) : 20.0

Soil Identification: Olive sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	39	s(CL)
% Fines	61	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	105.55
Wt.of Air-Dry Soil + Cont. (g)	267.10	Wt. of Container No.___ (g)	1.00	1.00	74.27
Wt. of Container	39.00	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	228.10	Wt. of Dry Soil (g)			31.28

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.50	99.8
Pan		

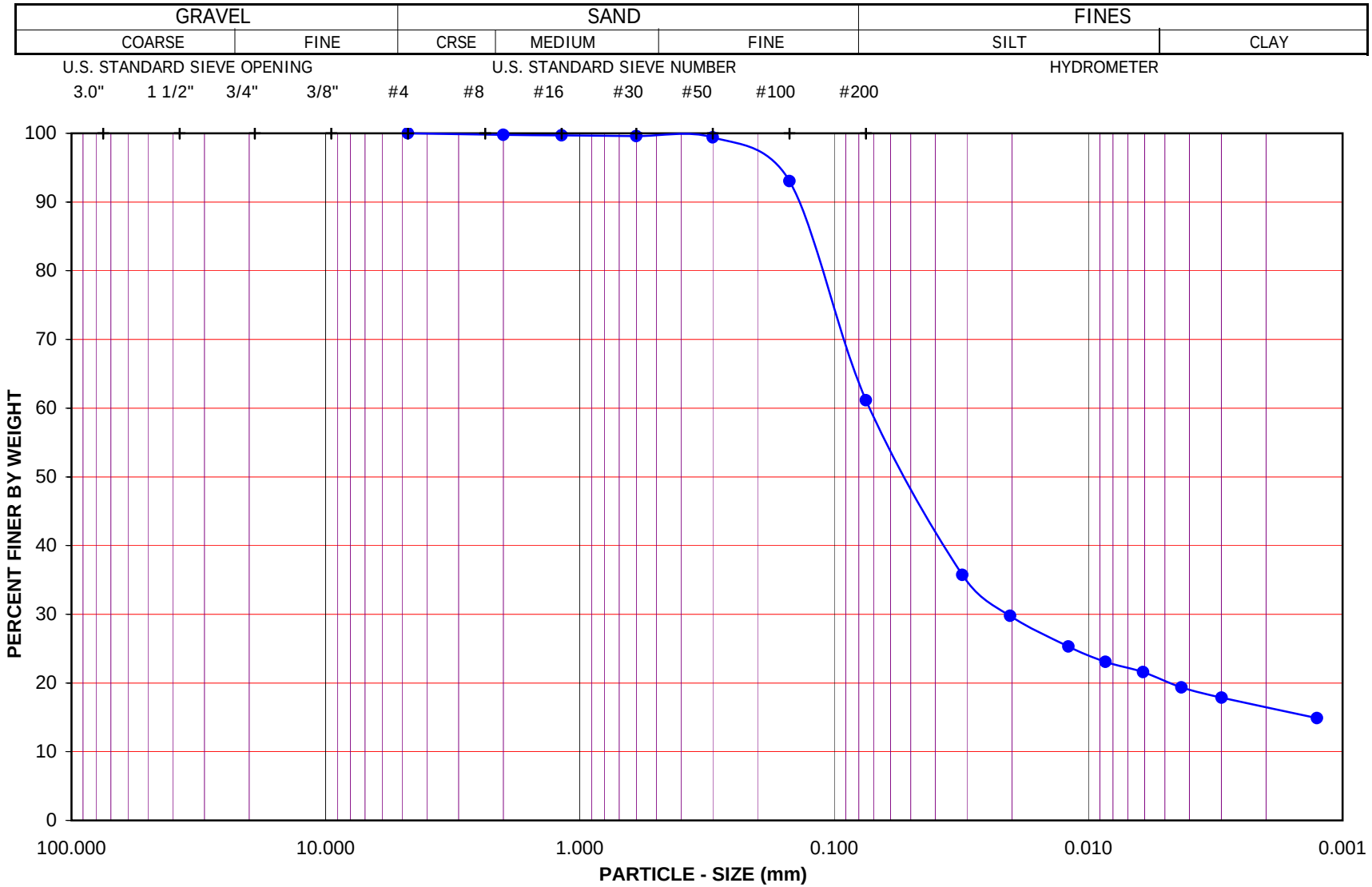
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.8
No. 16	0.06	99.9	99.7
No. 30	0.12	99.8	99.6
No. 50	0.24	99.6	99.4
No. 100	4.48	93.3	93.1
No. 200	25.74	61.3	61.2
Pan			

Hydrometer Wt. of Air-Dry Soil (g): 66.50 Wt. of Dry Soil (g): 66.50

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	9:06	0		8.0			
	9:08	2	21.7	8.0	32.0	35.7	0.0313
	9:11	5	21.7	8.0	28.0	29.8	0.0203
	9:21	15	21.5	8.0	25.0	25.3	0.0120
	9:36	30	21.6	8.0	23.5	23.1	0.0086
	10:06	60	21.7	8.0	22.5	21.6	0.0061
	11:06	120	22.1	8.0	21.0	19.3	0.0043
	13:16	250	22.6	8.0	20.0	17.9	0.0030
12-Aug-08	9:06	1440	22.2	8.0	18.0	14.9	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-004 Sample No.: S-4

Depth (feet) : 20.0 Soil Type : s(CL)

Soil Identification: Olive sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 39 : 61

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	07/28/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Exploration No.:	A-08-004	Depth (feet):	25.0		
Sample No.:	D-5				
Soil Identification:	Yellowish brown lean clay with sand (CL)s				

		Moisture Content of Total Air - Dry Soil	
Container No.:	CT	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	681.30	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	244.60	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	436.70	Moisture Content (%)	0.00

After Wet Sieve	Container No.	CT
	Wt. of Dry Soil + Container (g)	333.60
	Wt. of Container (g)	244.60
	Dry Wt. of Soil Retained on # 200 Sieve (g)	89.00

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.40	99.9
#8	2.360	0.90	99.8
#16	1.180	1.40	99.7
#30	0.600	2.40	99.5
#50	0.300	5.00	98.9
#100	0.150	28.00	93.6
#200	0.075	84.30	80.7
PAN			

GRAVEL: **0 %**

SAND: **19 %**

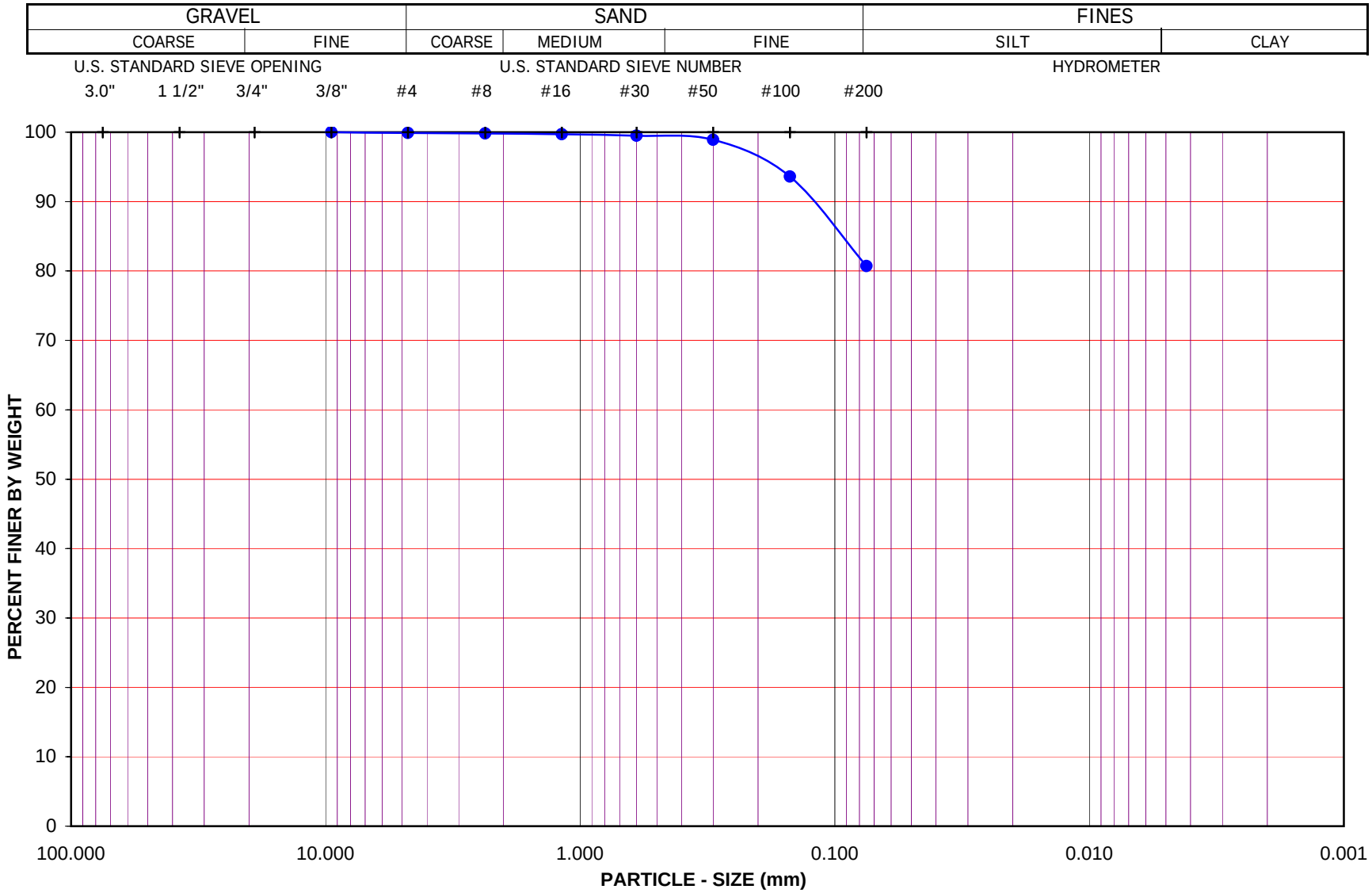
FINES: **81 %**

GROUP SYMBOL: **(CL)s**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-004 Sample No.: D-5

Depth (feet): 25.0 Soil Type : (CL)s

Soil Identification: Yellowish brown lean clay with sand (CL)s

GR:SA:FI : (%) 0 : 19 : 81

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jul-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Exploration No.: A-08-005
Sample No.: Bag-1
Soil Identification: Olive yellow sandy lean clay s(CL)

Tested By: S. Felter Date: 08/27/08
Checked By: LF Date: 08/29/08
Depth (feet): 0 - 7

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	602	969	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	2316.10	693.80	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	106.70	110.30	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	2209.40	583.50	Moisture Content (%)	0.00	0.00

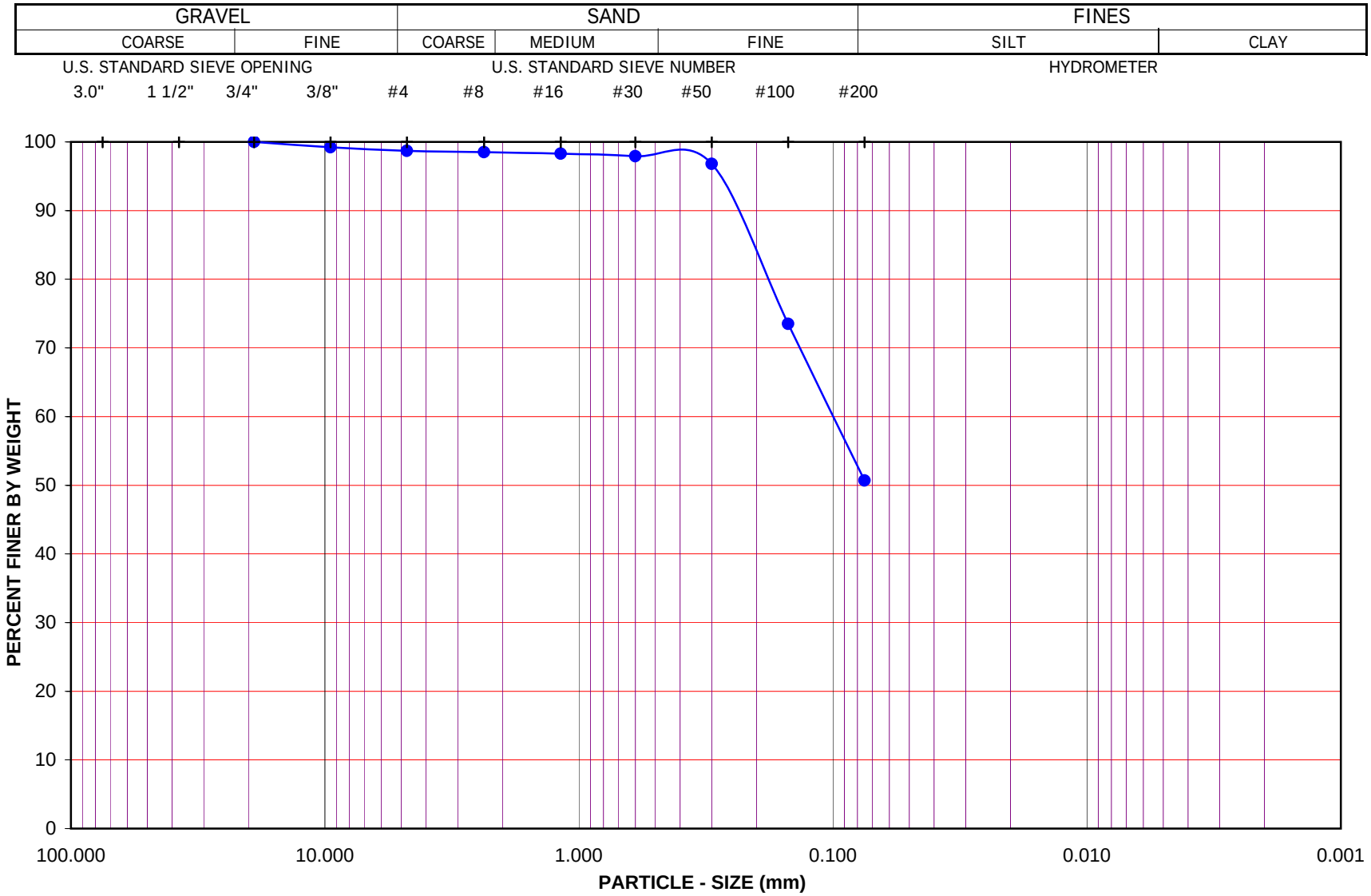
Passing #4 Material After Wet Sieve		
	Container No.	969
	Wt. of Dry Soil + Container (g)	401.20
	Wt. of Container (g)	110.30
	Dry Wt. of Soil Retained on # 200 Sieve (g)	290.90

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	0.00		
1 1/2	37.500	0.00		
3/4"	19.000	0.00		100.0
3/8"	9.500	17.80		99.2
#4	4.750	29.10		98.7
#8	2.360		1.20	98.5
#16	1.180		2.50	98.3
#30	0.600		4.60	97.9
#50	0.300		11.20	96.8
#100	0.150		148.80	73.5
#200	0.075		283.80	50.7
PAN				

GRAVEL: **1 %**
SAND: **48 %**
FINES: **51 %**
GROUP SYMBOL **s(CL)**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-005 Sample No.: Bag-1

Depth (feet): 0 - 7 Soil Type : s(CL)

Soil Identification: Olive yellow sandy lean clay s(CL)

GR:SA:FI : (%) 1 : 48 : 51

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/07/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Exploration No.:	A-08-005	Depth (feet):	5.0		
Sample No.:	D-1				
Soil Identification:	Yellowish brown sandy silt s(ML)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	VO	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	732.60	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	234.80	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	497.80	Moisture Content (%)	0.00

After Wet Sieve	Container No.	VO
	Wt. of Dry Soil + Container (g)	489.00
	Wt. of Container (g)	234.80
	Dry Wt. of Soil Retained on # 200 Sieve (g)	254.20

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	100.0
#8	2.360	0.20	100.0
#16	1.180	1.50	99.7
#30	0.600	3.10	99.4
#50	0.300	5.10	99.0
#100	0.150	93.40	81.2
#200	0.075	245.10	50.8
PAN			

GRAVEL: **0 %**

SAND: **49 %**

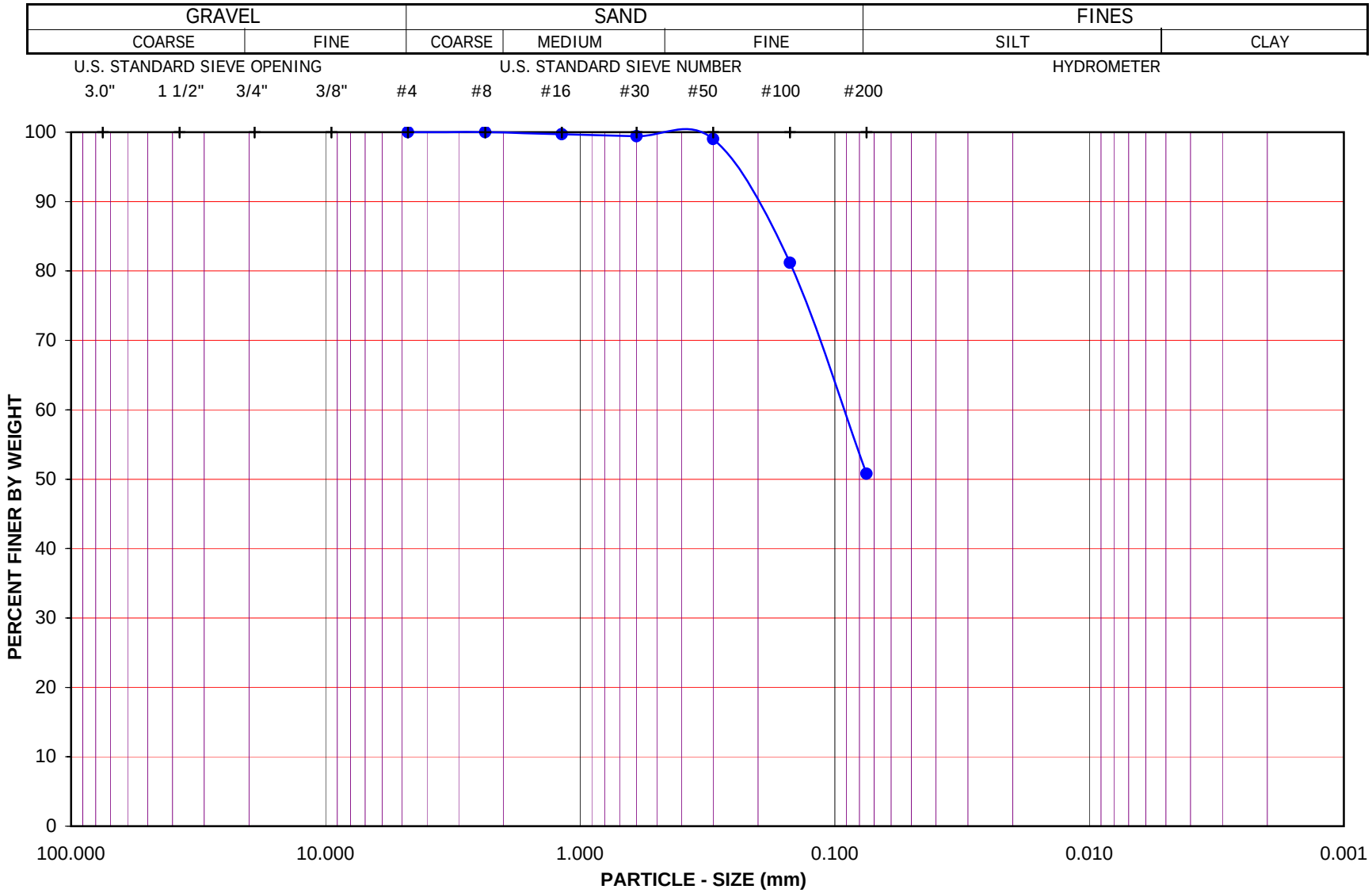
FINES: **51 %**

GROUP SYMBOL: **s(ML)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-005 Sample No.: D-1

Depth (feet): 5.0 Soil Type : s(ML)

Soil Identification: Yellowish brown sandy silt s(ML)

GR:SA:FI : (%) 0 : 49 : 51

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-005	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Brown silty gravel with sand (GM)s				

		Moisture Content of Total Air - Dry Soil	
Container No.:	RA	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	602.46	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	132.77	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	469.69	Moisture Content (%)	0.00

After Wet Sieve	Container No.	RA
	Wt. of Dry Soil + Container (g)	502.80
	Wt. of Container (g)	132.77
	Dry Wt. of Soil Retained on # 200 Sieve (g)	370.03

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	100.0
3/4"	19.000	50.90	89.2
3/8"	9.500	135.90	71.1
#4	4.750	190.00	59.5
#8	2.360	224.50	52.2
#16	1.180	250.40	46.7
#30	0.600	283.00	39.7
#50	0.300	318.10	32.3
#100	0.150	350.10	25.5
#200	0.075	369.50	21.3
PAN			

GRAVEL: **41 %**

SAND: **38 %**

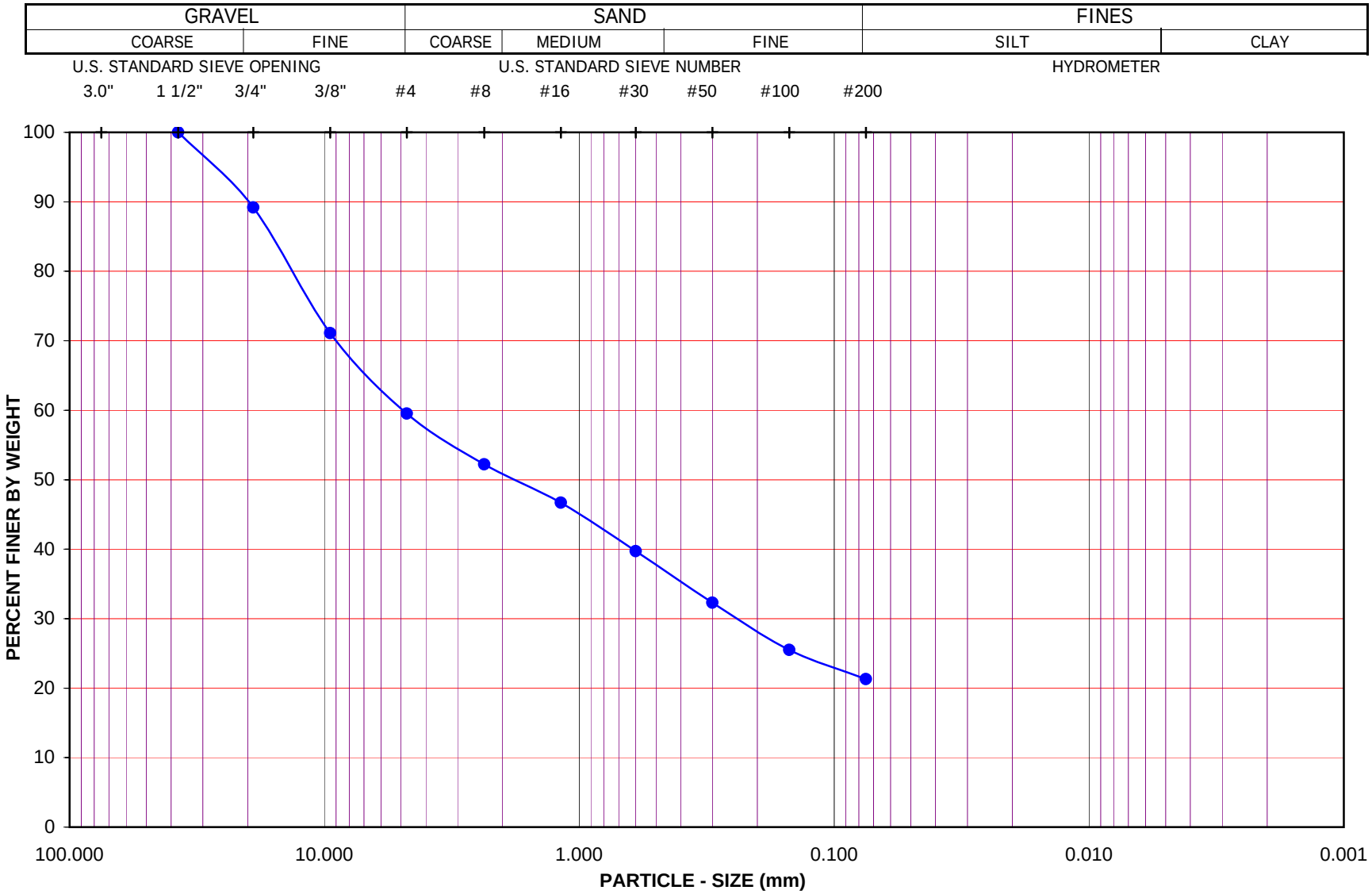
FINES: **21 %**

GROUP SYMBOL: **(GM)s**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: Insufficient sample mass available to meet the ASTM specification for this material



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-005 Sample No.: S-2

Depth (feet): 10.0 Soil Type : (GM)s

Soil Identification: Brown silty gravel with sand (GM)s

GR:SA:FI : (%) 41 : 38 : 21

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/19/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/21/08

Exploration No.: A-08-005

Sample No.: S-4 | Depth (feet) : 20.0

Soil Identification: Olive brown sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	34	s(CL)
% Fines	66	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	101.14
Wt.of Air-Dry Soil + Cont. (g)	349.91	Wt. of Container No.___ (g)	1.00	1.00	76.79
Wt. of Container	39.68	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	310.23	Wt. of Dry Soil (g)			24.35

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.00	100.0
Pan		

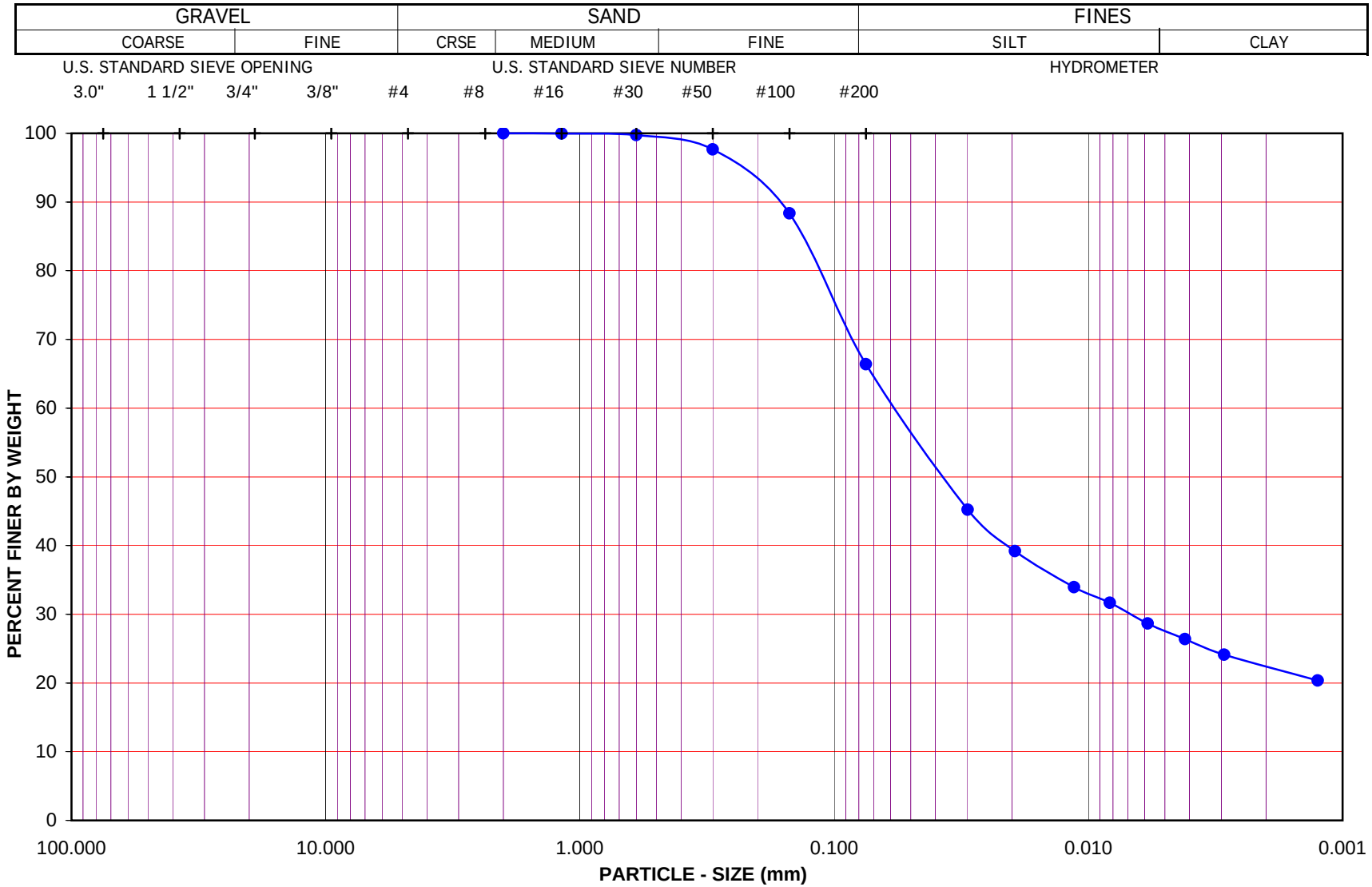
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.03	100.0	100.0
No. 30	0.16	99.8	99.8
No. 50	1.55	97.6	97.6
No. 100	7.66	88.4	88.4
No. 200	22.12	66.4	66.4
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.79 Wt. of Dry Soil (g) 65.79

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Aug-08	10:22	0		8.0			
	10:24	2	21.7	8.0	38.0	45.2	0.0298
	10:27	5	21.8	8.0	34.0	39.2	0.0194
	10:37	15	22.0	8.0	30.5	33.9	0.0114
	10:52	30	21.9	8.0	29.0	31.7	0.0082
	11:22	60	22.0	8.0	27.0	28.6	0.0058
	12:22	120	22.4	8.0	25.5	26.4	0.0042
	14:32	250	22.9	8.0	24.0	24.1	0.0029
20-Aug-08	10:22	1440	21.6	8.0	21.5	20.4	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-005 Sample No.: S-4

Depth (feet) : 20.0 Soil Type : s(CL)

Soil Identification: Olive brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 34 : 66

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	07/29/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Exploration No.:	A-08-007	Depth (feet):	5.0		
Sample No.:	D-1				
Soil Identification:	Yellowish brown silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	GE	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	649.20	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	251.40	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	397.80	Moisture Content (%)	0.00

After Wet Sieve	Container No.	GE
	Wt. of Dry Soil + Container (g)	594.70
	Wt. of Container (g)	251.40
	Dry Wt. of Soil Retained on # 200 Sieve (g)	343.30

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.20	99.9
#8	2.360	1.10	99.7
#16	1.180	2.20	99.4
#30	0.600	5.10	98.7
#50	0.300	46.00	88.4
#100	0.150	252.20	36.6
#200	0.075	342.20	14.0
PAN			

GRAVEL: **0 %**

SAND: **86 %**

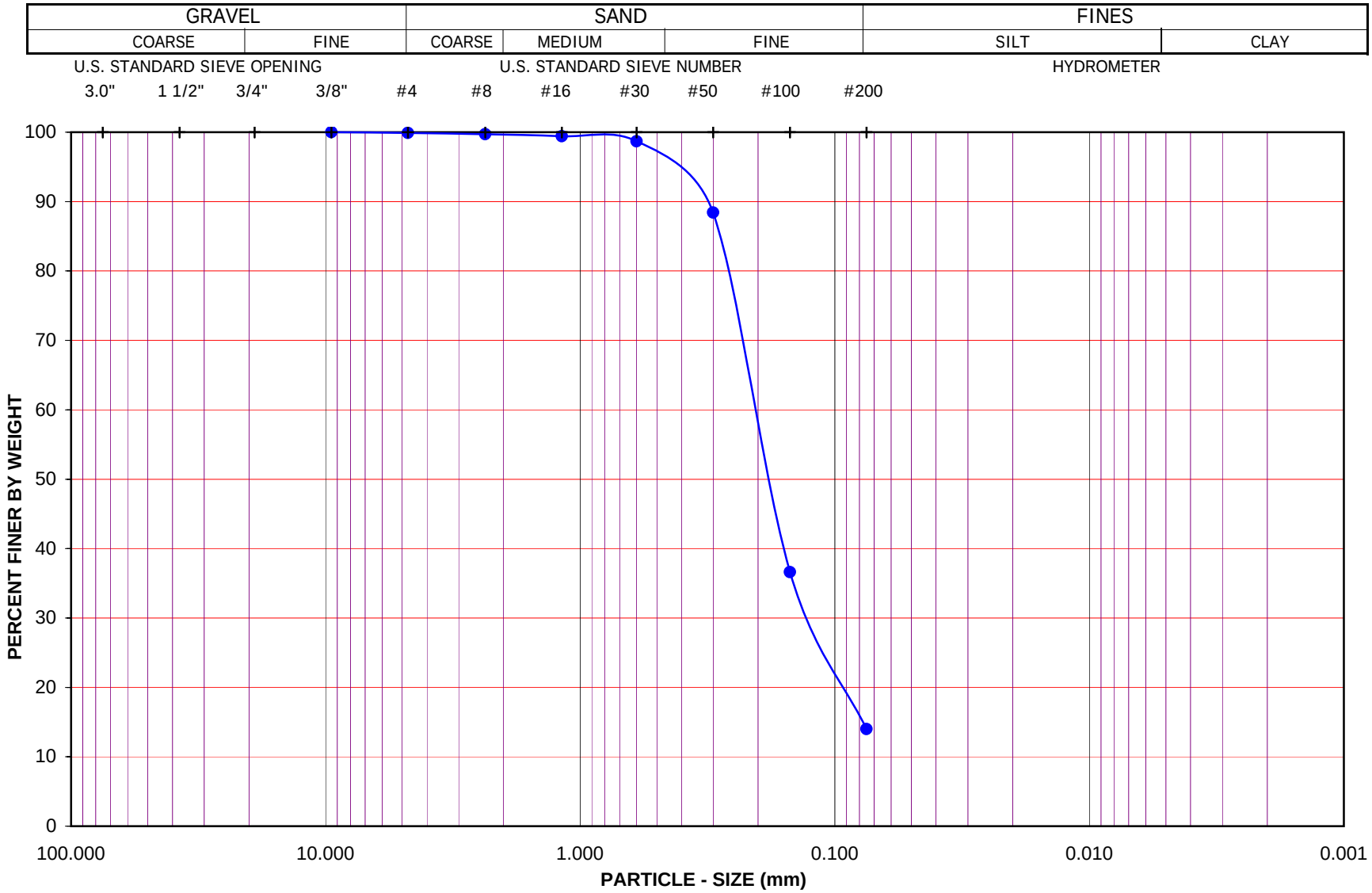
FINES: **14 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-007 Sample No.: D-1

Depth (feet): 5.0 Soil Type : SM

Soil Identification: Yellowish brown silty sand (SM)

GR:SA:FI : (%) 0 : 86 : 14

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jul-08

SA A-08-007, D-1

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/01/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/06/08
Exploration No.:	A-08-007	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Brown silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	RA	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	409.10	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	132.79	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	276.31	Moisture Content (%)	0.00

After Wet Sieve	Container No.	RA
	Wt. of Dry Soil + Container (g)	364.50
	Wt. of Container (g)	132.79
	Dry Wt. of Soil Retained on # 200 Sieve (g)	231.71

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	
#8	2.360	0.00	100.0
#16	1.180	0.30	99.9
#30	0.600	0.80	99.7
#50	0.300	9.40	96.6
#100	0.150	160.40	41.9
#200	0.075	230.10	16.7
PAN			

GRAVEL: **0 %**

SAND: **83 %**

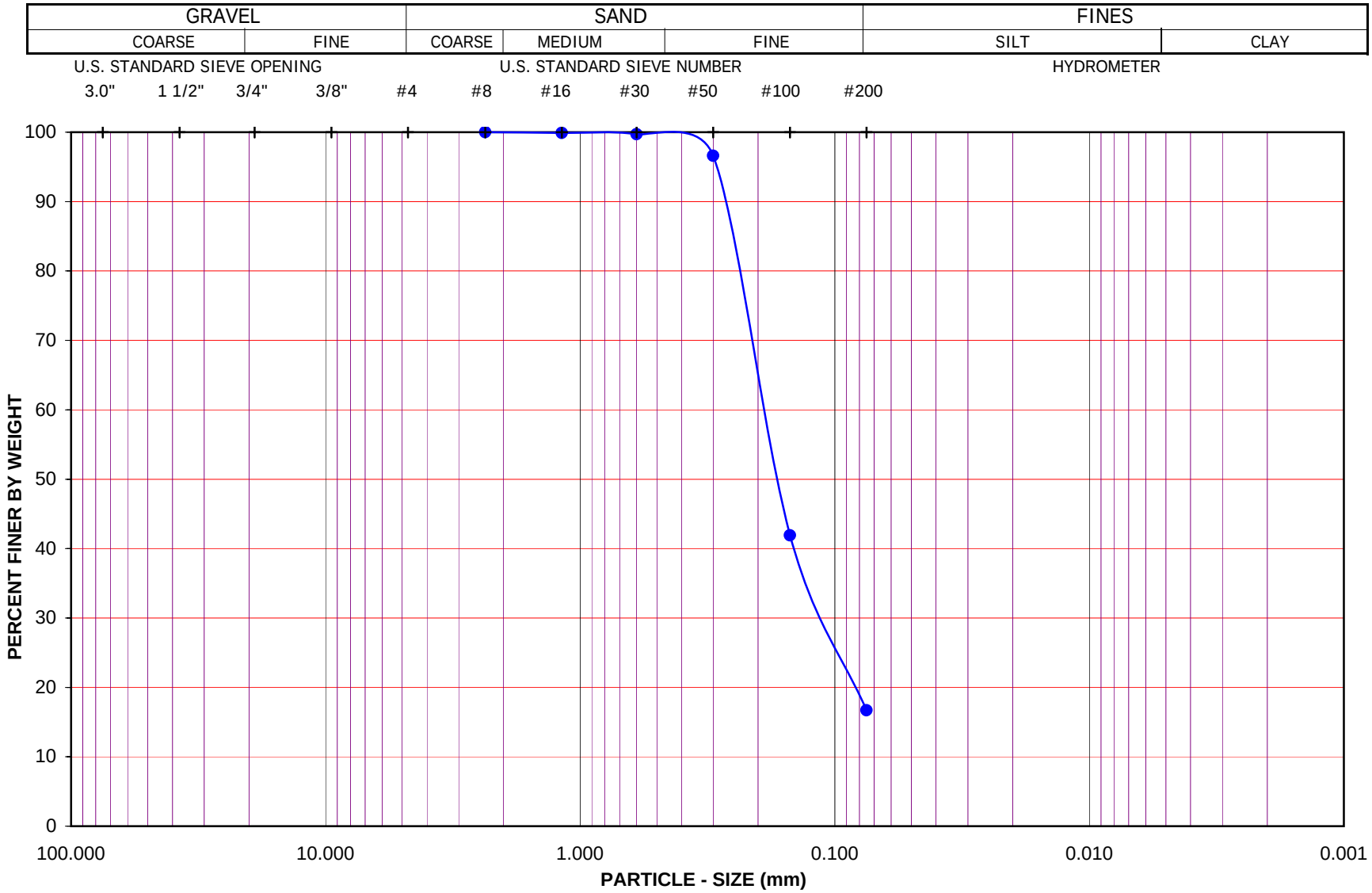
FINES: **17 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-007 Sample No.: S-2

Depth (feet): 10.0 Soil Type : SM

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 0 : 83 : 17

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-007, S-2

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/07/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/20/08

Exploration No.: A-08-008

Sample No.: BAG-1 | Depth (feet) : 0-7

Soil Identification: Yellowish brown lean clay with sand (CL)s

% Gravel	0	Soil Type
% Sand	15	(CL)s
% Fines	85	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	92.59
Wt.of Air-Dry Soil + Cont. (g)	411.30	Wt. of Container No.___ (g)	1.00	1.00	82.75
Wt. of Container	76.40	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	334.90	Wt. of Dry Soil (g)			9.84

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	1.30	99.6
No. 10	2.80	99.2
Pan		

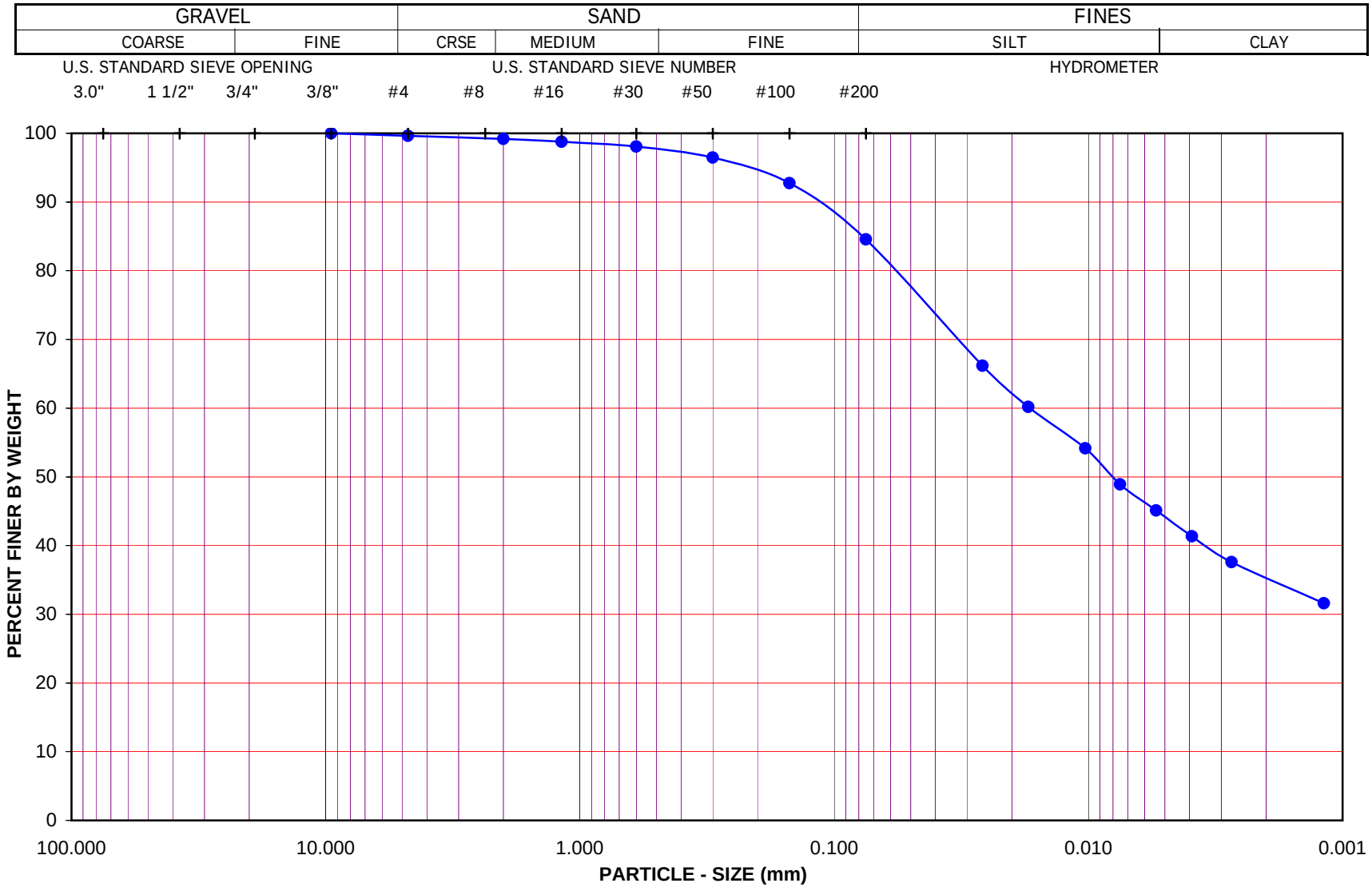
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.2
No. 16	0.25	99.6	98.8
No. 30	0.72	98.9	98.1
No. 50	1.79	97.3	96.4
No. 100	4.24	93.5	92.7
No. 200	9.63	85.3	84.6
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.40 Wt. of Dry Soil (g) 65.40

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
07-Aug-08	9:38	0		7.0			
	9:40	2	22.1	7.0	51.0	66.2	0.0261
	9:43	5	22.1	7.0	47.0	60.2	0.0172
	9:53	15	22.1	7.0	43.0	54.1	0.0103
	10:08	30	22.2	7.0	39.5	48.9	0.0075
	10:38	60	22.5	7.0	37.0	45.1	0.0054
	11:38	120	22.9	7.0	34.5	41.4	0.0039
	13:48	250	23.6	7.0	32.0	37.6	0.0027
08-Aug-08	9:38	1440	22.3	7.0	28.0	31.6	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-008 Sample No.: BAG-1

Depth (feet) : 0-7 Soil Type : (CL)s

Soil Identification: Yellowish brown lean clay with sand (CL)s

GR:SA:FI : (%) 0 : 15 : 85

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/01/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/22/08
Exploration No.:	A-08-008	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Yellowish brown fat clay (CH) with caliche				

		Moisture Content of Total Air - Dry Soil	
Container No.:	RC	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	376.20	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	135.80	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	240.40	Moisture Content (%)	0.00

After Wet Sieve	Container No.	RC
	Wt. of Dry Soil + Container (g)	161.50
	Wt. of Container (g)	135.80
	Dry Wt. of Soil Retained on # 200 Sieve (g)	25.70

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.40	99.8
#8	2.360	0.50	99.8
#16	1.180	0.60	99.8
#30	0.600	0.90	99.6
#50	0.300	1.80	99.3
#100	0.150	10.70	95.5
#200	0.075	25.20	89.5
PAN			

GRAVEL: **0 %**

SAND: **10 %**

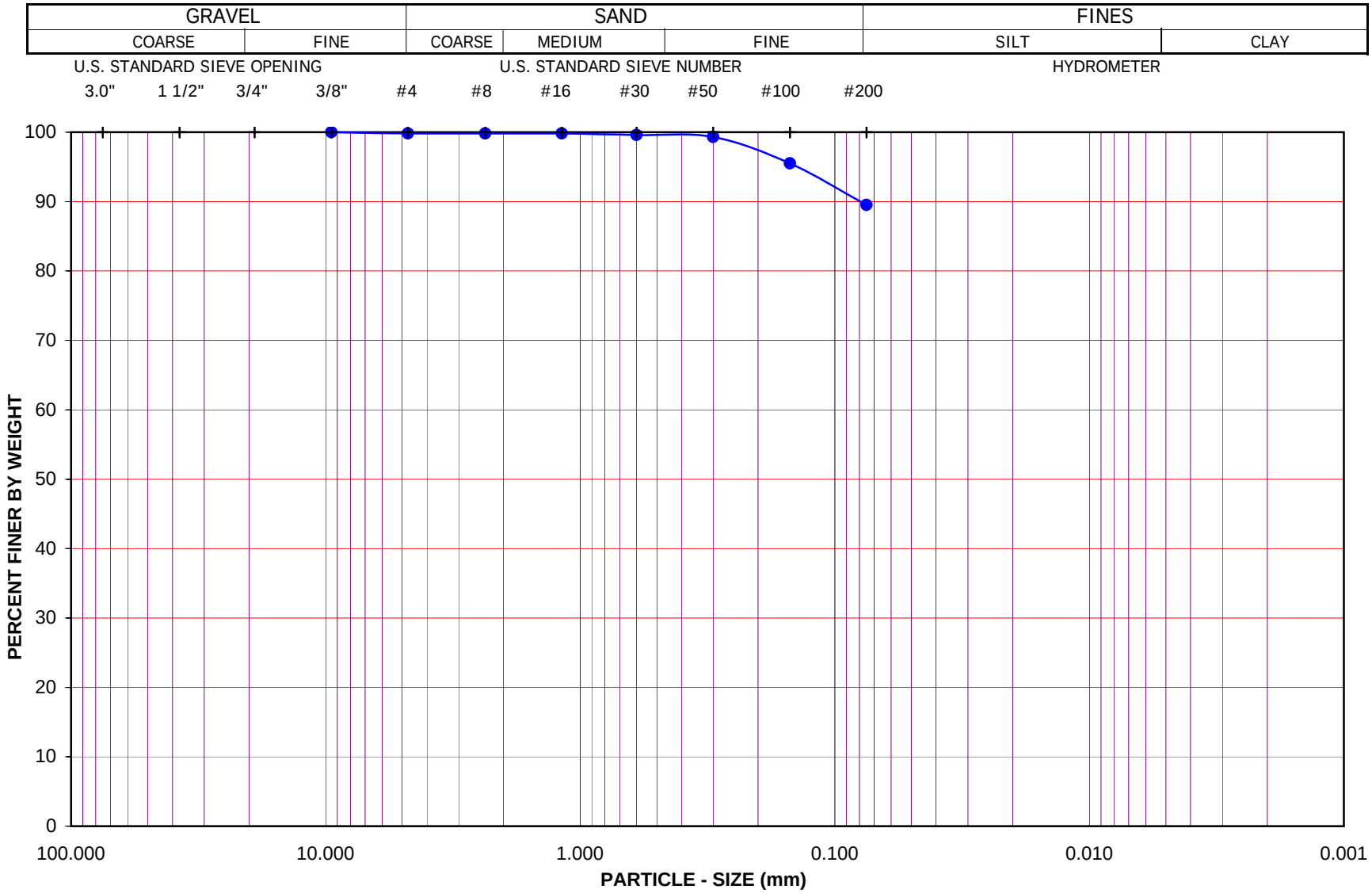
FINES: **90 %**

GROUP SYMBOL: **CH**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-008 Sample No.: S-2

Depth (feet): 10.0 Soil Type : CH

Soil Identification: Yellowish brown fat clay (CH) with caliche

GR:SA:FI : (%) 0 : 10 : 90

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/01/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/06/08
Exploration No.:	A-08-008	Depth (feet):	20.0		
Sample No.:	S-4				
Soil Identification:	Grayish brown silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	TK	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	381.06	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	142.65	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	238.41	Moisture Content (%)	0.00

After Wet Sieve	Container No.	TK
	Wt. of Dry Soil + Container (g)	302.10
	Wt. of Container (g)	142.65
	Dry Wt. of Soil Retained on # 200 Sieve (g)	159.45

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	
#8	2.360	0.00	
#16	1.180	0.00	100.0
#30	0.600	0.10	100.0
#50	0.300	0.80	99.7
#100	0.150	48.70	79.6
#200	0.075	150.80	36.7
PAN			

GRAVEL: **0 %**

SAND: **63 %**

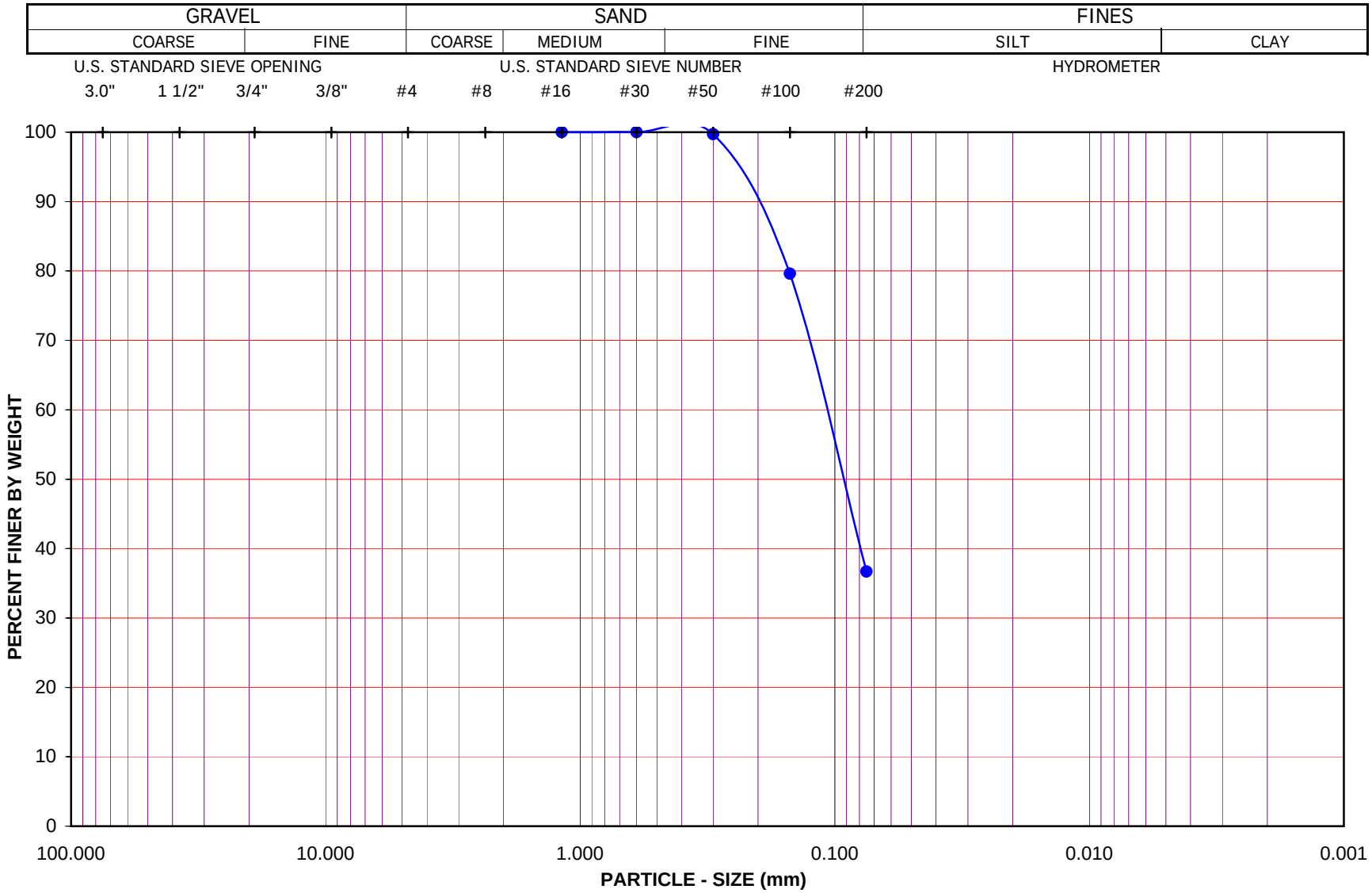
FINES: **37 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-008 Sample No.: S-4

Depth (feet): 20.0 Soil Type : SM

Soil Identification: Grayish brown silty sand (SM)

GR:SA:FI : (%) 0 : 63 : 37

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-008, S-4

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/01/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/06/08
Exploration No.:	A-08-008	Depth (feet):	25.0		
Sample No.:	D-5				
Soil Identification:	Olive brown lean clay (CL)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	O	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	504.82	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	154.62	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	350.20	Moisture Content (%)	0.00

After Wet Sieve	Container No.	O
	Wt. of Dry Soil + Container (g)	162.80
	Wt. of Container (g)	154.62
	Dry Wt. of Soil Retained on # 200 Sieve (g)	8.18

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.50	99.9
#8	2.360	2.60	99.3
#16	1.180	4.10	98.8
#30	0.600	4.70	98.7
#50	0.300	4.90	98.6
#100	0.150	5.20	98.5
#200	0.075	7.70	97.8
PAN			

GRAVEL: **0 %**

SAND: **2 %**

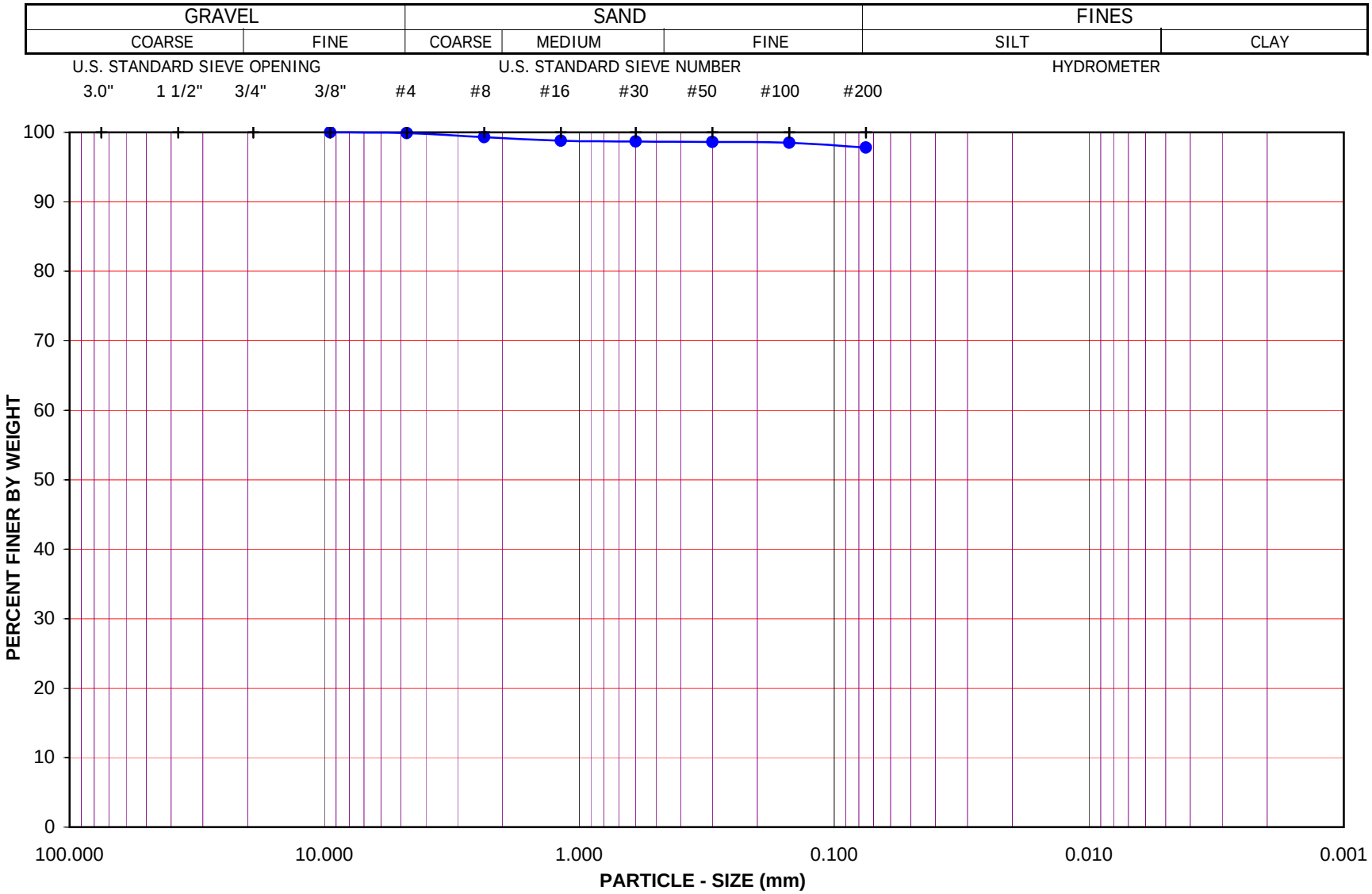
FINES: **98 %**

GROUP SYMBOL: **CL**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-008 Sample No.: D-5

Depth (feet): 25.0 Soil Type : CL

Soil Identification: Olive brown lean clay (CL)

GR:SA:FI : (%) 0 : 2 : 98

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Exploration No.: A-08-009
Sample No.: Bag-1
Soil Identification: Olive brown clayey sand (SC)

Tested By: S. Felter Date: 08/18/08
Checked By: LF Date: 08/19/08
Depth (feet): 0 - 7

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	ES-10	WR	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	3562.10	730.90	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	224.60	238.60	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	3337.50	492.30	Moisture Content (%)	0.00	0.00

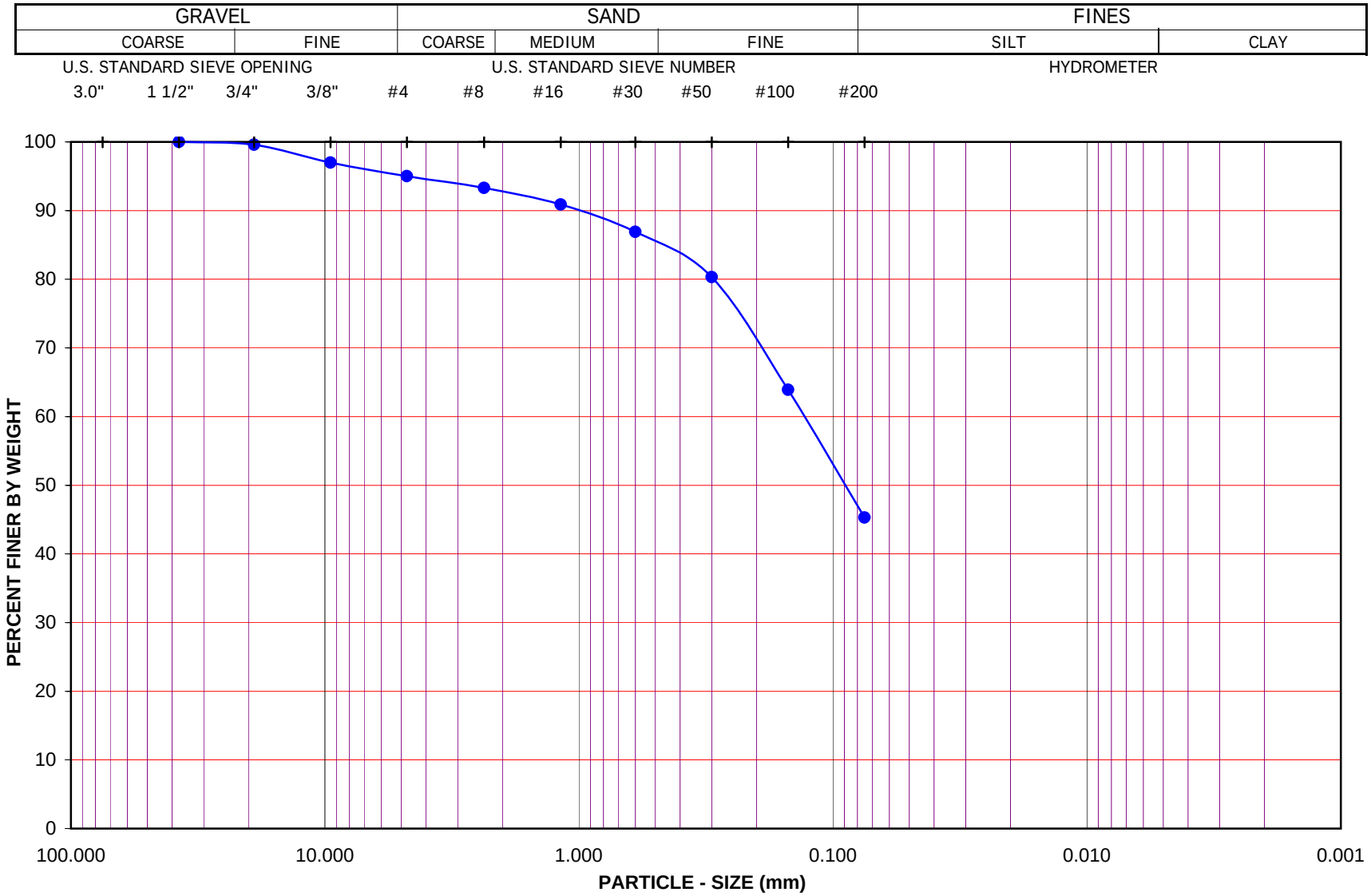
Passing #4 Material After Wet Sieve		
	Container No.	WR
	Wt. of Dry Soil + Container (g)	501.10
	Wt. of Container (g)	238.60
	Dry Wt. of Soil Retained on # 200 Sieve (g)	262.50

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	0.00		
1 1/2	37.500	0.00		100.0
3/4"	19.000	14.60		99.6
3/8"	9.500	99.50		97.0
#4	4.750	166.80		95.0
#8	2.360		9.00	93.3
#16	1.180		21.20	90.9
#30	0.600		42.00	86.9
#50	0.300		76.20	80.3
#100	0.150		161.40	63.9
#200	0.075		257.60	45.3
PAN				

GRAVEL: **5 %**
SAND: **50 %**
FINES: **45 %**
GROUP SYMBOL **SC**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-009 Sample No.: Bag-1

Depth (feet): 0 - 7 Soil Type : SC

Soil Identification: Olive brown clayey sand (SC)

GR:SA:FI : (%) 5 : 50 : 45

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-009, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-009	Depth (feet):	5.0		
Sample No.:	D-1				
Soil Identification:	Yellowish brown silty, clayey sand (SC-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	ZK	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	757.80	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	249.50	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	508.30	Moisture Content (%)	0.00

After Wet Sieve	Container No.	ZK
	Wt. of Dry Soil + Container (g)	516.00
	Wt. of Container (g)	249.50
	Dry Wt. of Soil Retained on # 200 Sieve (g)	266.50

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	2.20	99.6
#4	4.750	5.40	98.9
#8	2.360	9.80	98.1
#16	1.180	14.00	97.2
#30	0.600	19.90	96.1
#50	0.300	33.40	93.4
#100	0.150	117.40	76.9
#200	0.075	261.30	48.6
PAN			

GRAVEL: **1 %**

SAND: **50 %**

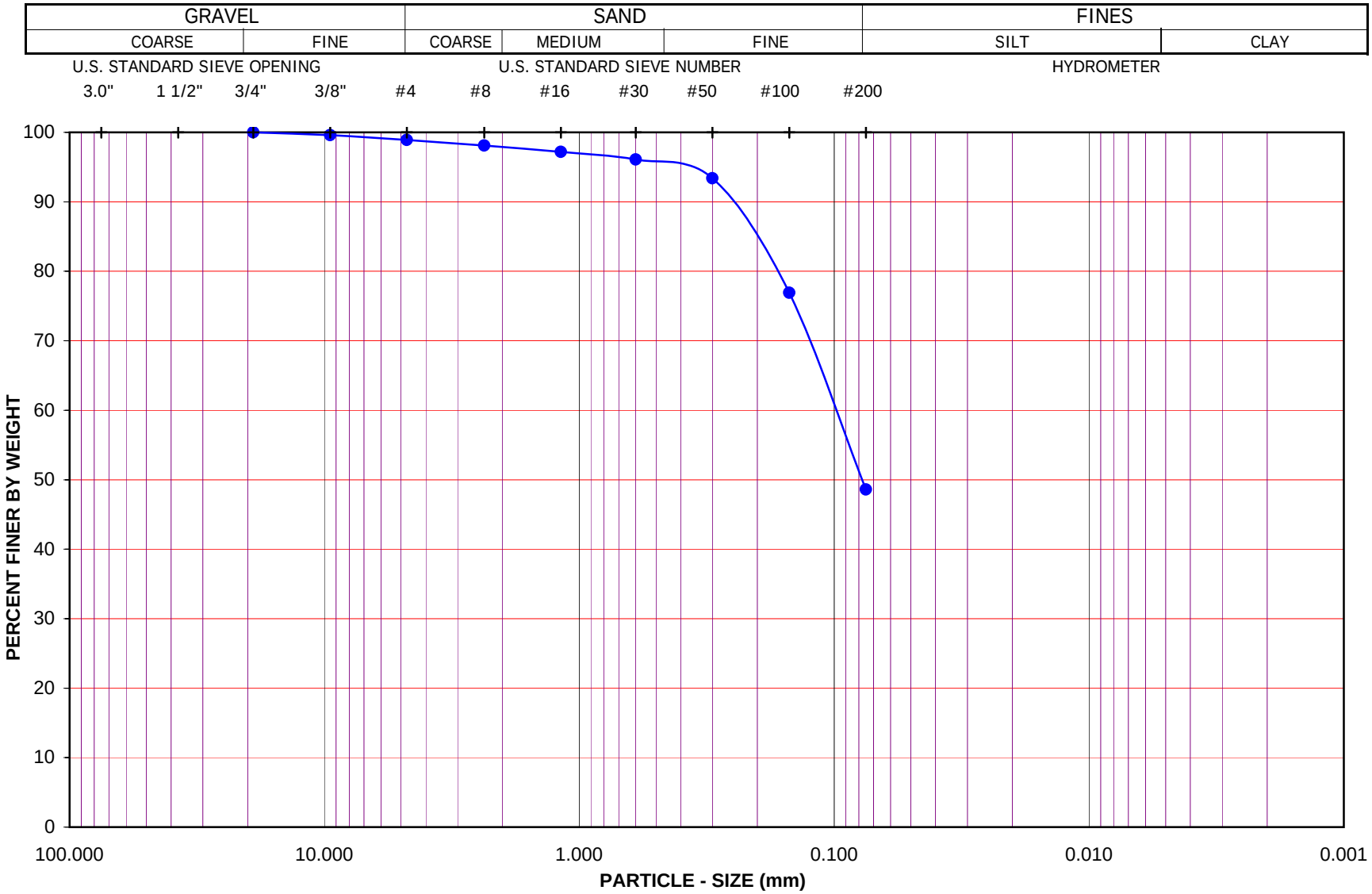
FINES: **49 %**

GROUP SYMBOL: **SC-SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-009 Sample No.: D-1

Depth (feet): 5.0 Soil Type : SC-SM

Soil Identification: Yellowish brown silty, clayey sand (SC-SM)

GR:SA:FI : (%) 1 : 50 : 49

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-009	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Brown sandy lean clay s(CL)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	RC	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	514.11	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	135.74	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	378.37	Moisture Content (%)	0.00

After Wet Sieve	Container No.	RC
	Wt. of Dry Soil + Container (g)	327.80
	Wt. of Container (g)	135.74
	Dry Wt. of Soil Retained on # 200 Sieve (g)	192.06

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	2.50	99.3
#8	2.360	4.40	98.8
#16	1.180	7.70	98.0
#30	0.600	16.80	95.6
#50	0.300	42.20	88.8
#100	0.150	116.90	69.1
#200	0.075	188.90	50.1
PAN			

GRAVEL: **1 %**

SAND: **49 %**

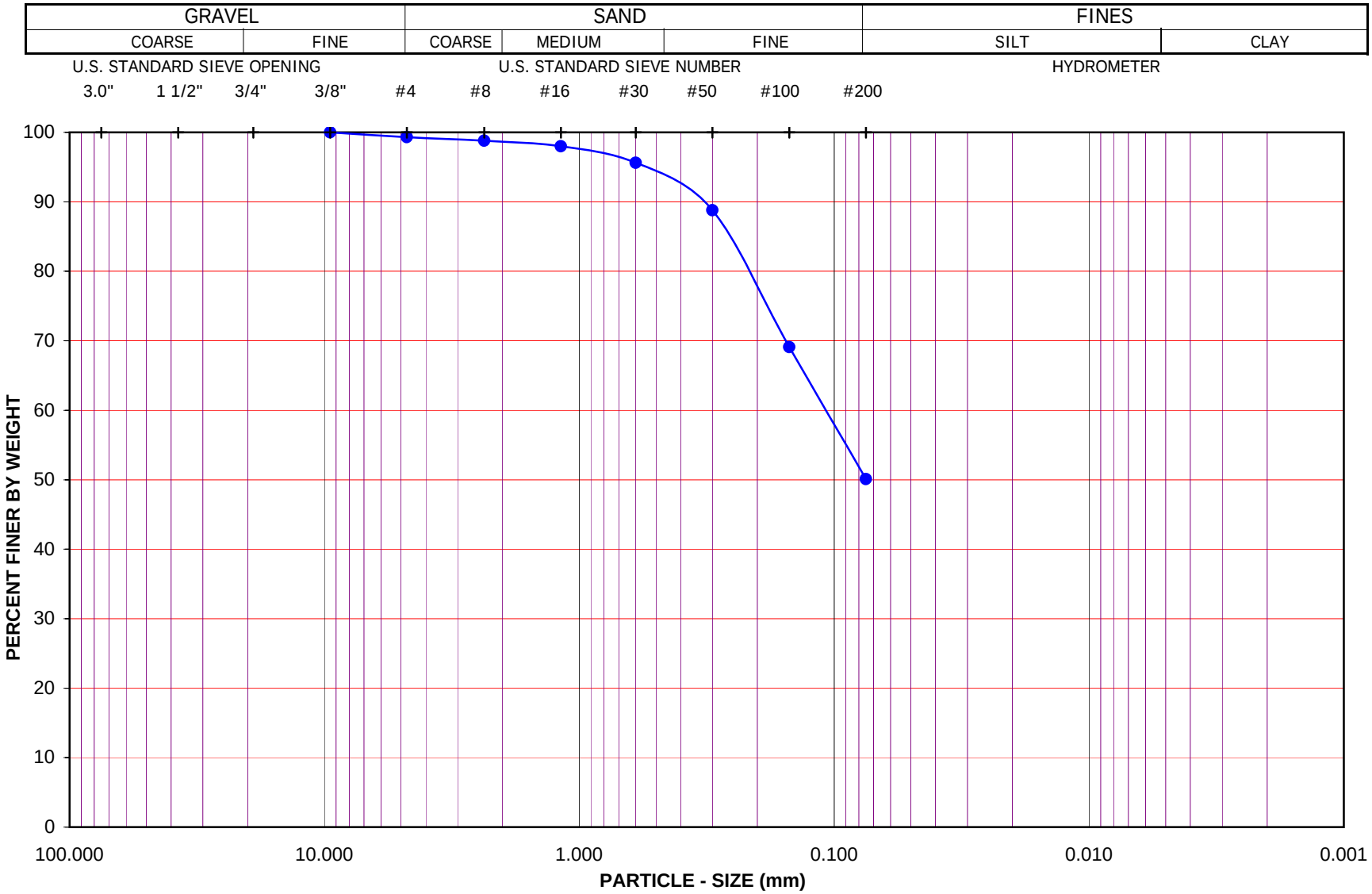
FINES: **50 %**

GROUP SYMBOL: **s(CL)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-009 Sample No.: S-2

Depth (feet): 10.0 Soil Type : s(CL)

Soil Identification: Brown sandy lean clay s(CL)

GR:SA:FI : (%) 1 : 49 : 50

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/05/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/07/08
Exploration No.:	A-08-009	Depth (feet):	25.0		
Sample No.:	D-5				
Soil Identification:	Olive brown sandy silty clay s(CL-ML)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	VI	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	643.50	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	220.51	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	422.99	Moisture Content (%)	0.00

After Wet Sieve	Container No.	VI
	Wt. of Dry Soil + Container (g)	422.60
	Wt. of Container (g)	220.51
	Dry Wt. of Soil Retained on # 200 Sieve (g)	202.09

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	11.20	97.4
#4	4.750	12.10	97.1
#8	2.360	14.70	96.5
#16	1.180	17.80	95.8
#30	0.600	24.90	94.1
#50	0.300	41.20	90.3
#100	0.150	111.80	73.6
#200	0.075	198.70	53.0
PAN			

GRAVEL: **3 %**

SAND: **44 %**

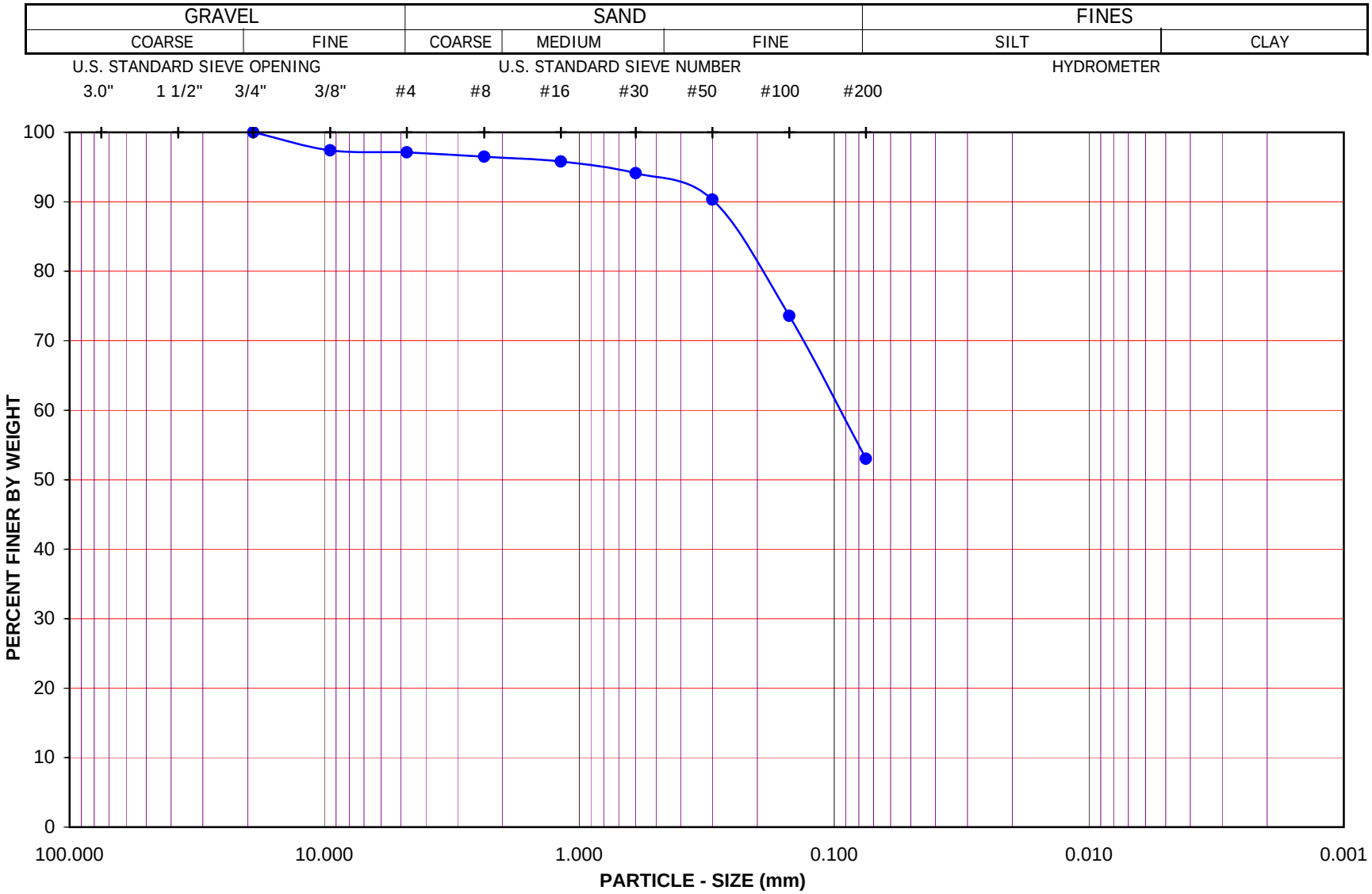
FINES: **53 %**

GROUP SYMBOL: **s(CL-ML)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-009 Sample No.: D-5

Depth (feet): 25.0 Soil Type : s(CL-ML)

Soil Identification: Olive brown sandy silty clay s(CL-ML)

GR:SA:FI : (%) 3 : 44 : 53

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Exploration No.: A-08-010
Sample No.: Bag-1
Soil Identification: Yellowish brown clayey sand (SC)

Tested By: S. Felter Date: 08/05/08
Checked By: LF Date: 08/07/08
Depth (feet): 0 - 7

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	CP-11	CT	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	2736.60	801.60	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	223.70	244.30	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	2512.90	557.30	Moisture Content (%)	0.00	0.00

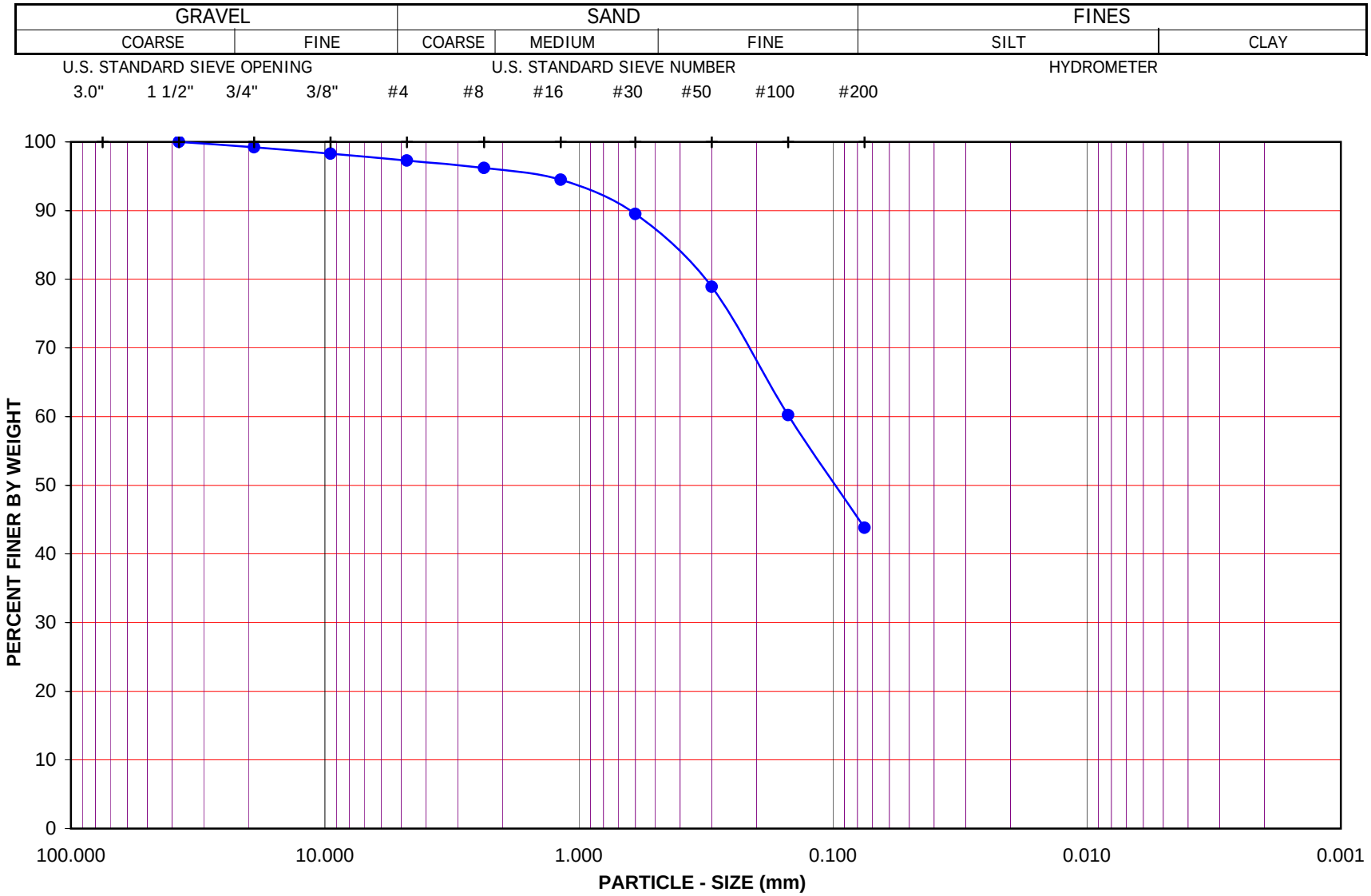
Passing #4 Material After Wet Sieve		
	Container No.	CT
	Wt. of Dry Soil + Container (g)	553.60
	Wt. of Container (g)	244.30
	Dry Wt. of Soil Retained on # 200 Sieve (g)	309.30

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	0.00		
1 1/2	37.500	0.00		100.0
3/4"	19.000	19.00		99.2
3/8"	9.500	42.20		98.3
#4	4.750	69.00		97.3
#8	2.360		6.40	96.2
#16	1.180		16.30	94.5
#30	0.600		44.80	89.5
#50	0.300		105.50	78.9
#100	0.150		212.50	60.2
#200	0.075		306.70	43.8
PAN				

GRAVEL: **3 %**
SAND: **53 %**
FINES: **44 %**
GROUP SYMBOL **SC**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-010 Sample No.: Bag-1

Depth (feet): 0 - 7 Soil Type : SC

Soil Identification: Yellowish brown clayey sand (SC)

GR:SA:FI : (%) 3 : 53 : 44

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-010, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/01/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/06/08
Exploration No.:	A-08-010	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Brown silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	J	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	527.48	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	140.72	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	386.76	Moisture Content (%)	0.00

After Wet Sieve	Container No.	J
	Wt. of Dry Soil + Container (g)	364.90
	Wt. of Container (g)	140.72
	Dry Wt. of Soil Retained on # 200 Sieve (g)	224.18

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.80	99.8
#8	2.360	4.70	98.8
#16	1.180	12.70	96.7
#30	0.600	37.00	90.4
#50	0.300	83.30	78.5
#100	0.150	163.80	57.6
#200	0.075	222.90	42.4
PAN			

GRAVEL: **0 %**

SAND: **58 %**

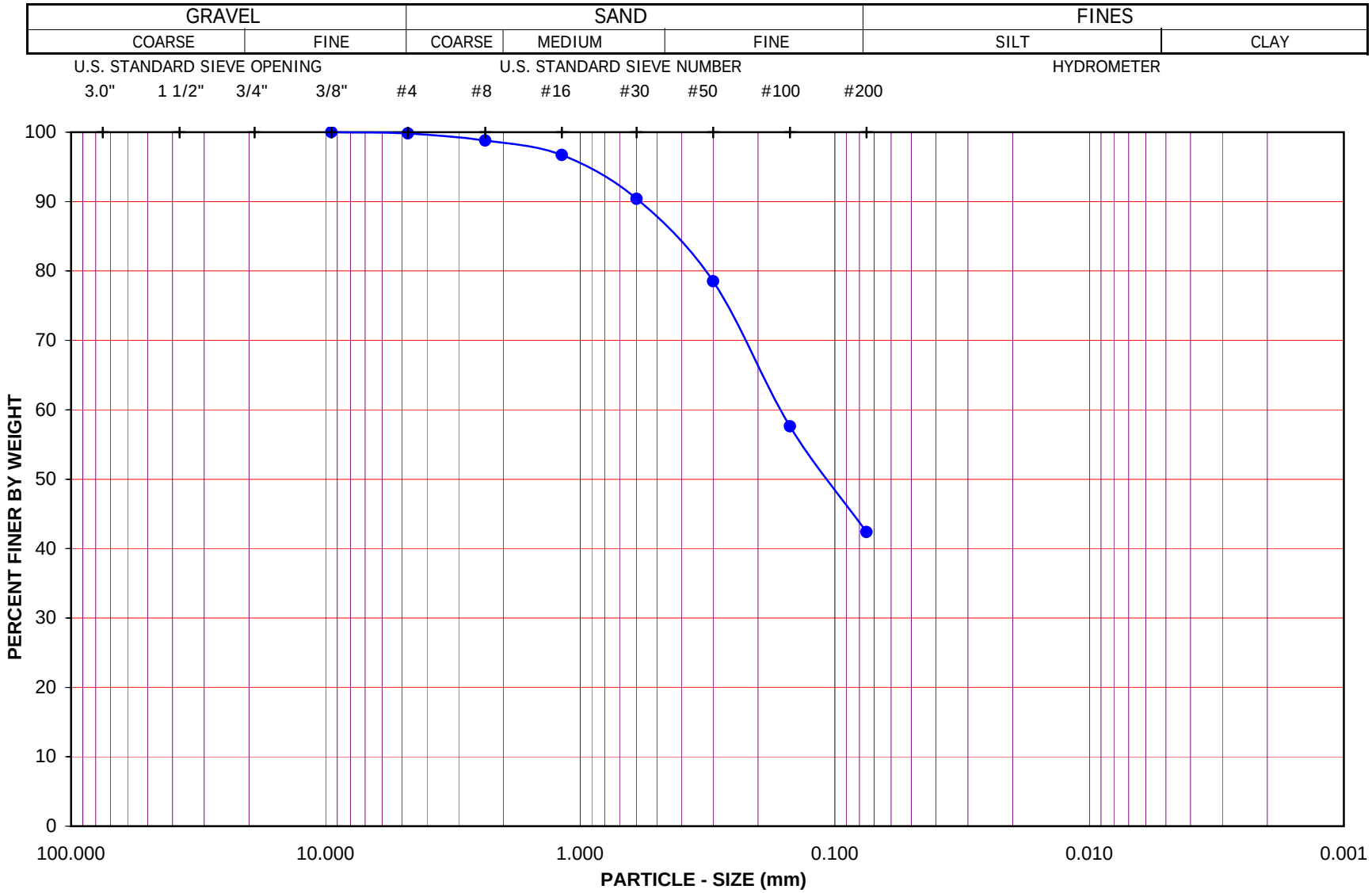
FINES: **42 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-010 Sample No.: S-2

Depth (feet): 10.0 Soil Type : SM

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 0 : 58 : 42

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-010, S-2

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/20/08

Exploration No.: A-08-010

Sample No.: S-4 | Depth (feet) : 20.0

Soil Identification: Dark brown sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	49	s(CL)
% Fines	51	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	107.54
Wt.of Air-Dry Soil + Cont. (g)	305.60	Wt. of Container No.___ (g)	1.00	1.00	75.44
Wt. of Container	38.80	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	266.80	Wt. of Dry Soil (g)			32.10

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.50	99.8
No. 10	3.00	98.9
Pan		

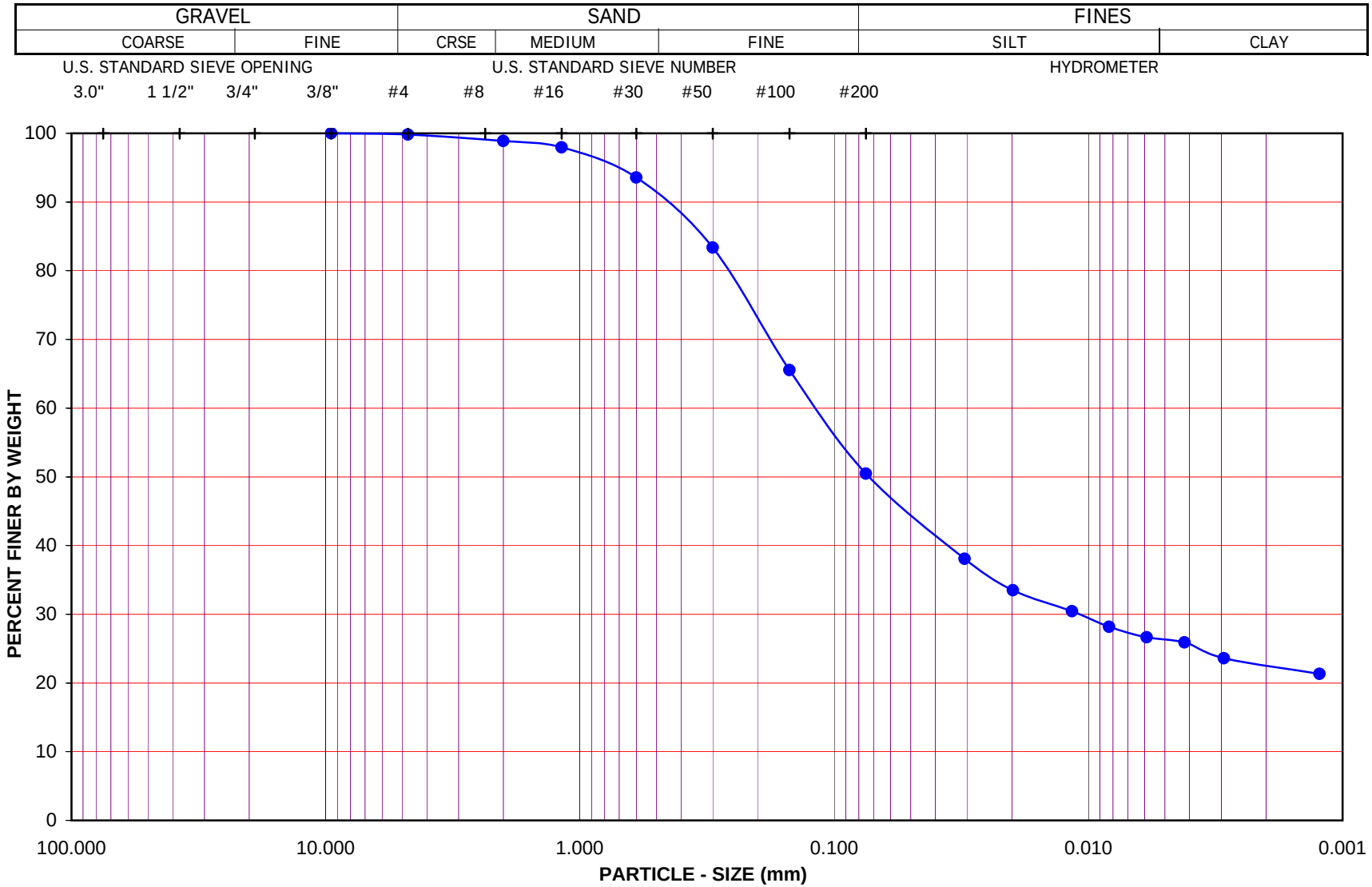
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	98.9
No. 16	0.61	99.1	97.9
No. 30	3.47	94.6	93.5
No. 50	10.10	84.3	83.4
No. 100	21.71	66.3	65.5
No. 200	31.54	51.0	50.5
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 64.40 Wt. of Dry Soil (g) 64.40

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	11:18	0		8.0			
	11:20	2	22.2	8.0	33.0	38.1	0.0306
	11:23	5	22.2	8.0	30.0	33.5	0.0198
	11:33	15	22.2	8.0	28.0	30.5	0.0116
	11:48	30	22.2	8.0	26.5	28.2	0.0083
	12:18	60	22.2	8.0	25.5	26.7	0.0059
	13:18	120	22.6	8.0	25.0	25.9	0.0042
	15:28	250	22.7	8.0	23.5	23.6	0.0029
12-Aug-08	11:18	1440	22.7	8.0	22.0	21.3	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-010 Sample No.: S-4

Depth (feet) : 20.0 Soil Type : s(CL)

Soil Identification: Dark brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 49 : 51

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/27/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/29/08
Exploration No.:	A-08-011	Depth (feet):	0-7		
Sample No.:	Bag-1				
Soil Identification:	Yellowish brown clayey sand (SC)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	543	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	711.80	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	82.40	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	629.40	Moisture Content (%)	0.00

After Wet Sieve	Container No.	543
	Wt. of Dry Soil + Container (g)	N/A
	Wt. of Container (g)	82.40
	Dry Wt. of Soil Retained on # 200 Sieve (g)	N/A

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	7.00	98.9
#4	4.750	11.00	98.3
#8	2.360	15.80	97.5
#16	1.180	23.50	96.3
#30	0.600	52.80	91.6
#50	0.300	131.10	79.2
#100	0.150	269.50	57.2
#200	0.075	360.80	42.7
PAN			

GRAVEL: **2 %**

SAND: **55 %**

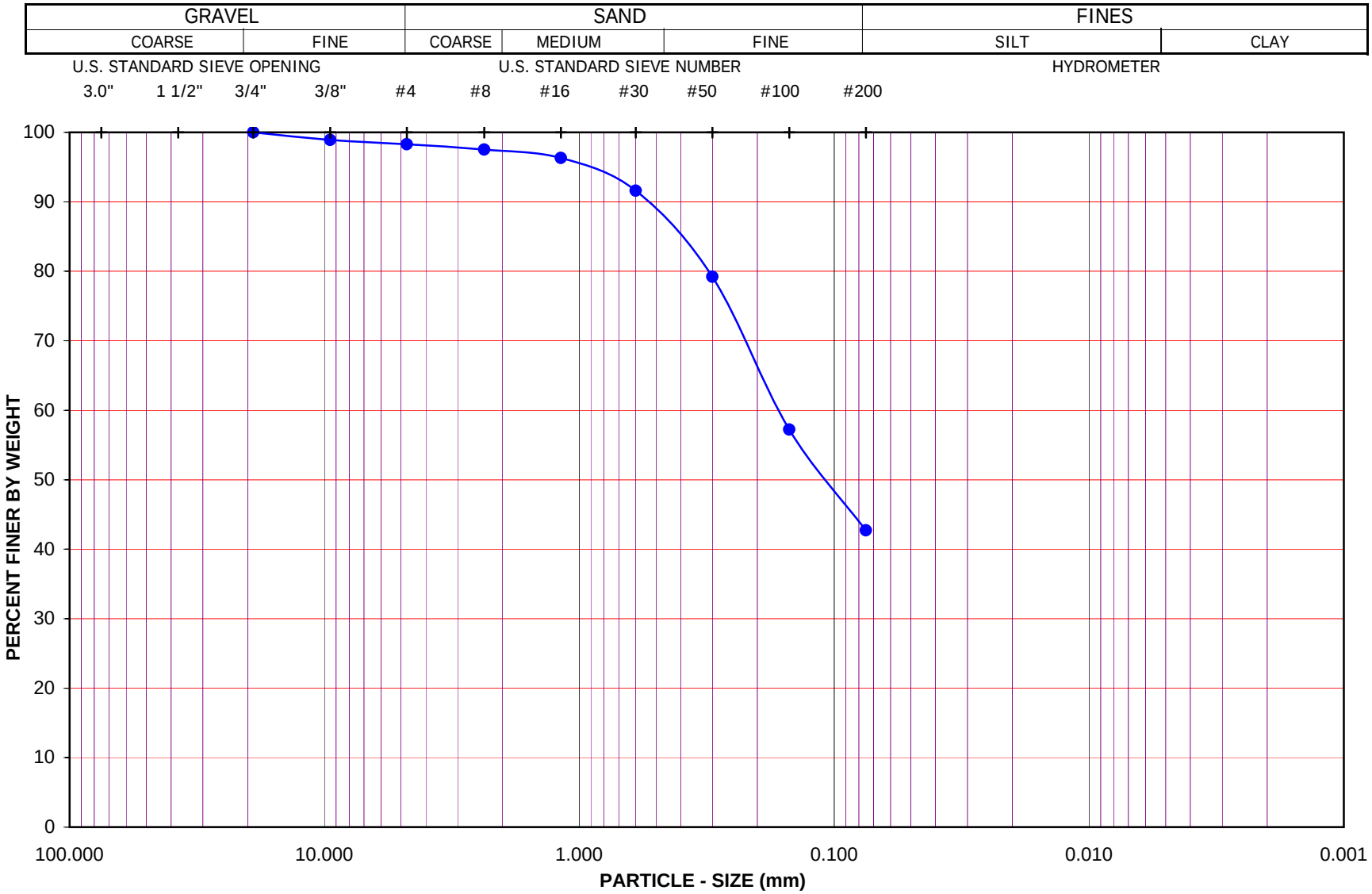
FINES: **43 %**

GROUP SYMBOL: **SC**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-011 Sample No.: Bag-1

Depth (feet): 0-7 Soil Type : SC

Soil Identification: Yellowish brown clayey sand (SC)

GR:SA:FI : (%) 2 : 55 : 43

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-011, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/21/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/26/08
Exploration No.:	A-08-011	Depth (feet):	5.0		
Sample No.:	D-1				
Soil Identification:	Yellowish brown silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	VO	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	611.90	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	234.80	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	377.10	Moisture Content (%)	0.00

After Wet Sieve	Container No.	VO
	Wt. of Dry Soil + Container (g)	531.60
	Wt. of Container (g)	234.80
	Dry Wt. of Soil Retained on # 200 Sieve (g)	296.80

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.50	99.9
#8	2.360	1.00	99.7
#16	1.180	4.80	98.7
#30	0.600	29.10	92.3
#50	0.300	119.50	68.3
#100	0.150	243.50	35.4
#200	0.075	295.30	21.7
PAN			

GRAVEL: **0 %**

SAND: **78 %**

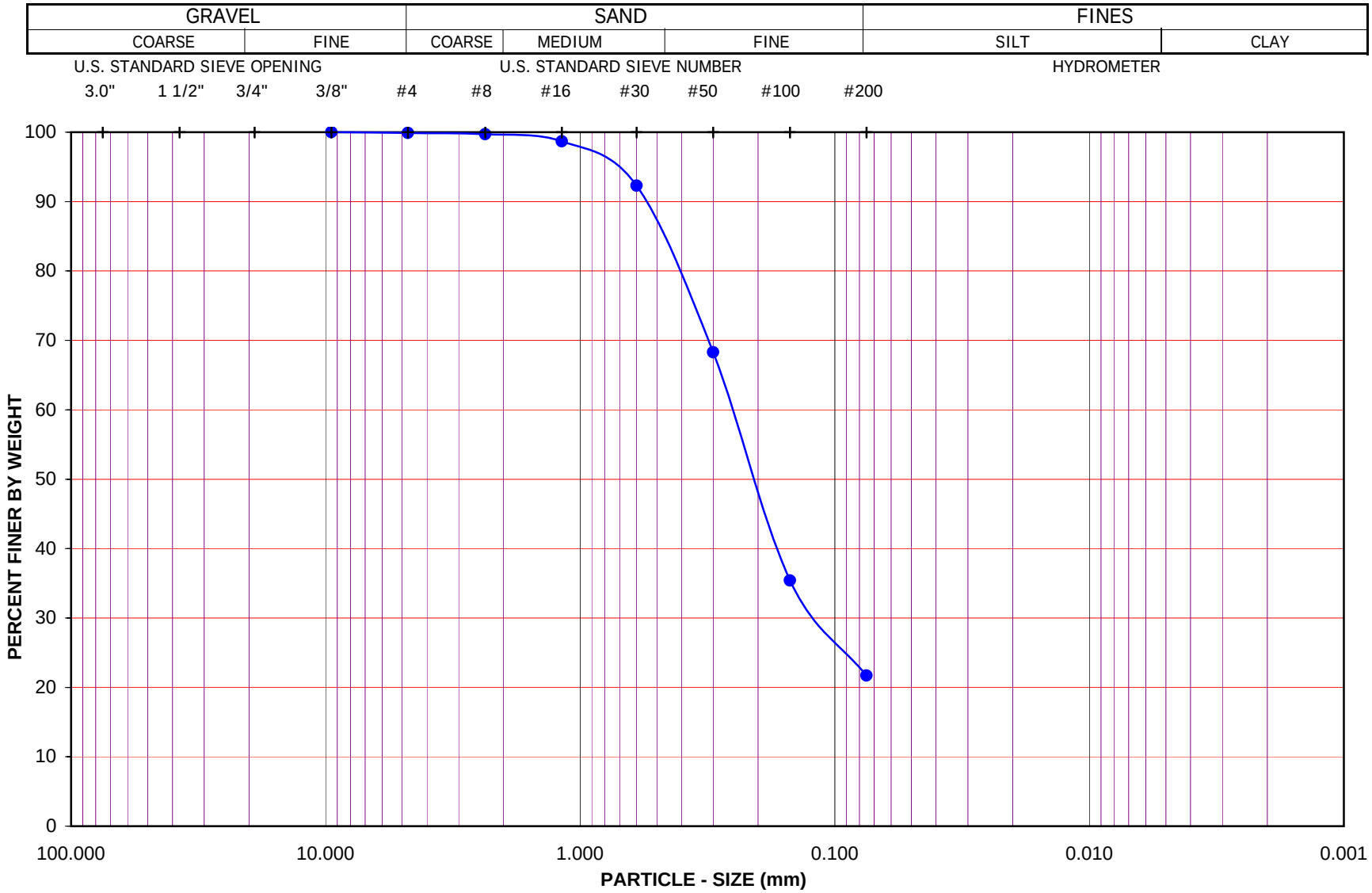
FINES: **22 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-011 Sample No.: D-1

Depth (feet): 5.0 Soil Type : SM

Soil Identification: Yellowish brown silty sand (SM)

GR:SA:FI : (%) 0 : 78 : 22

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/18/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/19/08
Exploration No.:	A-08-011	Depth (feet):	15.0		
Sample No.:	D-3				
Soil Identification:	Yellowish brown silty, clayey sand (SC-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	VI	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	790.40	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	220.60	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	569.80	Moisture Content (%)	0.00

After Wet Sieve	Container No.	VI
	Wt. of Dry Soil + Container (g)	585.90
	Wt. of Container (g)	220.60
	Dry Wt. of Soil Retained on # 200 Sieve (g)	365.30

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.40	99.9
#8	2.360	1.80	99.7
#16	1.180	4.00	99.3
#30	0.600	15.00	97.4
#50	0.300	74.10	87.0
#100	0.150	264.50	53.6
#200	0.075	362.50	36.4
PAN			

GRAVEL: **0 %**

SAND: **64 %**

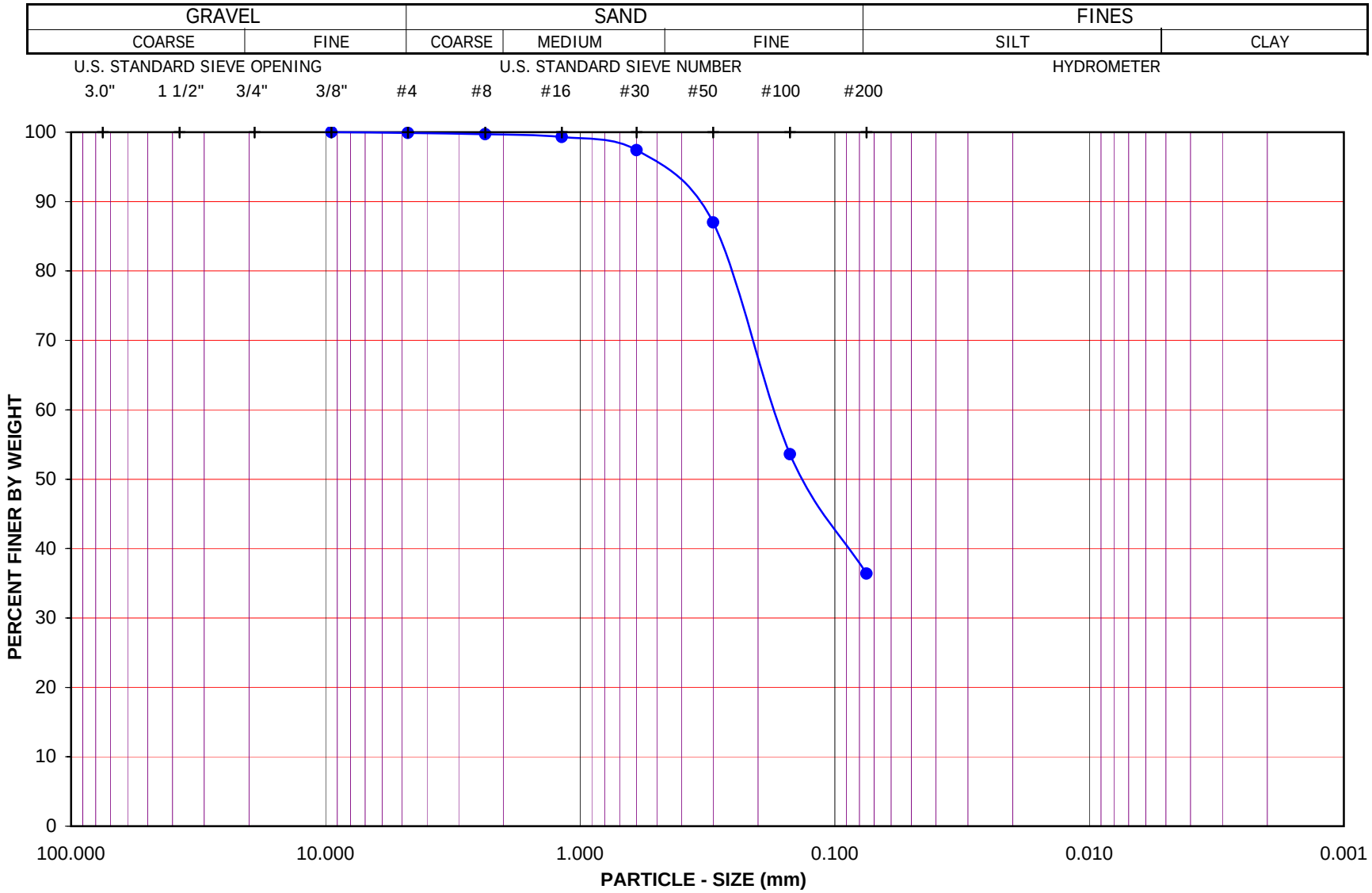
FINES: **36 %**

GROUP SYMBOL: **SC-SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-011 Sample No.: D-3

Depth (feet): 15.0 Soil Type : SC-SM

Soil Identification: Yellowish brown silty, clayey sand (SC-SM)

GR:SA:FI : (%) 0 : 64 : 36

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/03/08
Exploration No.:	A-08-012	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Olive fat clay (CH)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	TK	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	393.44	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	142.68	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	250.76	Moisture Content (%)	0.00

After Wet Sieve	Container No.	TK
	Wt. of Dry Soil + Container (g)	168.90
	Wt. of Container (g)	142.68
	Dry Wt. of Soil Retained on # 200 Sieve (g)	26.22

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	0.40	99.8
#8	2.360	0.50	99.8
#16	1.180	0.70	99.7
#30	0.600	1.20	99.5
#50	0.300	2.20	99.1
#100	0.150	7.80	96.9
#200	0.075	24.60	90.2
PAN			

GRAVEL: **0 %**

SAND: **10 %**

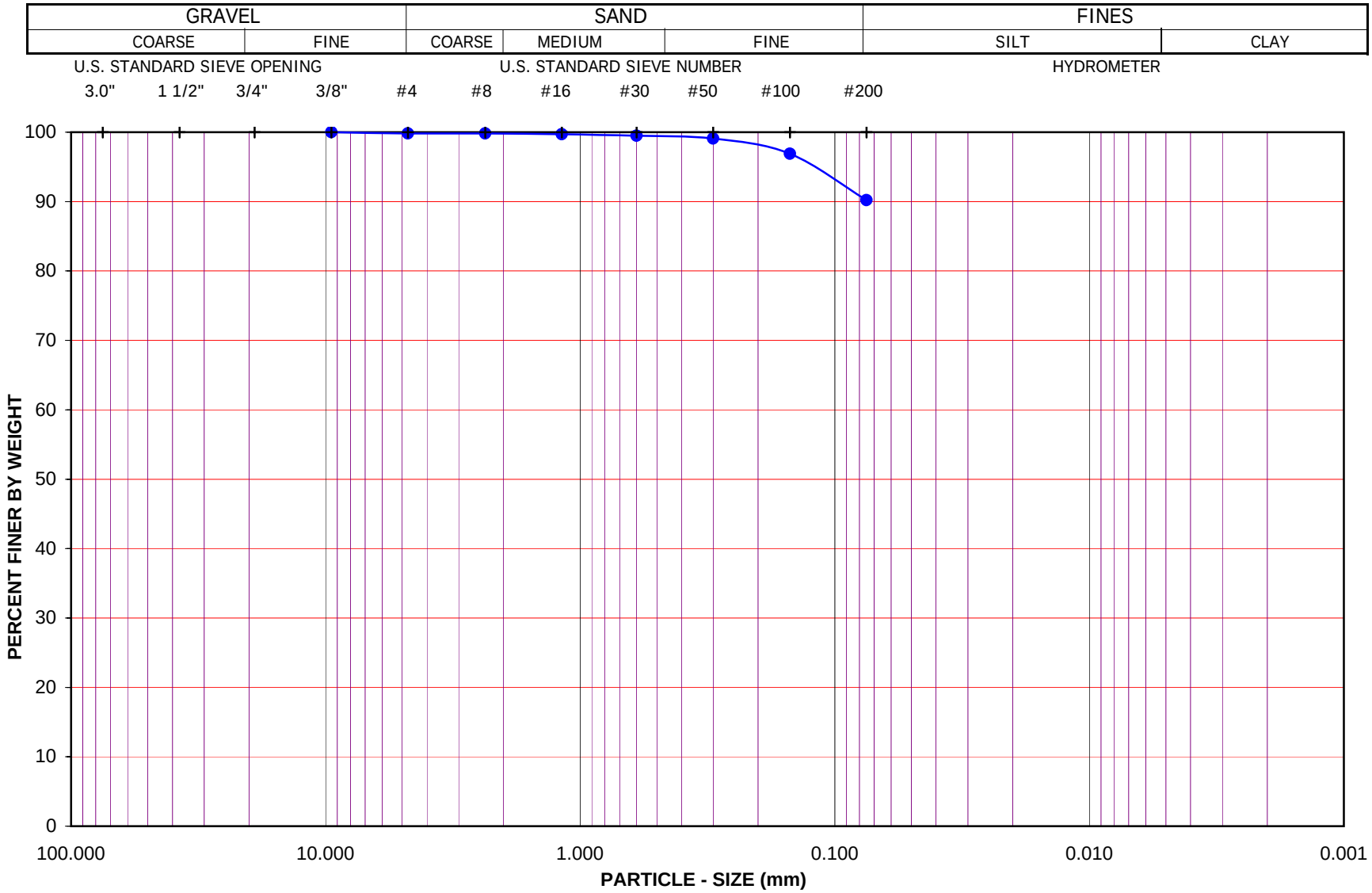
FINES: **90 %**

GROUP SYMBOL: **CH**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-012 Sample No.: S-2

Depth (feet): 10.0 Soil Type : CH

Soil Identification: Olive fat clay (CH)

GR:SA:FI : (%) 0 : 10 : 90

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-013	Depth (feet):	30.0		
Sample No.:	S-6				
Soil Identification:	Olive gray lean clay (CL)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	O	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	504.15	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	154.60	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	349.55	Moisture Content (%)	0.00

After Wet Sieve	Container No.	O
	Wt. of Dry Soil + Container (g)	207.80
	Wt. of Container (g)	154.60
	Dry Wt. of Soil Retained on # 200 Sieve (g)	53.20

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	
#8	2.360	0.00	
#16	1.180	0.00	100.0
#30	0.600	0.40	99.9
#50	0.300	1.40	99.6
#100	0.150	9.90	97.2
#200	0.075	47.10	86.5
PAN			

GRAVEL: **0 %**

SAND: **13 %**

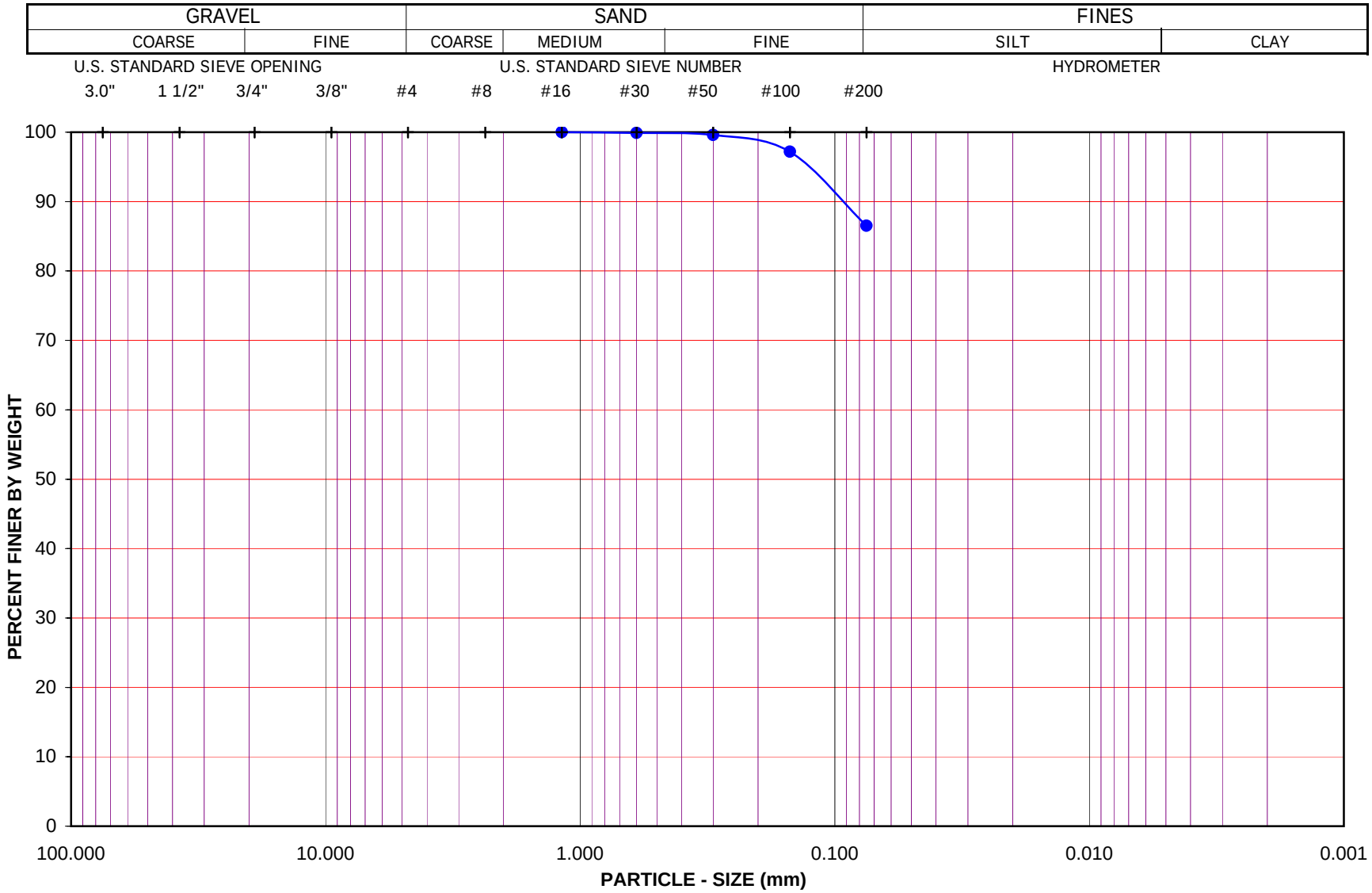
FINES: **87 %**

GROUP SYMBOL: **CL**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-013 Sample No.: S-6

Depth (feet): 30.0 Soil Type : CL

Soil Identification: Olive gray lean clay (CL)

GR:SA:FI : (%) 0 : 13 : 87

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/20/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/26/08

Exploration No.: A-08-013

Sample No.: S-12 | Depth (feet) : 60.0

Soil Identification: Light olive brown sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	41	s(CL)
% Fines	59	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	105.18
Wt.of Air-Dry Soil + Cont. (g)	431.75	Wt. of Container No.___ (g)	1.00	1.00	75.48
Wt. of Container	39.23	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	392.52	Wt. of Dry Soil (g)			29.70

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.46	99.9
Pan		

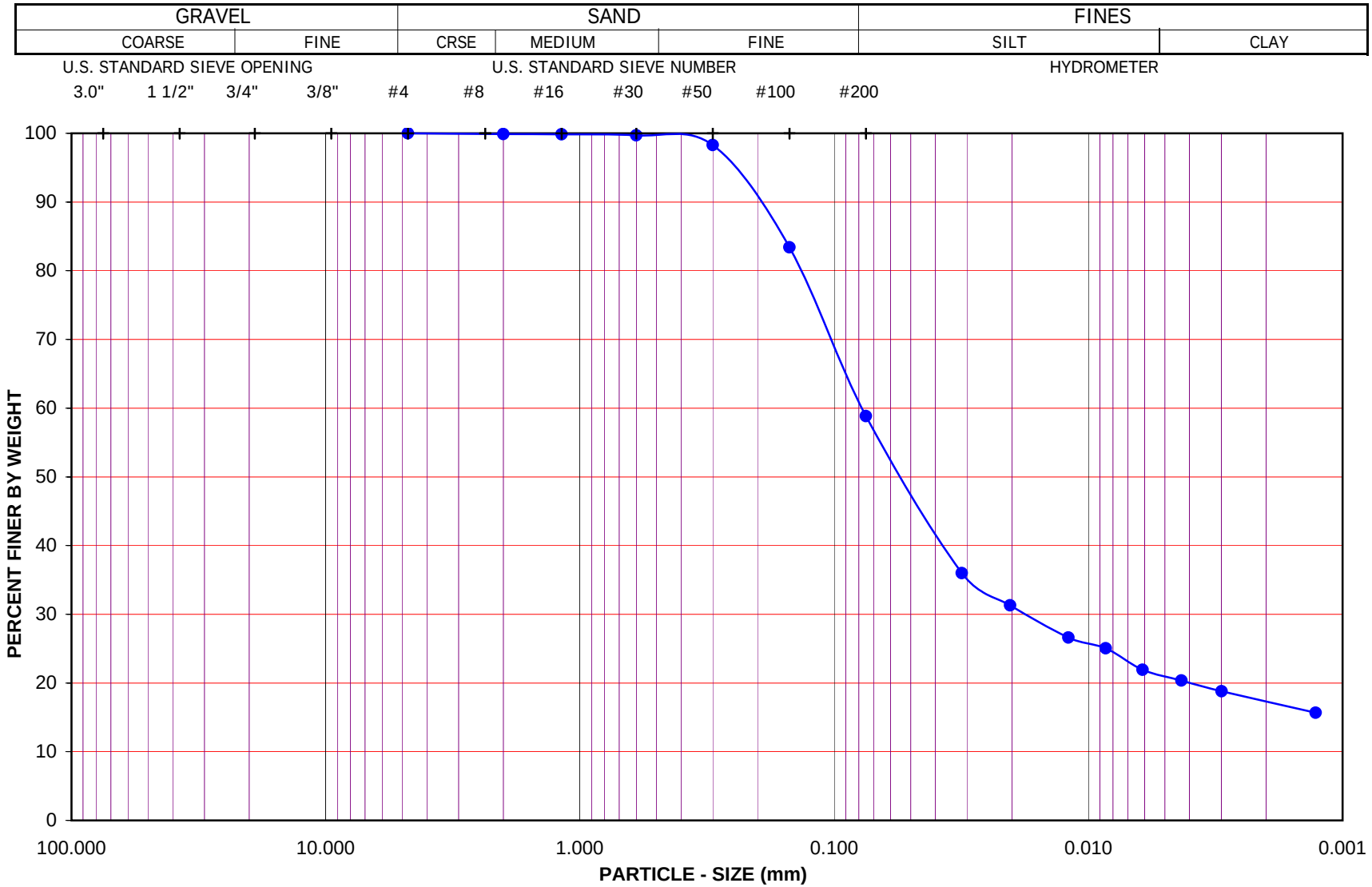
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.9
No. 16	0.02	100.0	99.9
No. 30	0.11	99.8	99.7
No. 50	1.00	98.4	98.3
No. 100	10.45	83.5	83.4
No. 200	26.00	58.9	58.9
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 63.30 Wt. of Dry Soil (g) 63.30

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
20-Aug-08	9:58	0		8.0			
	10:00	2	21.6	8.0	31.0	36.0	0.0314
	10:03	5	21.6	8.0	28.0	31.3	0.0203
	10:13	15	21.5	8.0	25.0	26.6	0.0120
	10:28	30	21.6	8.0	24.0	25.0	0.0085
	10:58	60	21.7	8.0	22.0	21.9	0.0061
	11:58	120	22.0	8.0	21.0	20.3	0.0043
	14:08	250	22.5	8.0	20.0	18.8	0.0030
21-Aug-08	9:58	1440	21.6	8.0	18.0	15.7	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-013 Sample No.: S-12

Depth (feet) : 60.0 Soil Type : s(CL)

Soil Identification: Light olive brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 41 : 59

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Exploration No.: A-08-014
Sample No.: Bag-1
Soil Identification: Yellowish brown clayey sand (SC)

Tested By: S. Felter Date: 08/25/08
Checked By: LF Date: 08/26/08
Depth (feet): 0 - 7

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	M12	CT	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	3062.40	730.90	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	231.00	244.30	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	2831.40	486.60	Moisture Content (%)	0.00	0.00

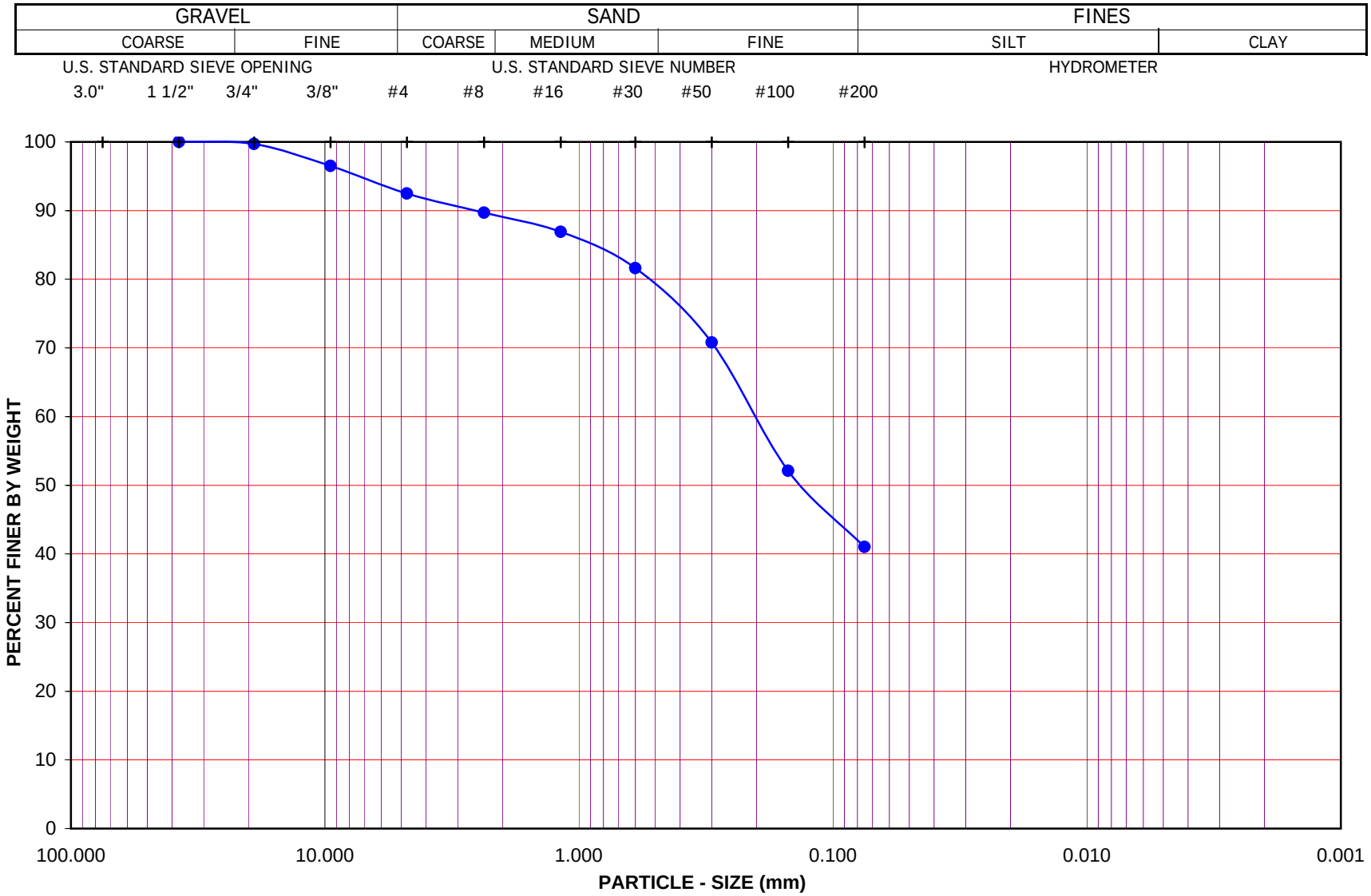
Passing #4 Material After Wet Sieve		
	Container No.	CT
	Wt. of Dry Soil + Container (g)	518.10
	Wt. of Container (g)	244.30
	Dry Wt. of Soil Retained on # 200 Sieve (g)	273.80

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	0.00		
1 1/2	37.500	0.00		100.0
3/4"	19.000	8.40		99.7
3/8"	9.500	99.10		96.5
#4	4.750	211.00		92.5
#8	2.360		14.90	89.7
#16	1.180		29.60	86.9
#30	0.600		57.60	81.6
#50	0.300		114.20	70.8
#100	0.150		212.50	52.1
#200	0.075		270.90	41.0
PAN				

GRAVEL: **8 %**
SAND: **51 %**
FINES: **41 %**
GROUP SYMBOL **SC**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-014 Sample No.: Bag-1

Depth (feet): 0 - 7 Soil Type : SC

Soil Identification: Yellowish brown clayey sand (SC)

GR:SA:FI : (%) 8 : 51 : 41

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-014, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/19/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/21/08

Exploration No.: A-08-014

Sample No.: S-4 | Depth (feet) : 20.0

Soil Identification: Olive lean clay (CL)

% Gravel	0	Soil Type
% Sand	10	CL
% Fines	90	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	84.80
Wt.of Air-Dry Soil + Cont. (g)	214.60	Wt. of Container No.___ (g)	1.00	1.00	76.46
Wt. of Container	39.52	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	175.08	Wt. of Dry Soil (g)			8.34

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.00	100.0
Pan		

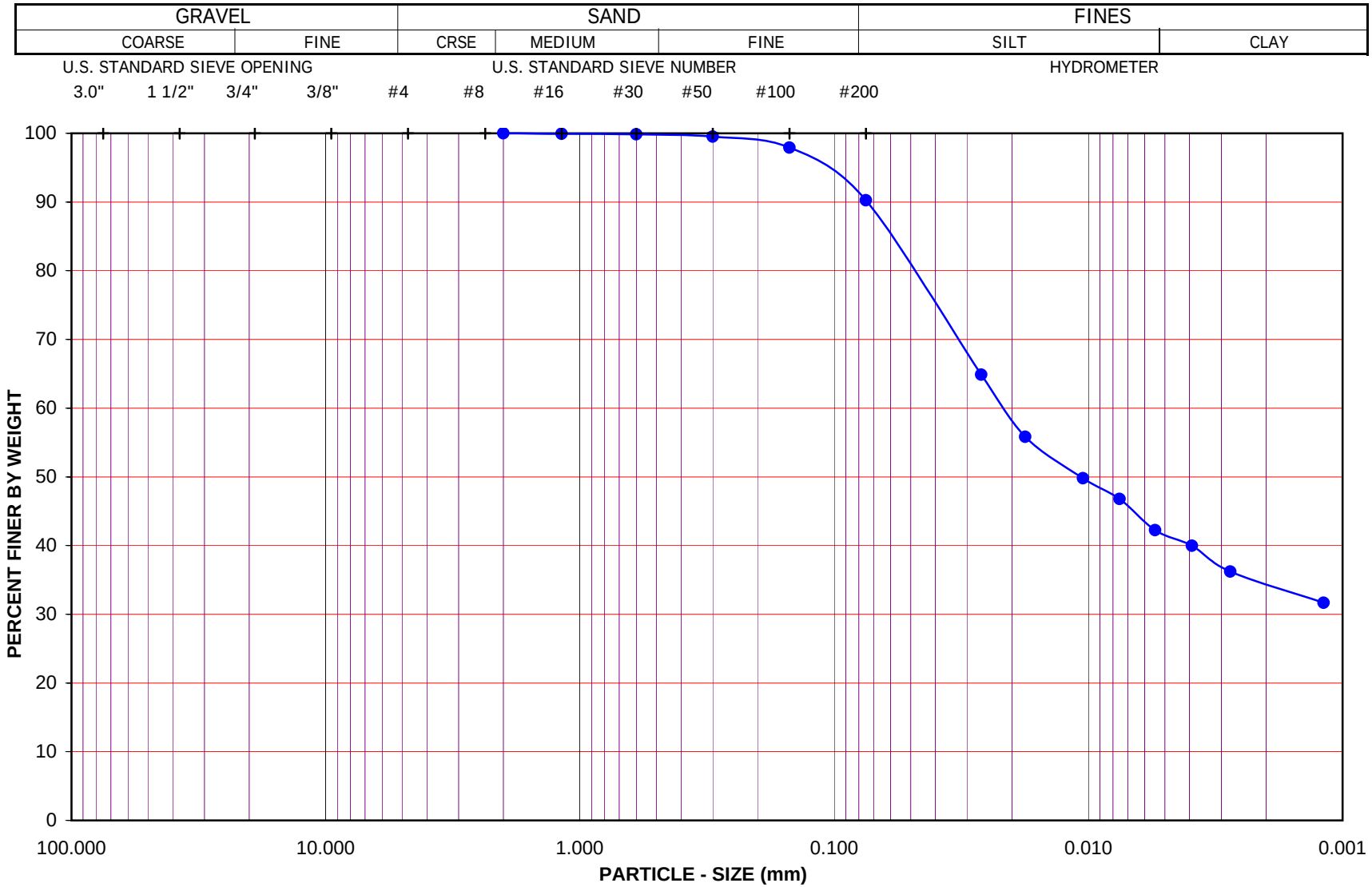
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.06	99.9	99.9
No. 30	0.10	99.8	99.8
No. 50	0.31	99.5	99.5
No. 100	1.36	97.9	97.9
No. 200	6.42	90.2	90.2
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.76 Wt. of Dry Soil (g) 65.76

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Aug-08	10:14	0		8.0			
	10:16	2	21.8	8.0	51.0	64.9	0.0264
	10:19	5	21.8	8.0	45.0	55.8	0.0177
	10:29	15	22.0	8.0	41.0	49.8	0.0105
	10:44	30	22.0	8.0	39.0	46.8	0.0075
	11:14	60	22.0	8.0	36.0	42.2	0.0055
	12:14	120	22.3	8.0	34.5	40.0	0.0039
	14:24	250	22.9	8.0	32.0	36.2	0.0028
20-Aug-08	10:14	1440	21.6	8.0	29.0	31.7	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-014 Sample No.: S-4

Depth (feet) : 20.0 Soil Type : CL

Soil Identification: Olive lean clay (CL)

GR:SA:FI : (%) 0 : 10 : 90

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/20/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/26/08

Exploration No.: A-08-015

Sample No.: D-1 | Depth (feet) : 5.0

Soil Identification: Pale olive fat clay (CH)

% Gravel	0	Soil Type
% Sand	5	CH
% Fines	95	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	86.21
Wt.of Air-Dry Soil + Cont. (g)	381.14	Wt. of Container No.___ (g)	1.00	1.00	82.72
Wt. of Container	39.31	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	341.83	Wt. of Dry Soil (g)			3.49

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	1.07	99.7
Pan		

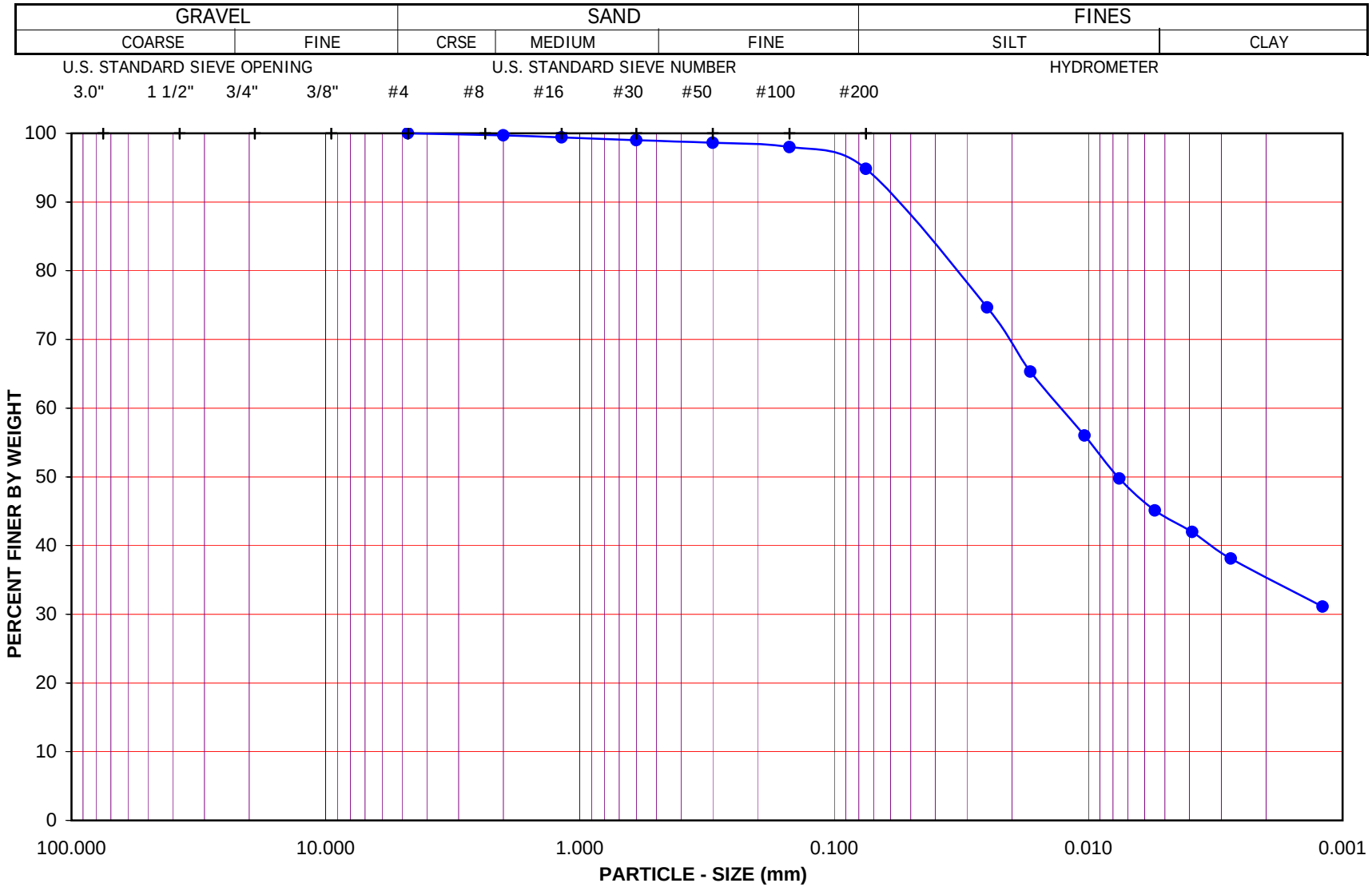
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.7
No. 16	0.19	99.7	99.4
No. 30	0.43	99.3	99.0
No. 50	0.69	98.9	98.6
No. 100	1.09	98.3	98.0
No. 200	3.10	95.1	94.8
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 63.58 Wt. of Dry Soil (g) 63.58

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
20-Aug-08	9:54	0		8.0			
	9:56	2	21.6	8.0	56.0	74.7	0.0250
	9:59	5	21.6	8.0	50.0	65.3	0.0169
	10:09	15	21.5	8.0	44.0	56.0	0.0103
	10:24	30	21.5	8.0	40.0	49.8	0.0076
	10:54	60	21.6	8.0	37.0	45.1	0.0055
	11:54	120	22.0	8.0	35.0	42.0	0.0039
	14:04	250	22.5	8.0	32.5	38.1	0.0028
21-Aug-08	9:54	1440	21.6	8.0	28.0	31.1	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-015 Sample No.: D-1

Depth (feet) : 5.0 Soil Type : CH

Soil Identification: Pale olive fat clay (CH)

GR:SA:FI : (%) 0 : 5 : 95

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/20/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/26/08

Exploration No.: A-08-016

Sample No.: D-11 | Depth (feet) : 55.0

Soil Identification: Pale olive lean clay with sand (CL)s

% Gravel	0	Soil Type
% Sand	28	(CL)s
% Fines	72	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	96.08
Wt.of Air-Dry Soil + Cont. (g)	275.93	Wt. of Container No.___ (g)	1.00	1.00	75.90
Wt. of Container	39.53	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	236.40	Wt. of Dry Soil (g)			20.18

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.11	100.0
Pan		

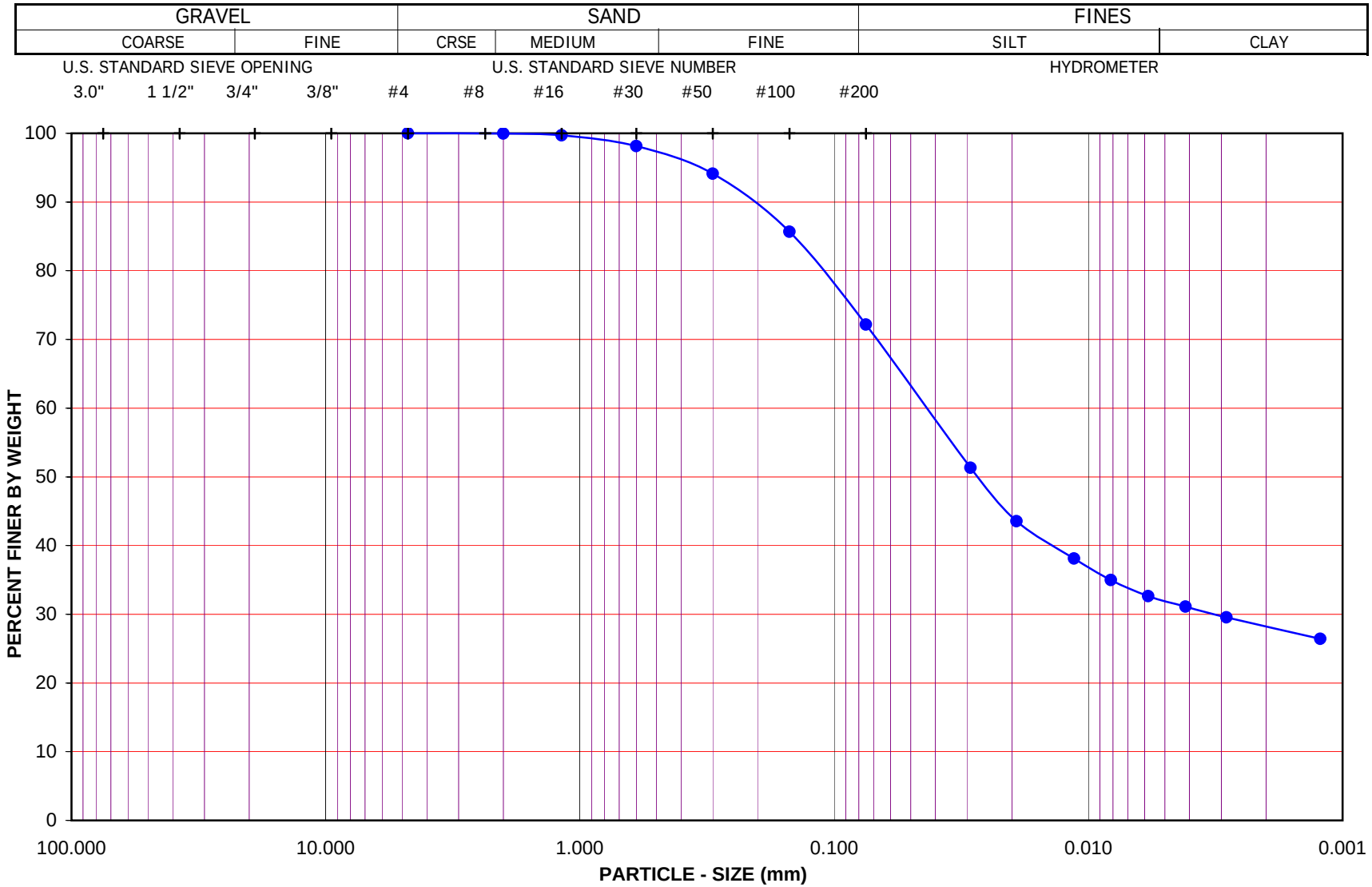
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.15	99.8	99.7
No. 30	1.15	98.2	98.2
No. 50	3.72	94.2	94.1
No. 100	9.10	85.7	85.7
No. 200	17.74	72.2	72.1
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 63.77 Wt. of Dry Soil (g) 63.77

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
20-Aug-08	9:46	0		8.0			
	9:48	2	21.6	8.0	41.0	51.3	0.0291
	9:51	5	21.6	8.0	36.0	43.5	0.0192
	10:01	15	21.6	8.0	32.5	38.1	0.0114
	10:16	30	21.5	8.0	30.5	35.0	0.0082
	10:46	60	21.6	8.0	29.0	32.7	0.0058
	11:46	120	21.9	8.0	28.0	31.1	0.0041
	13:56	250	22.5	8.0	27.0	29.5	0.0029
21-Aug-08	9:46	1440	21.6	8.0	25.0	26.4	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-016 Sample No.: D-11

Depth (feet) : 55.0 Soil Type : (CL)s

Soil Identification: Pale olive lean clay with sand (CL)s

GR:SA:FI : (%) 0 : 28 : 72

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/19/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/21/08

Exploration No.: A-08-016

Sample No.: S-12 | Depth (feet) : 60.0

Soil Identification: Olive sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	42	s(CL)
% Fines	58	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	105.67
Wt.of Air-Dry Soil + Cont. (g)	306.32	Wt. of Container No.___ (g)	1.00	1.00	76.75
Wt. of Container	39.38	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	266.94	Wt. of Dry Soil (g)			28.92

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.07	100.0
Pan		

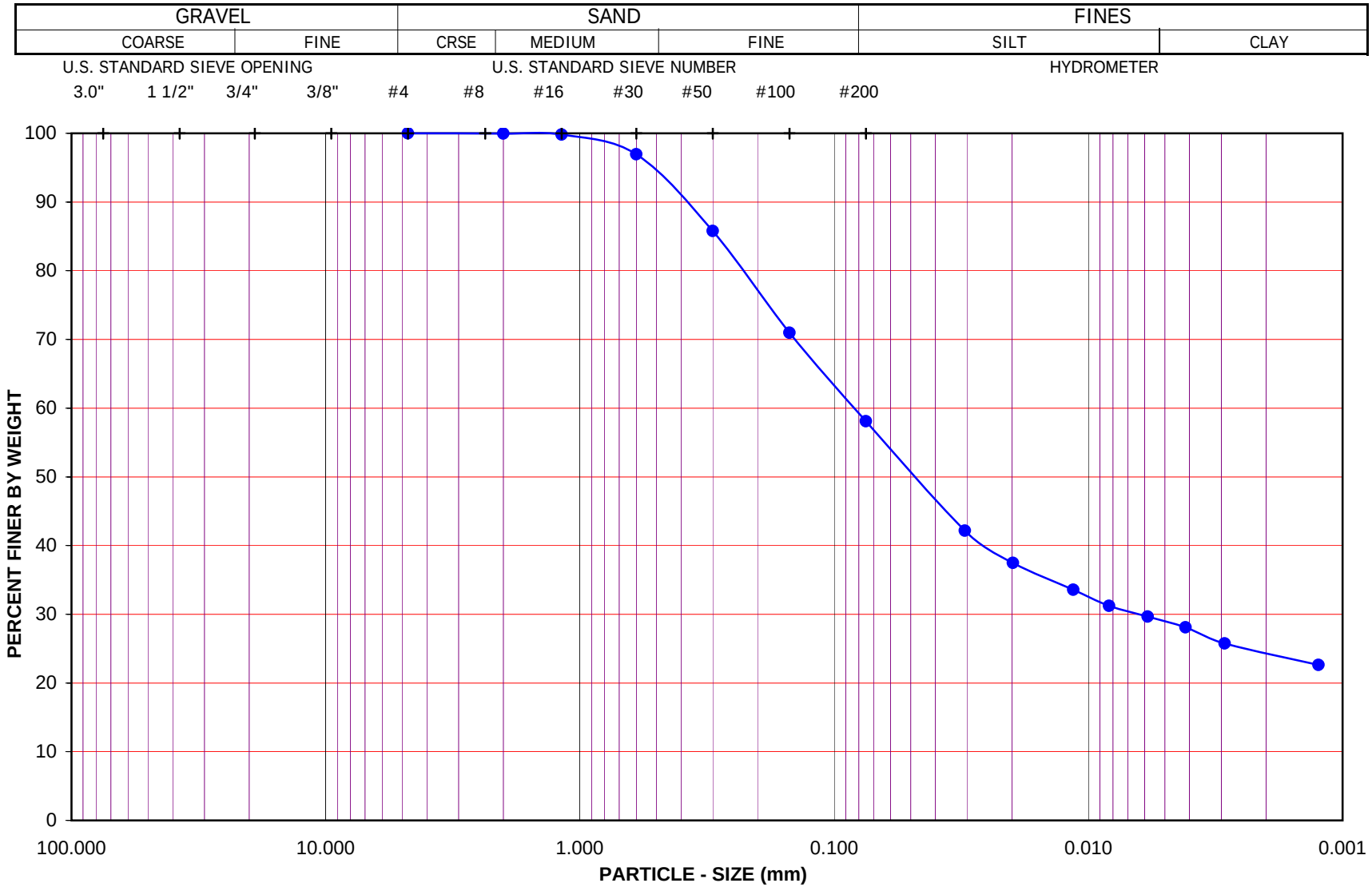
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.10	99.8	99.8
No. 30	1.93	97.0	96.9
No. 50	9.01	85.8	85.8
No. 100	18.44	71.0	71.0
No. 200	26.61	58.1	58.1
Pan			

Hydrometer Wt. of Air-Dry Soil (g): 63.53 Wt. of Dry Soil (g): 63.53

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Aug-08	10:18	0		8.0			
	10:20	2	21.8	8.0	35.0	42.1	0.0306
	10:23	5	21.7	8.0	32.0	37.5	0.0198
	10:33	15	22.0	8.0	29.5	33.6	0.0115
	10:48	30	21.9	8.0	28.0	31.2	0.0083
	11:18	60	22.0	8.0	27.0	29.7	0.0058
	12:18	120	22.4	8.0	26.0	28.1	0.0041
	14:28	250	22.9	8.0	24.5	25.8	0.0029
20-Aug-08	10:18	1440	21.6	8.0	22.5	22.6	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-016 Sample No.: S-12

Depth (feet) : 60.0 Soil Type : s(CL)

Soil Identification: Olive sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 42 : 58

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/19/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/21/08

Exploration No.: A-08-016

Sample No.: S-14 | Depth (feet) : 70.0

Soil Identification: Olive sandy lean clay s(CL)

% Gravel	2	Soil Type
% Sand	41	s(CL)
% Fines	57	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	109.86
Wt.of Air-Dry Soil + Cont. (g)	392.30	Wt. of Container No.___ (g)	1.00	1.00	75.92
Wt. of Container	39.17	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	353.13	Wt. of Dry Soil (g)			33.94

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	5.37	98.5
No. 4	7.06	98.0
No. 10	9.55	97.3
Pan		

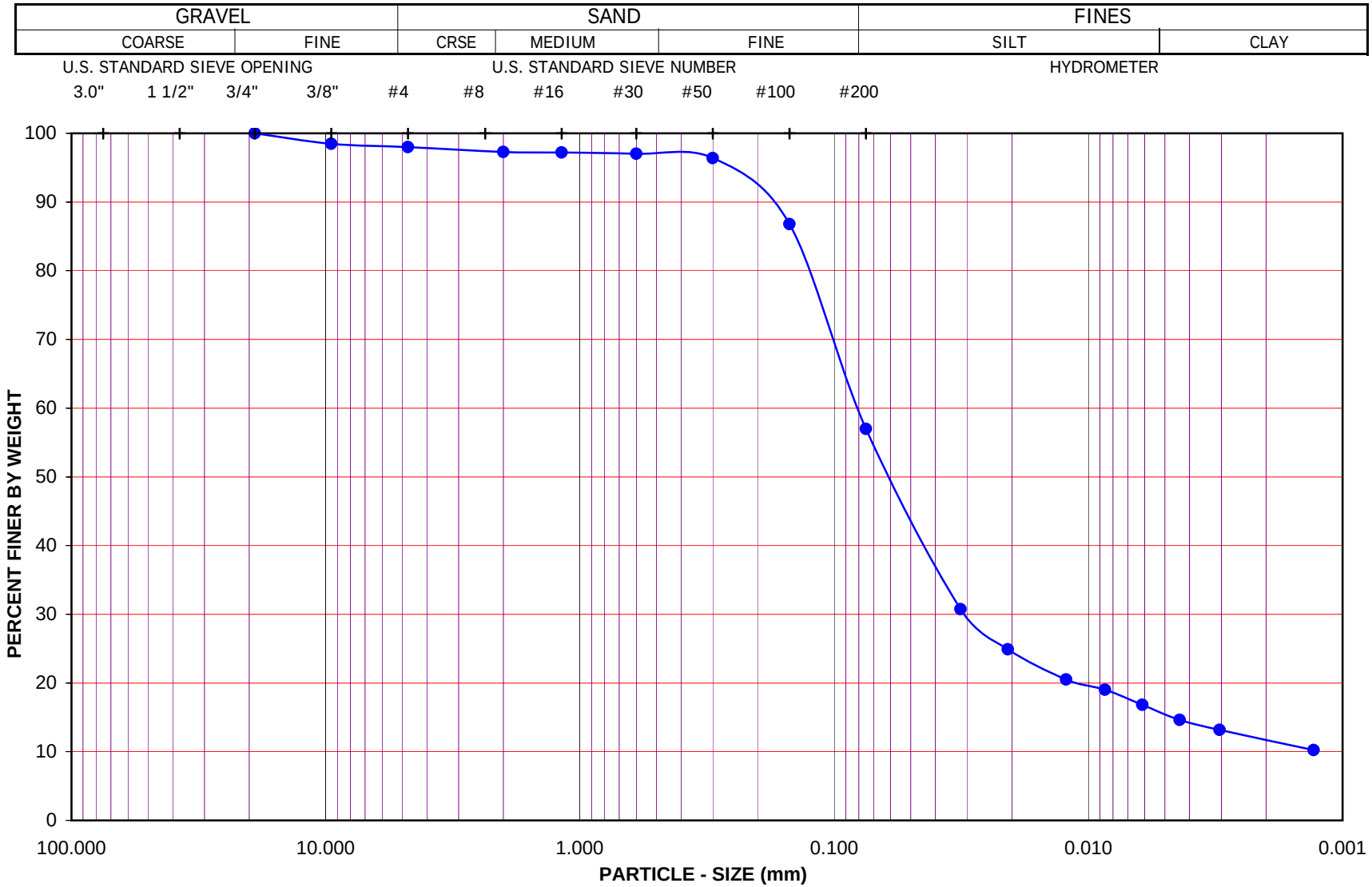
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	97.3
No. 16	0.05	99.9	97.2
No. 30	0.19	99.7	97.0
No. 50	0.62	99.1	96.4
No. 100	7.13	89.2	86.8
No. 200	27.33	58.6	57.0
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.94 Wt. of Dry Soil (g) 65.94

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Aug-08	10:10	0		8.0			
	10:12	2	21.8	8.0	29.0	30.7	0.0318
	10:15	5	21.8	8.0	25.0	24.9	0.0207
	10:25	15	21.7	8.0	22.0	20.5	0.0122
	10:40	30	22.0	8.0	21.0	19.0	0.0086
	11:10	60	22.0	8.0	19.5	16.8	0.0061
	12:10	120	22.3	8.0	18.0	14.6	0.0044
	14:20	250	22.9	8.0	17.0	13.2	0.0030
20-Aug-08	10:10	1440	21.6	8.0	15.0	10.2	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-016 Sample No.: S-14

Depth (feet) : 70.0 Soil Type : s(CL)

Soil Identification: Olive sandy lean clay s(CL)

GR:SA:FI : (%) 2 : 41 : 57

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/20/08

Exploration No.: A-08-018

Sample No.: Bag-1 | Depth (feet) : 0-7

Soil Identification: Dark brown sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	47	s(CL)
% Fines	53	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	107.65
Wt.of Air-Dry Soil + Cont. (g)	571.60	Wt. of Container No.___ (g)	1.00	1.00	76.46
Wt. of Container	74.40	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	497.20	Wt. of Dry Soil (g)			31.19

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.60	99.9
No. 10	2.90	99.4
Pan		

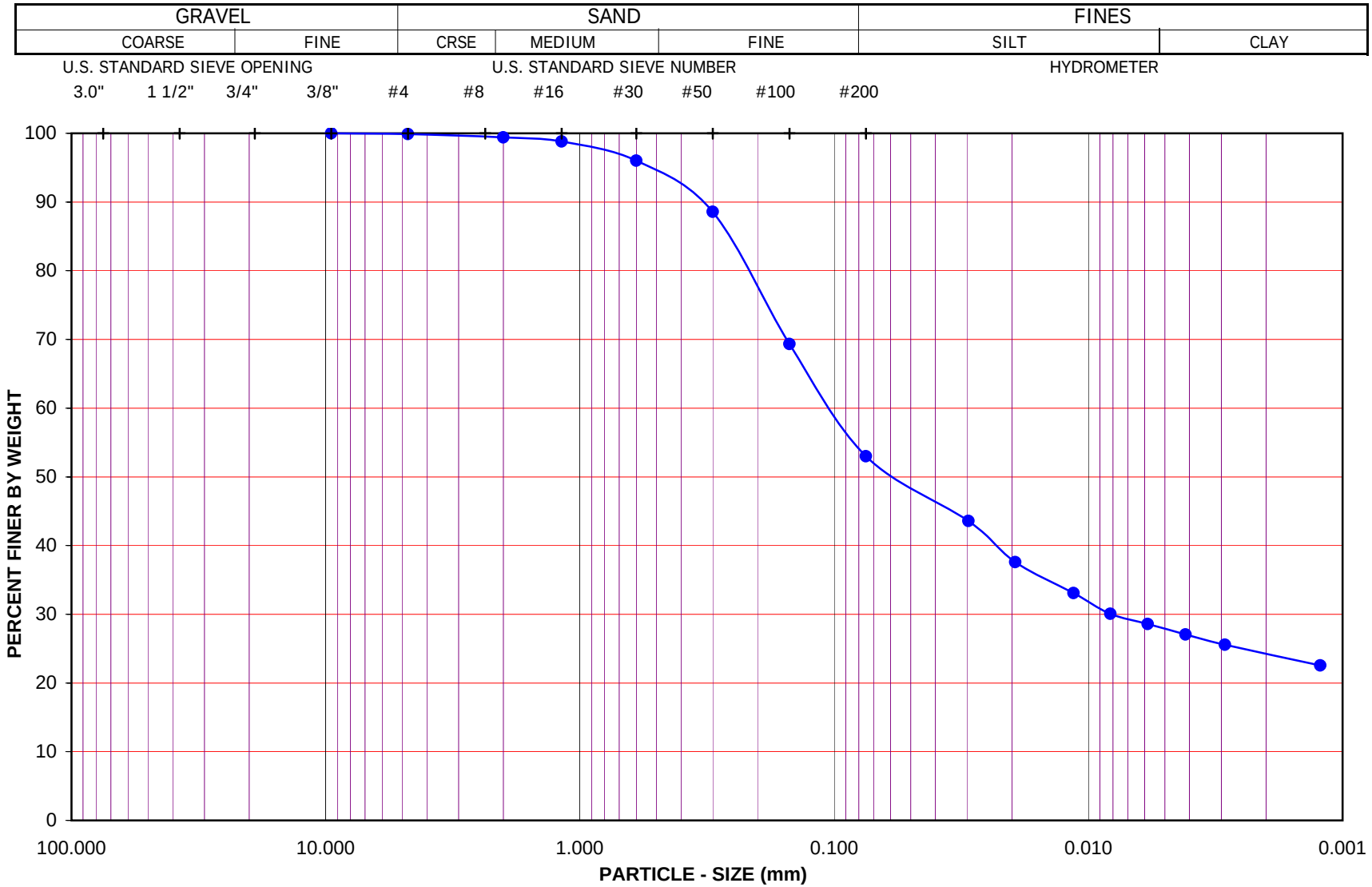
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.4
No. 16	0.39	99.4	98.8
No. 30	2.25	96.6	96.0
No. 50	7.15	89.1	88.6
No. 100	19.84	69.8	69.3
No. 200	30.62	53.3	53.0
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.60 Wt. of Dry Soil (g) 65.60

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	11:34	0		8.0			
	11:36	2	22.2	8.0	37.0	43.6	0.0296
	11:39	5	22.2	8.0	33.0	37.6	0.0194
	11:49	15	22.2	8.0	30.0	33.1	0.0114
	12:04	30	22.2	8.0	28.0	30.1	0.0082
	12:34	60	22.4	8.0	27.0	28.6	0.0058
	13:34	120	22.7	8.0	26.0	27.1	0.0041
	15:44	250	22.7	8.0	25.0	25.6	0.0029
12-Aug-08	11:34	1440	22.7	8.0	23.0	22.6	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-018 Sample No.: Bag-1

Depth (feet) : 0-7 Soil Type : s(CL)

Soil Identification: Dark brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 47 : 53

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA & Hyd A-08-018, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/20/08

Exploration No.: A-08-018

Sample No.: S-2 | Depth (feet) : 10.0

Soil Identification: Yellowish brown sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	46	s(CL)
% Fines	54	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	107.13
Wt.of Air-Dry Soil + Cont. (g)	376.90	Wt. of Container No.___ (g)	1.00	1.00	76.83
Wt. of Container	39.30	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	337.60	Wt. of Dry Soil (g)			30.30

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.40	99.9
No. 10	1.90	99.4
Pan		

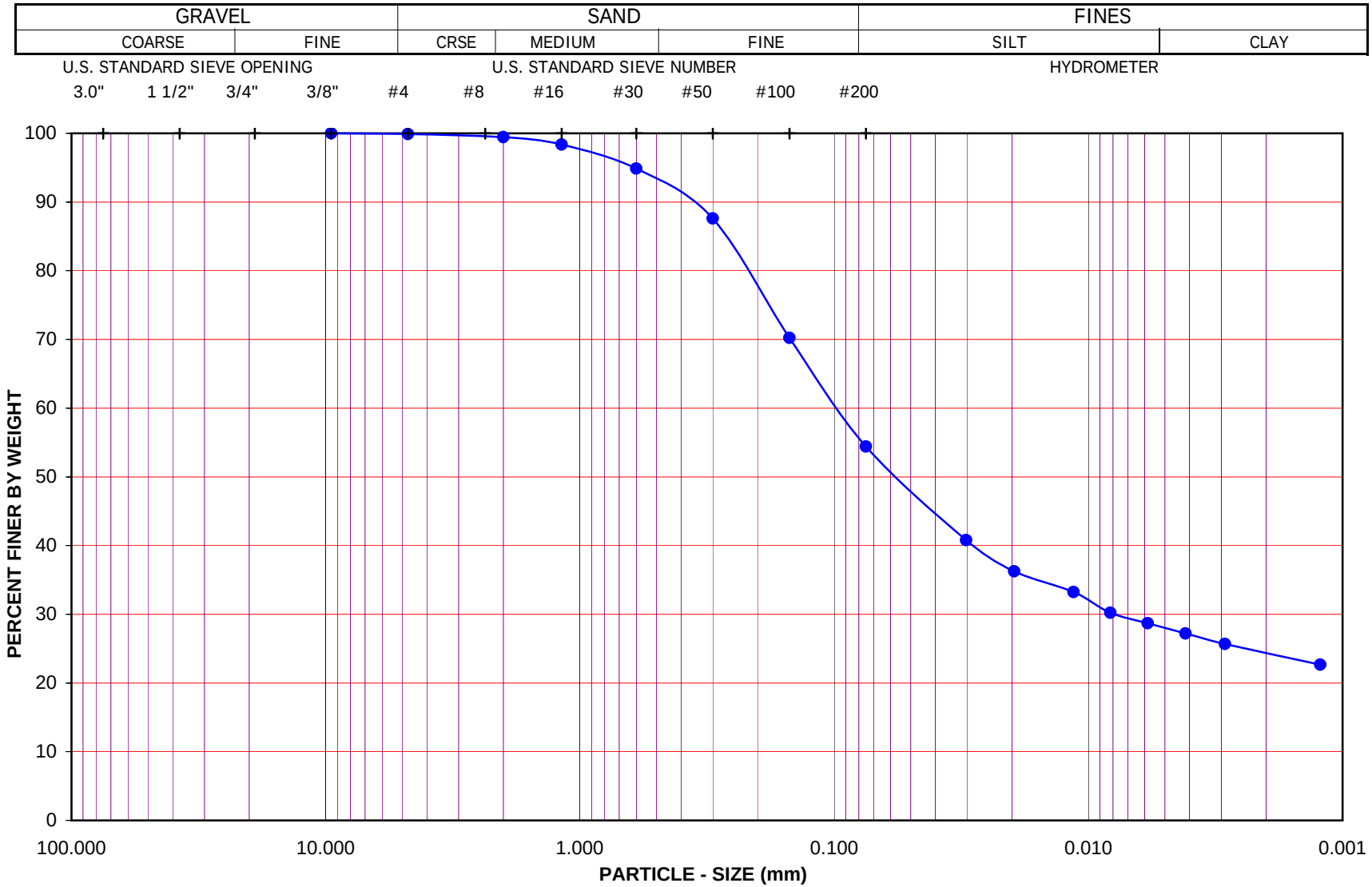
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.4
No. 16	0.71	98.9	98.4
No. 30	3.01	95.4	94.9
No. 50	7.77	88.1	87.6
No. 100	19.19	70.6	70.2
No. 200	29.58	54.7	54.4
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.30 Wt. of Dry Soil (g) 65.30

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	11:30	0		8.0			
	11:32	2	22.2	8.0	35.0	40.8	0.0302
	11:35	5	22.2	8.0	32.0	36.3	0.0196
	11:45	15	22.2	8.0	30.0	33.2	0.0114
	12:00	30	22.2	8.0	28.0	30.2	0.0082
	12:30	60	22.4	8.0	27.0	28.7	0.0058
	13:30	120	22.6	8.0	26.0	27.2	0.0041
	15:40	250	22.7	8.0	25.0	25.7	0.0029
12-Aug-08	11:30	1440	22.7	8.0	23.0	22.7	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-018 Sample No.: S-2

Depth (feet) : 10.0 Soil Type : s(CL)

Soil Identification: Yellowish brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 46 : 54

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/07/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Exploration No.:	A-08-021	Depth (feet):	2-7		
Sample No.:	BAG-1				
Soil Identification:	Yellowish brown sandy lean clay s(CL) with caliche				

		Moisture Content of Total Air - Dry Soil	
Container No.:	4-C	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	683.70	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	108.50	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	575.20	Moisture Content (%)	0.00

After Wet Sieve	Container No.	4-C
	Wt. of Dry Soil + Container (g)	284.60
	Wt. of Container (g)	108.50
	Dry Wt. of Soil Retained on # 200 Sieve (g)	176.10

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	1.90	99.7
#4	4.750	9.80	98.3
#8	2.360	16.30	97.2
#16	1.180	20.70	96.4
#30	0.600	26.40	95.4
#50	0.300	38.70	93.3
#100	0.150	102.50	82.2
#200	0.075	173.30	69.9
PAN			

GRAVEL: **2 %**

SAND: **28 %**

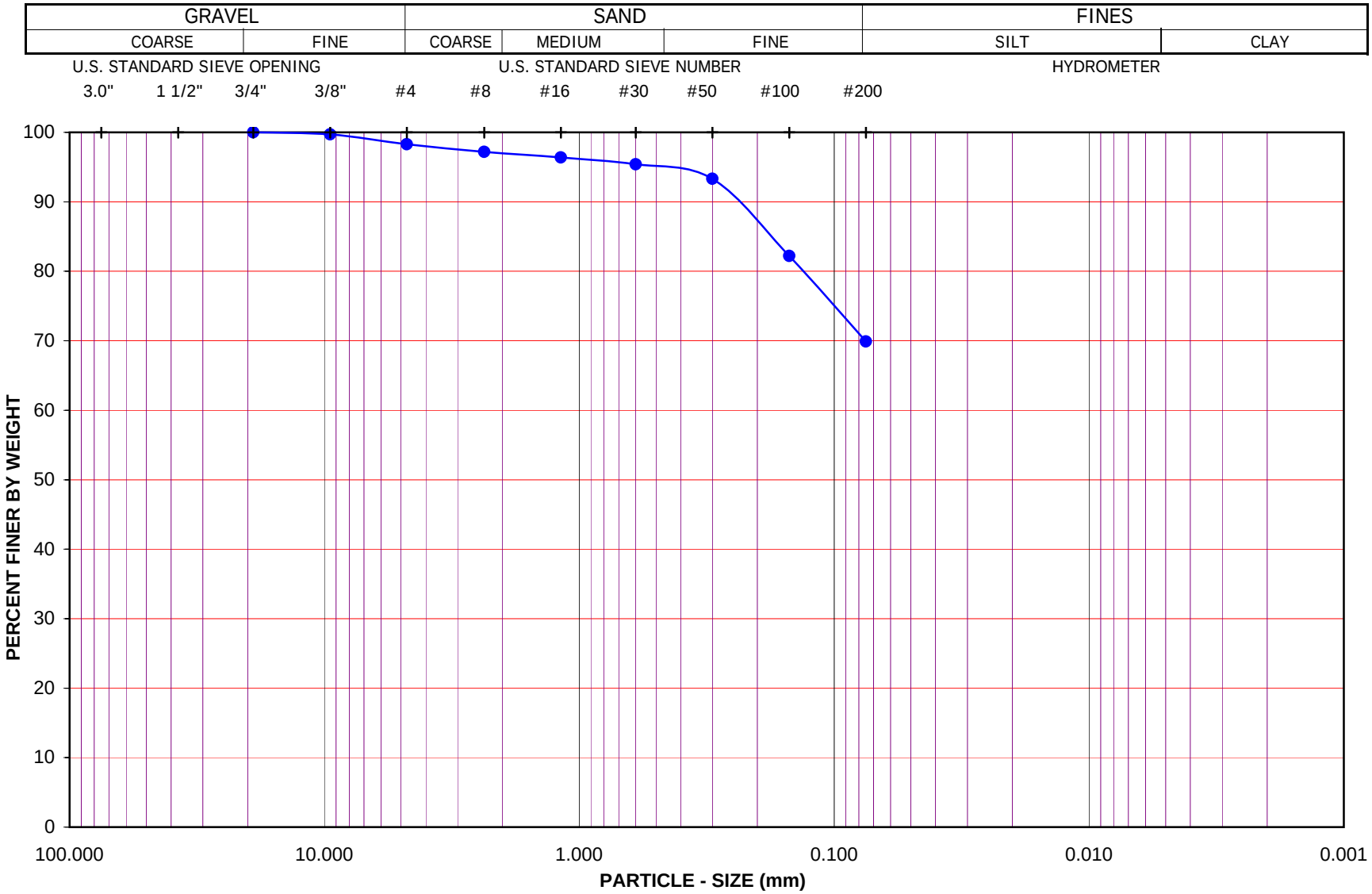
FINES: **70 %**

GROUP SYMBOL: **s(CL)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-021 Sample No.: BAG-1

Depth (feet): 2-7 Soil Type : s(CL)

Soil Identification: Yellowish brown sandy lean clay s(CL) with caliche

GR:SA:FI : (%) 2 : 28 : 70

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-021, BAG-1

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/28/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/03/08

Exploration No.: A-08-021

Sample No.: D-1 | Depth (feet) : 5.0

Soil Identification: Yellowish brown lean clay with sand (CL)s

% Gravel	1	Soil Type
% Sand	25	(CL)s
% Fines	74	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	90.50
Wt.of Air-Dry Soil + Cont. (g)	549.57	Wt. of Container No.___ (g)	1.00	1.00	74.28
Wt. of Container	154.49	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	395.08	Wt. of Dry Soil (g)			16.22

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	2.94	99.3
No. 10	5.77	98.5
Pan		

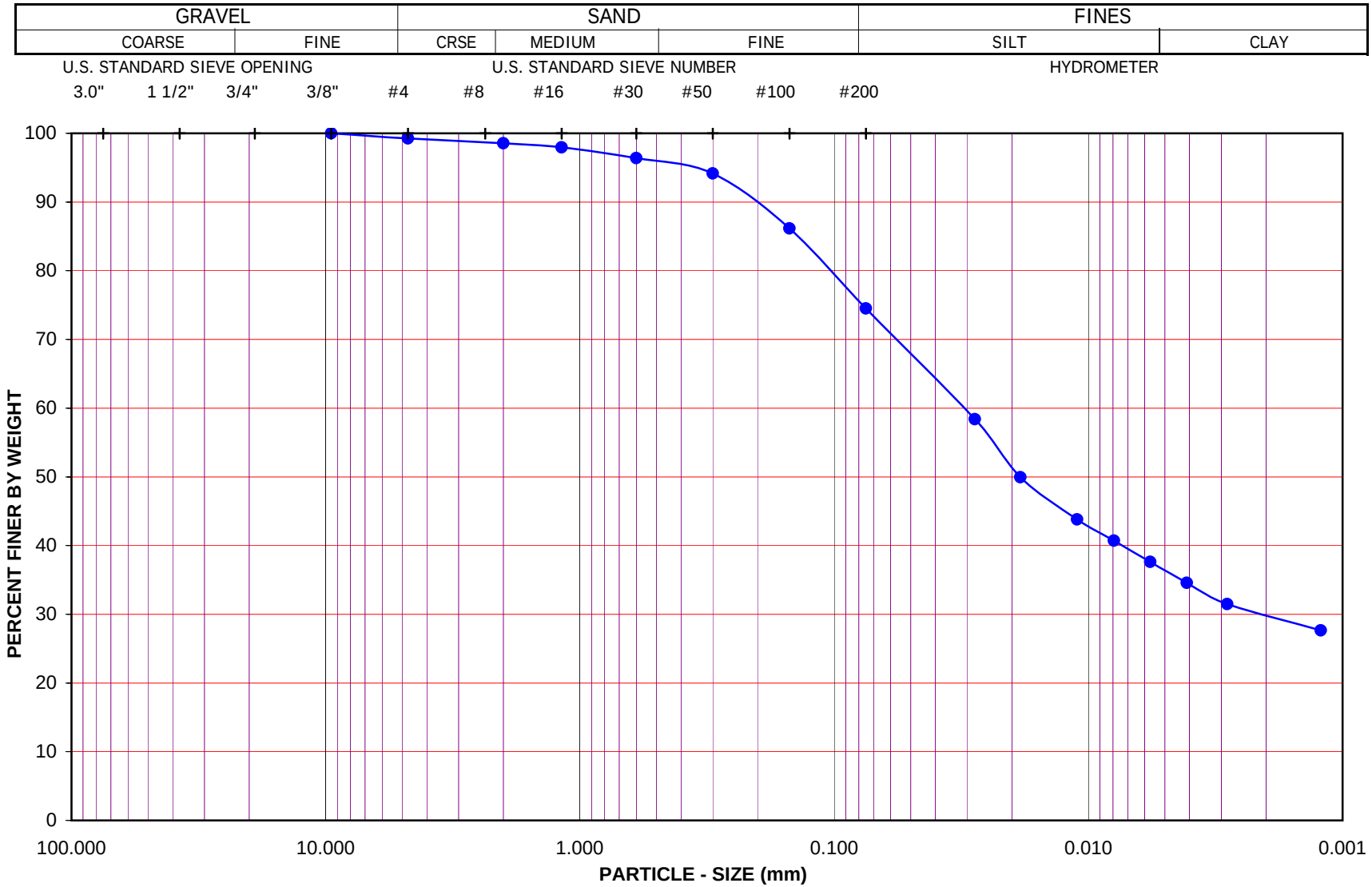
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	98.5
No. 16	0.37	99.4	98.0
No. 30	1.39	97.8	96.4
No. 50	2.83	95.6	94.2
No. 100	7.99	87.4	86.2
No. 200	15.51	75.6	74.5
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 63.62 Wt. of Dry Soil (g) 63.62

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
28-Aug-08	9:10	0		7.5			
	9:12	2	21.8	7.5	45.5	58.4	0.0279
	9:15	5	21.8	7.5	40.0	49.9	0.0185
	9:25	15	21.8	7.5	36.0	43.8	0.0111
	9:40	30	21.8	7.5	34.0	40.7	0.0079
	10:10	60	21.6	7.5	32.0	37.6	0.0057
	11:10	120	21.6	7.5	30.0	34.6	0.0041
	13:20	250	22.1	7.5	28.0	31.5	0.0028
29-Aug-08	9:10	1440	21.7	8.0	25.5	27.7	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-021 Sample No.: D-1

Depth (feet) : 5.0 Soil Type : (CL)s

Soil Identification: Yellowish brown lean clay with sand (CL)s

GR:SA:FI : (%) 1 : 25 : 74

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-021	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Brown poorly graded sand with silt (SP-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	N	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	527.99	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	132.98	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	395.01	Moisture Content (%)	0.00

After Wet Sieve	Container No.	N
	Wt. of Dry Soil + Container (g)	497.20
	Wt. of Container (g)	132.98
	Dry Wt. of Soil Retained on # 200 Sieve (g)	364.22

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	100.0
#8	2.360	0.20	99.9
#16	1.180	0.40	99.9
#30	0.600	0.70	99.8
#50	0.300	9.70	97.5
#100	0.150	281.90	28.6
#200	0.075	362.50	8.2
PAN			

GRAVEL: **0 %**

SAND: **92 %**

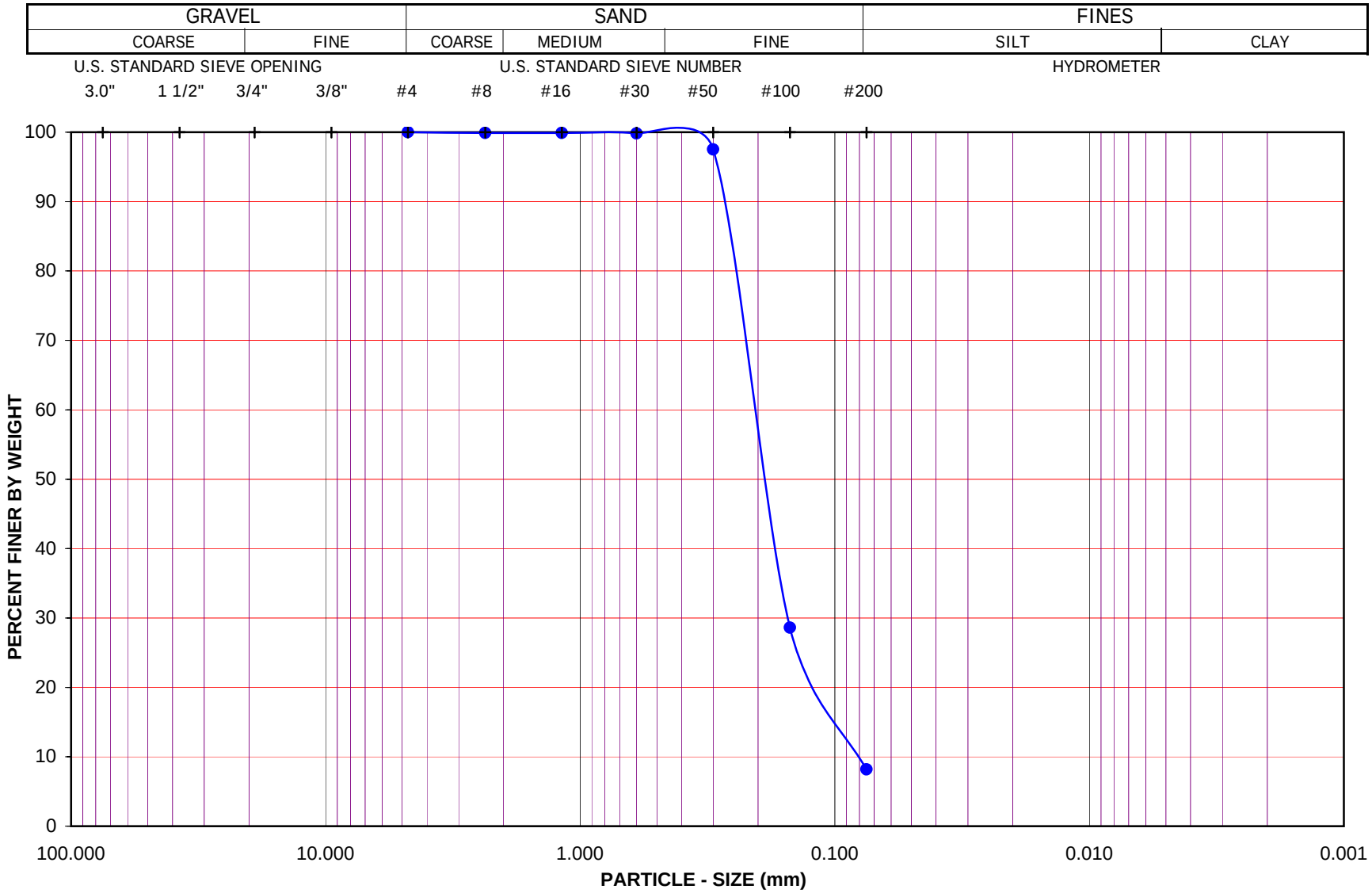
FINES: **8 %**

GROUP SYMBOL: **SP-SM**

Cu = D60/D10 = 2.48

Cc = $(D30)^2/(D60*D10)$ = 1.40

Remarks:



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-021 Sample No.: S-2

Depth (feet): 10.0 Soil Type : SP-SM

Soil Identification: Brown poorly graded sand with silt (SP-SM)

GR:SA:FI : (%) 0 : 92 : 8

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/04/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/07/08
Exploration No.:	A-08-021	Depth (feet):	15.0		
Sample No.:	D-3				
Soil Identification:	Olive brown poorly graded sand with silt (SP-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	HA	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	596.70	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	246.09	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	350.61	Moisture Content (%)	0.00

After Wet Sieve	Container No.	HA
	Wt. of Dry Soil + Container (g)	576.60
	Wt. of Container (g)	246.09
	Dry Wt. of Soil Retained on # 200 Sieve (g)	330.51

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	
#8	2.360	0.00	
#16	1.180	0.00	100.0
#30	0.600	1.20	99.7
#50	0.300	76.00	78.3
#100	0.150	286.00	18.4
#200	0.075	330.60	5.7
PAN			

GRAVEL: **0 %**

SAND: **94 %**

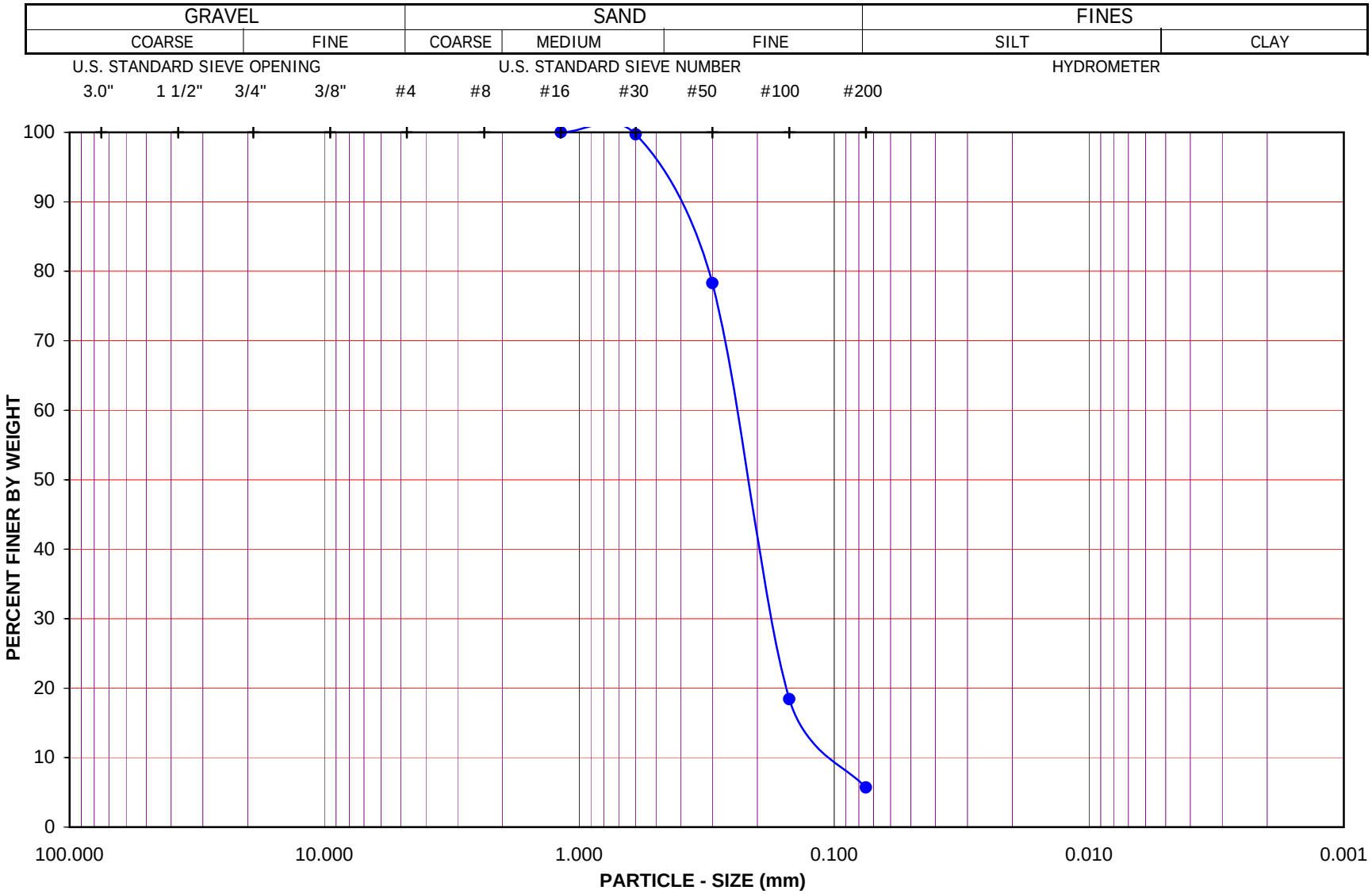
FINES: **6 %**

GROUP SYMBOL: **SP-SM**

Cu = D60/D10 = 2.33

Cc = $(D30)^2/(D60*D10)$ = 1.19

Remarks:



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-021 Sample No.: D-3

Depth (feet): 15.0 Soil Type : SP-SM

Soil Identification: Olive brown poorly graded sand with silt (SP-SM)

GR:SA:FI : (%) 0 : 94 : 6

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/19/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/21/08

Exploration No.: A-08-021

Sample No.: D-5 | Depth (feet) : 25.0

Soil Identification: Yellowish brown clayey sand (SC)

% Gravel	0	Soil Type
% Sand	55	SC
% Fines	45	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	112.35
Wt.of Air-Dry Soil + Cont. (g)	336.13	Wt. of Container No.___ (g)	1.00	1.00	75.91
Wt. of Container	38.64	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	297.49	Wt. of Dry Soil (g)			36.44

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.00	100.0
Pan		

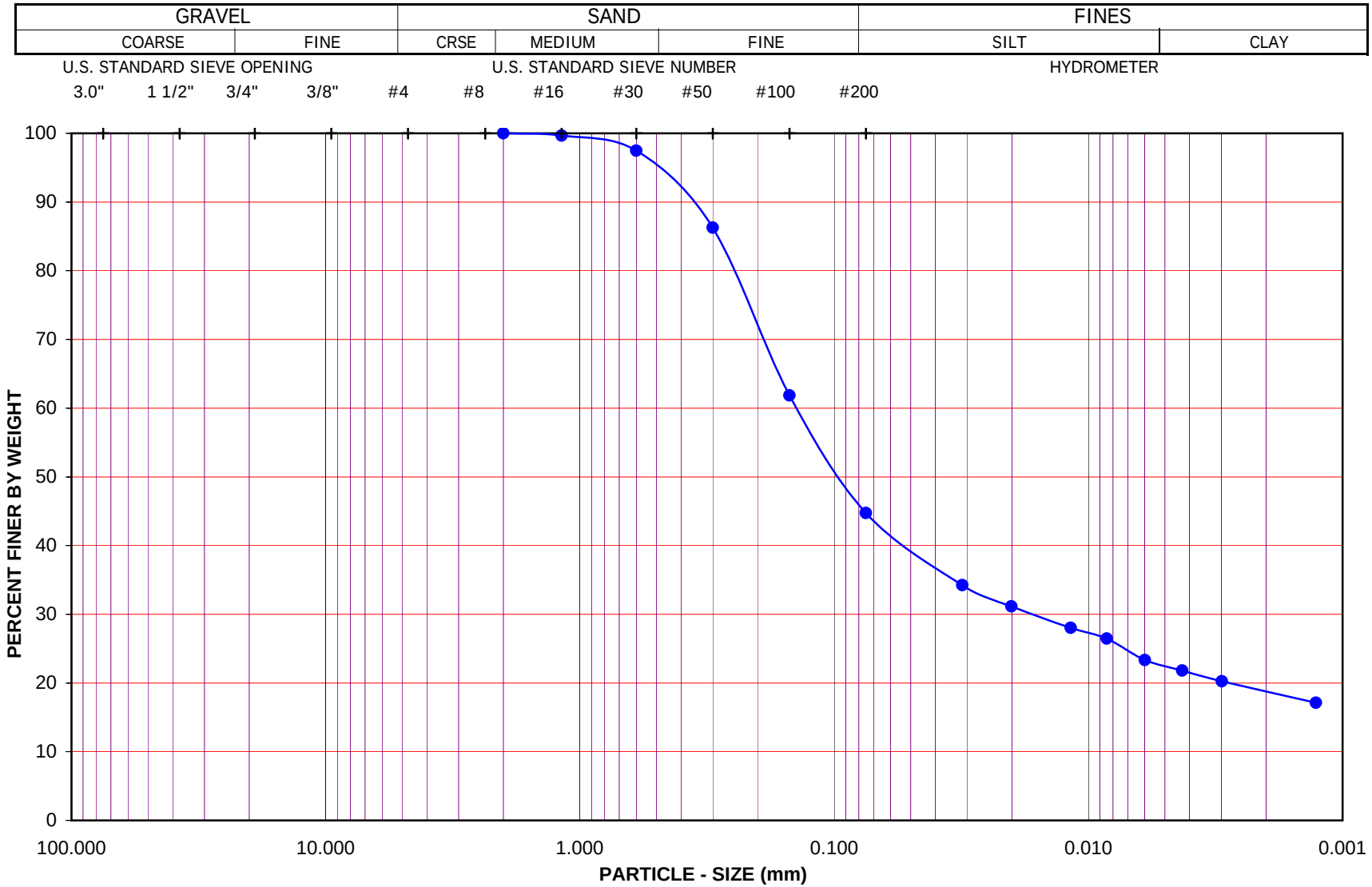
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.21	99.7	99.7
No. 30	1.61	97.5	97.5
No. 50	8.75	86.3	86.3
No. 100	24.31	61.8	61.8
No. 200	35.21	44.7	44.7
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 63.72 Wt. of Dry Soil (g) 63.72

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Aug-08	10:30	0		8.0			
	10:32	2	22.0	8.0	30.0	34.2	0.0313
	10:35	5	22.0	8.0	28.0	31.1	0.0201
	10:45	15	22.0	8.0	26.0	28.0	0.0117
	11:00	30	21.9	8.0	25.0	26.5	0.0085
	11:30	60	22.1	8.0	23.0	23.4	0.0060
	12:30	120	22.5	8.0	22.0	21.8	0.0043
	14:40	250	22.9	8.0	21.0	20.2	0.0030
20-Aug-08	10:30	1440	21.6	8.0	19.0	17.1	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-021 Sample No.: D-5

Depth (feet) : 25.0 Soil Type : SC

Soil Identification: Yellowish brown clayey sand (SC)

GR:SA:FI : (%) 0 : 55 : 45

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name: SR-57 Widening
Project No.: 370900.02.GE.0S
Exploration No.: A-08-022
Sample No.: Bag-1
Soil Identification: Brown clayey sand (SC)

Tested By: S. Felter Date: 08/18/08
Checked By: LF Date: 08/19/08
Depth (feet): 2 - 7

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	CP-17	VO	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	3234.20	775.00	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	223.30	234.80	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	3010.90	540.20	Moisture Content (%)	0.00	0.00

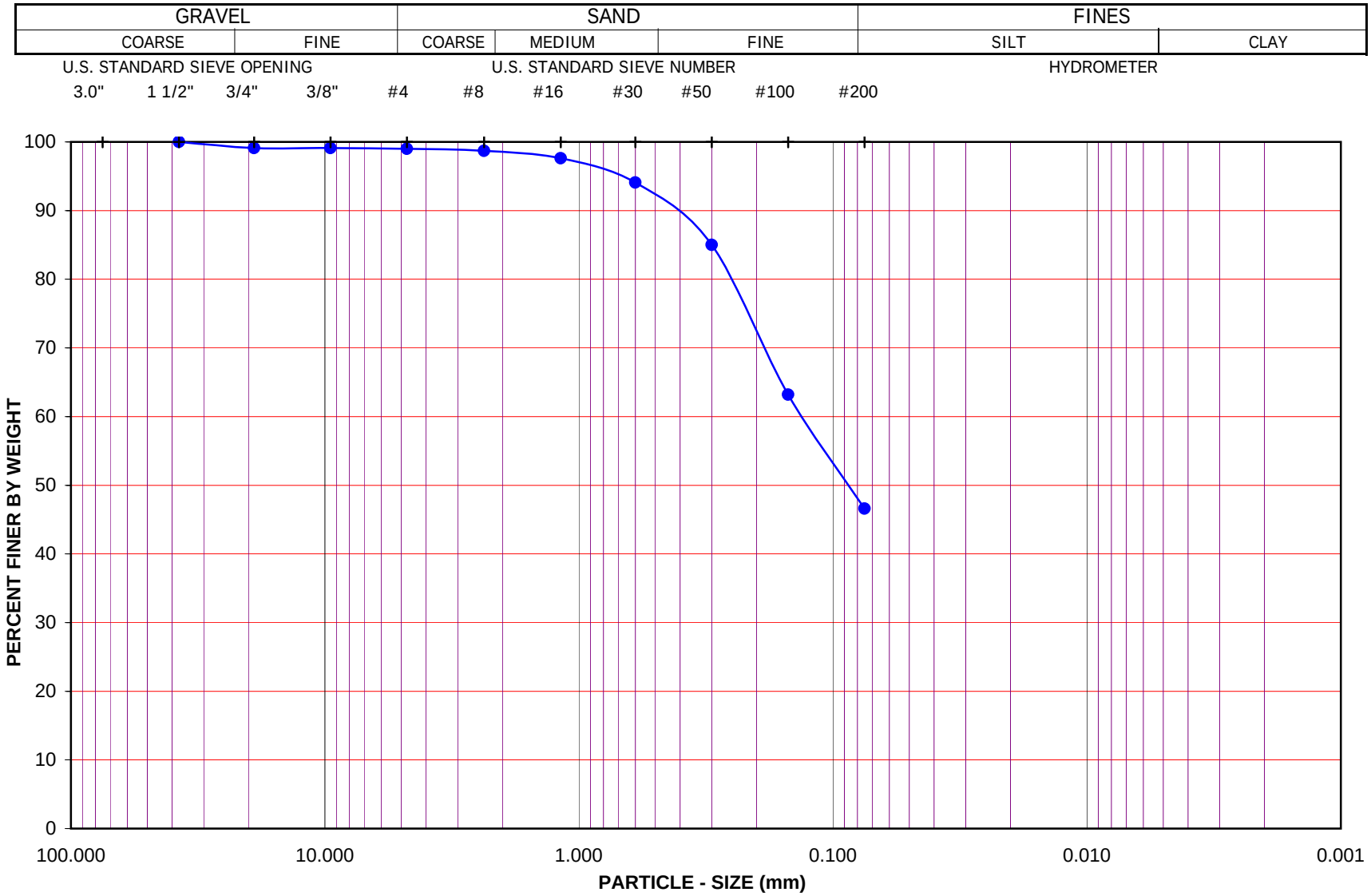
Passing #4 Material After Wet Sieve		
	Container No.	VO
	Wt. of Dry Soil + Container (g)	523.30
	Wt. of Container (g)	234.80
	Dry Wt. of Soil Retained on # 200 Sieve (g)	288.50

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	0.00		
1 1/2	37.500	0.00		100.0
3/4"	19.000	27.50		99.1
3/8"	9.500	27.50		99.1
#4	4.750	30.20		99.0
#8	2.360		1.40	98.7
#16	1.180		7.70	97.6
#30	0.600		26.60	94.1
#50	0.300		76.20	85.0
#100	0.150		195.30	63.2
#200	0.075		286.00	46.6
PAN				

GRAVEL: **1 %**
SAND: **52 %**
FINES: **47 %**
GROUP SYMBOL **SC**

Cu = D60/D10 = _____
Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-022 Sample No.: Bag-1

Depth (feet): 2 - 7 Soil Type : SC

Soil Identification: Brown clayey sand (SC)

GR:SA:FI : (%) 1 : 52 : 47

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/28/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/03/08

Exploration No.: A-08-022

Sample No.: D-1 | Depth (feet) : 5.0

Soil Identification: Yellowish brown clayey sand (SC)

% Gravel	0	Soil Type
% Sand	57	SC
% Fines	43	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	114.89
Wt.of Air-Dry Soil + Cont. (g)	424.51	Wt. of Container No.___ (g)	1.00	1.00	77.25
Wt. of Container	140.79	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	283.72	Wt. of Dry Soil (g)			37.64

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	1.20	99.6
No. 10	2.29	99.2
Pan		

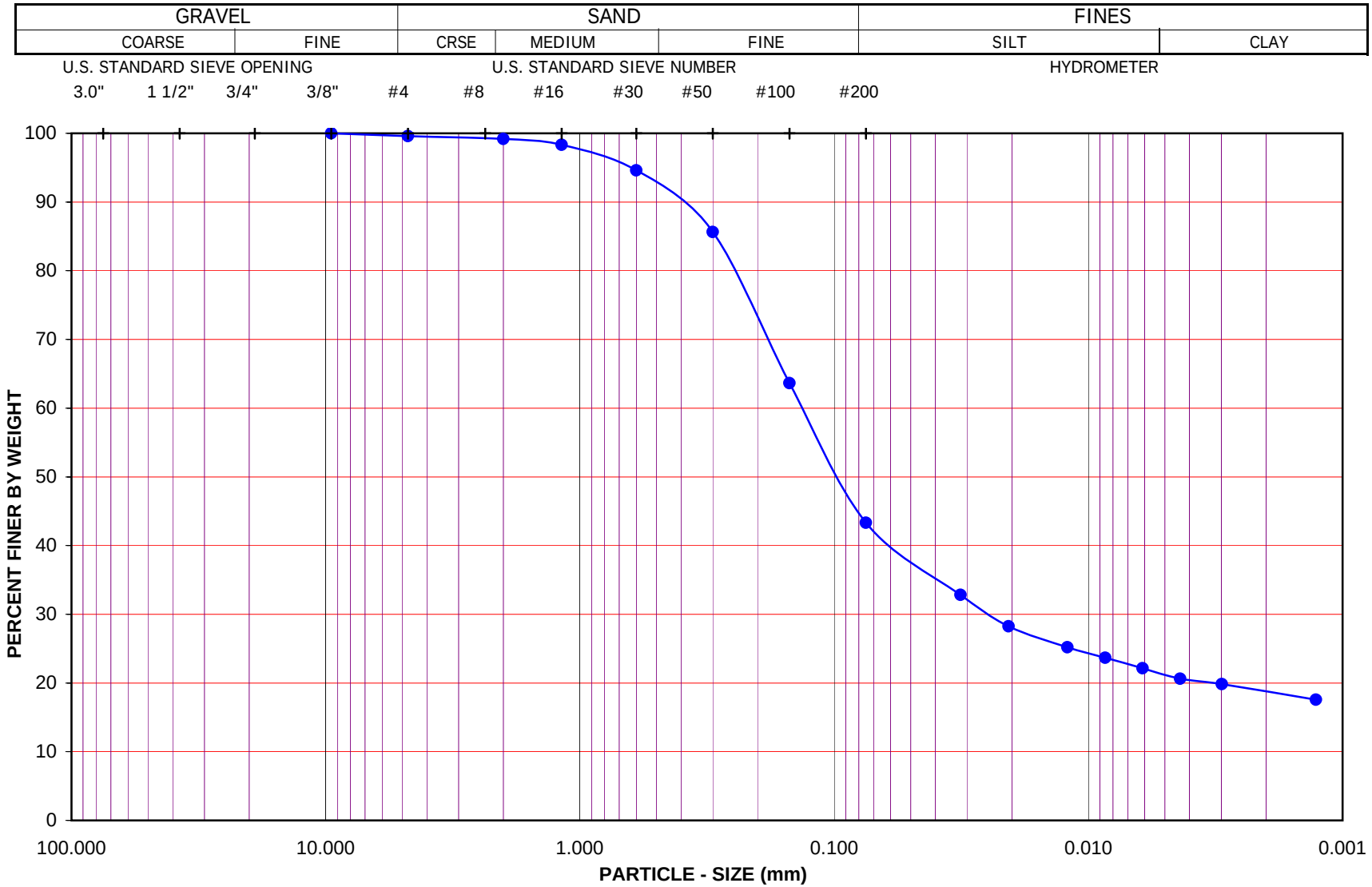
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.2
No. 16	0.56	99.1	98.3
No. 30	2.97	95.4	94.6
No. 50	8.82	86.3	85.6
No. 100	23.10	64.2	63.6
No. 200	36.29	43.7	43.3
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 64.44 Wt. of Dry Soil (g) 64.44

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
28-Aug-08	9:22	0		7.5			
	9:24	2	21.7	7.5	29.0	32.8	0.0318
	9:27	5	21.8	7.5	26.0	28.2	0.0206
	9:37	15	21.8	7.5	24.0	25.2	0.0121
	9:52	30	21.8	7.5	23.0	23.7	0.0086
	10:22	60	21.7	7.5	22.0	22.1	0.0061
	11:22	120	21.6	7.5	21.0	20.6	0.0044
	13:32	250	22.1	7.5	20.5	19.9	0.0030
29-Aug-08	9:22	1440	21.6	8.0	19.0	17.6	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-022 Sample No.: D-1

Depth (feet) : 5.0 Soil Type : SC

Soil Identification: Yellowish brown clayey sand (SC)

GR:SA:FI : (%) 0 : 57 : 43

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-022	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Brown clayey sand (SC)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	GP	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	579.26	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	137.74	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	441.52	Moisture Content (%)	0.00

After Wet Sieve	Container No.	GP
	Wt. of Dry Soil + Container (g)	406.30
	Wt. of Container (g)	137.74
	Dry Wt. of Soil Retained on # 200 Sieve (g)	268.56

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	2.10	99.5
#8	2.360	5.30	98.8
#16	1.180	13.20	97.0
#30	0.600	39.20	91.1
#50	0.300	86.00	80.5
#100	0.150	170.00	61.5
#200	0.075	263.00	40.4
PAN			

GRAVEL: **1 %**

SAND: **59 %**

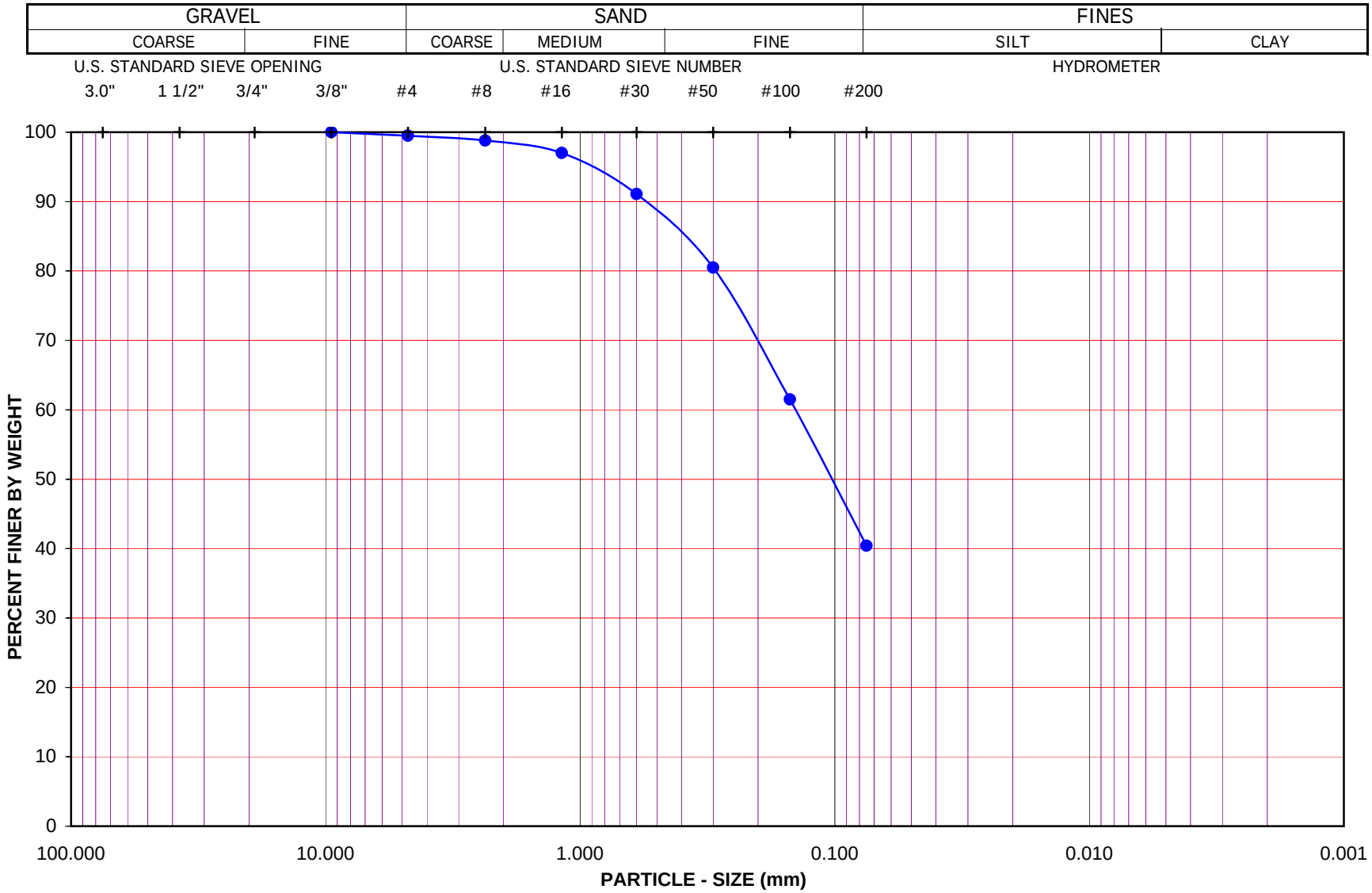
FINES: **40 %**

GROUP SYMBOL: **SC**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-022 Sample No.: S-2

Depth (feet): 10.0 Soil Type : SC

Soil Identification: Brown clayey sand (SC)

GR:SA:FI : (%) 1 : 59 : 40

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/05/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/07/08
Exploration No.:	A-08-022	Depth (feet):	15.0		
Sample No.:	D-3				
Soil Identification:	Brown silty sand (SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	SP	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	621.57	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	220.59	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	400.98	Moisture Content (%)	0.00

After Wet Sieve	Container No.	SP
	Wt. of Dry Soil + Container (g)	519.00
	Wt. of Container (g)	220.59
	Dry Wt. of Soil Retained on # 200 Sieve (g)	298.41

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	
#4	4.750	0.00	100.0
#8	2.360	0.80	99.8
#16	1.180	4.60	98.9
#30	0.600	28.10	93.0
#50	0.300	97.90	75.6
#100	0.150	230.40	42.5
#200	0.075	297.70	25.8
PAN			

GRAVEL: **0 %**

SAND: **74 %**

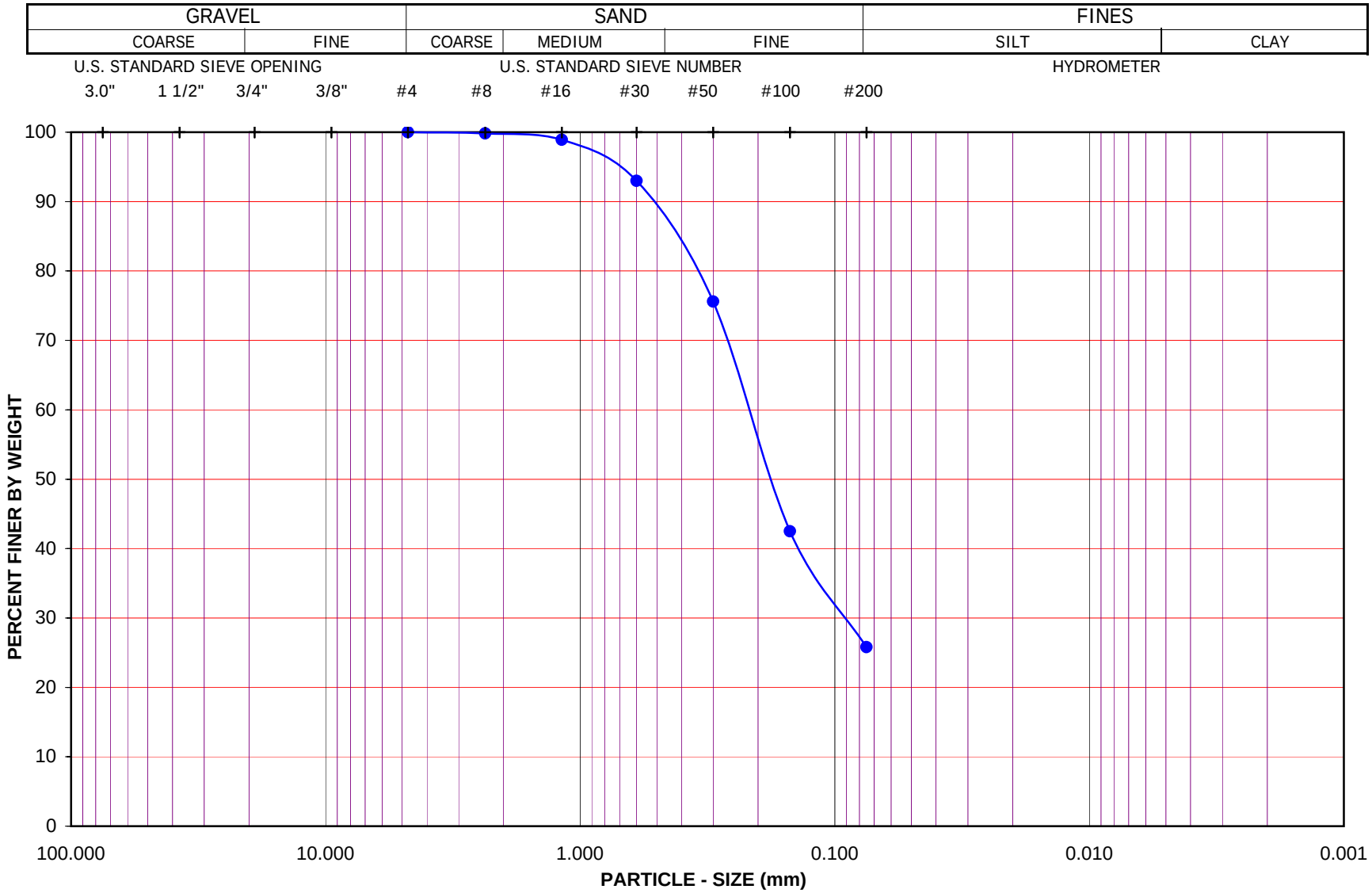
FINES: **26 %**

GROUP SYMBOL: **SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-022 Sample No.: D-3

Depth (feet): 15.0 Soil Type : SM

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 0 : 74 : 26

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/18/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/21/08

Exploration No.: A-08-023

Sample No.: D-1 | Depth (feet) : 5.0

Soil Identification: Olive sandy silty clay s(CL-ML)

% Gravel	11	Soil Type
% Sand	30	s(CL-ML)
% Fines	59	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	101.24
Wt.of Air-Dry Soil + Cont. (g)	781.70	Wt. of Container No.___ (g)	1.00	1.00	77.27
Wt. of Container	251.40	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	530.30	Wt. of Dry Soil (g)			23.97

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	26.15	95.1
3/8"	45.23	91.5
No. 4	59.59	88.8
No. 10	67.94	87.2
Pan		

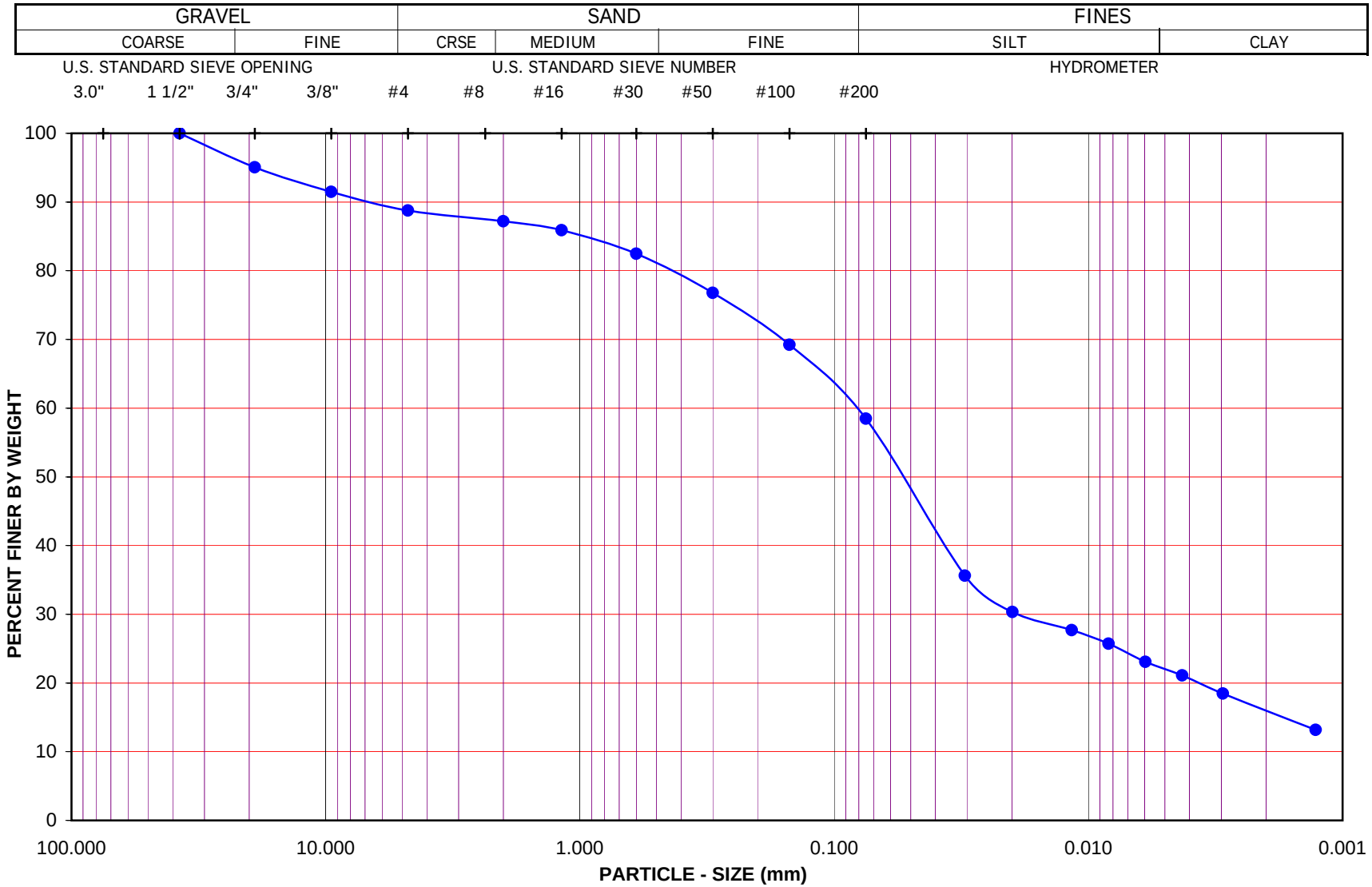
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	87.2
No. 16	0.97	98.5	85.9
No. 30	3.56	94.6	82.5
No. 50	7.83	88.1	76.8
No. 100	13.52	79.4	69.2
No. 200	21.61	67.1	58.5
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.60 Wt. of Dry Soil (g) 65.60

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
18-Aug-08	9:02	0		8.0			
	9:04	2	21.6	8.0	35.0	35.6	0.0306
	9:07	5	21.7	8.0	31.0	30.3	0.0199
	9:17	15	21.7	8.0	29.0	27.7	0.0116
	9:32	30	21.5	8.0	27.5	25.7	0.0083
	10:02	60	21.6	8.0	25.5	23.1	0.0060
	11:02	120	21.9	8.0	24.0	21.1	0.0043
	13:12	250	22.6	8.0	22.0	18.5	0.0030
19-Aug-08	9:02	1440	21.8	8.0	18.0	13.2	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-023 Sample No.: D-1

Depth (feet) : 5.0 Soil Type : s(CL-ML)

Soil Identification: Olive sandy silty clay s(CL-ML)

GR:SA:FI : (%) 11 : 30 : 59

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-023	Depth (feet):	20.0		
Sample No.:	S-4				
Soil Identification:	Olive gray silty, clayey sand (SC-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	RB	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	491.94	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	137.01	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	354.93	Moisture Content (%)	0.00

After Wet Sieve	Container No.	RB
	Wt. of Dry Soil + Container (g)	345.50
	Wt. of Container (g)	137.01
	Dry Wt. of Soil Retained on # 200 Sieve (g)	208.49

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	2.10	99.4
#4	4.750	5.20	98.5
#8	2.360	10.80	97.0
#16	1.180	15.90	95.5
#30	0.600	22.10	93.8
#50	0.300	43.90	87.6
#100	0.150	130.20	63.3
#200	0.075	205.90	42.0
PAN			

GRAVEL: **2 %**

SAND: **56 %**

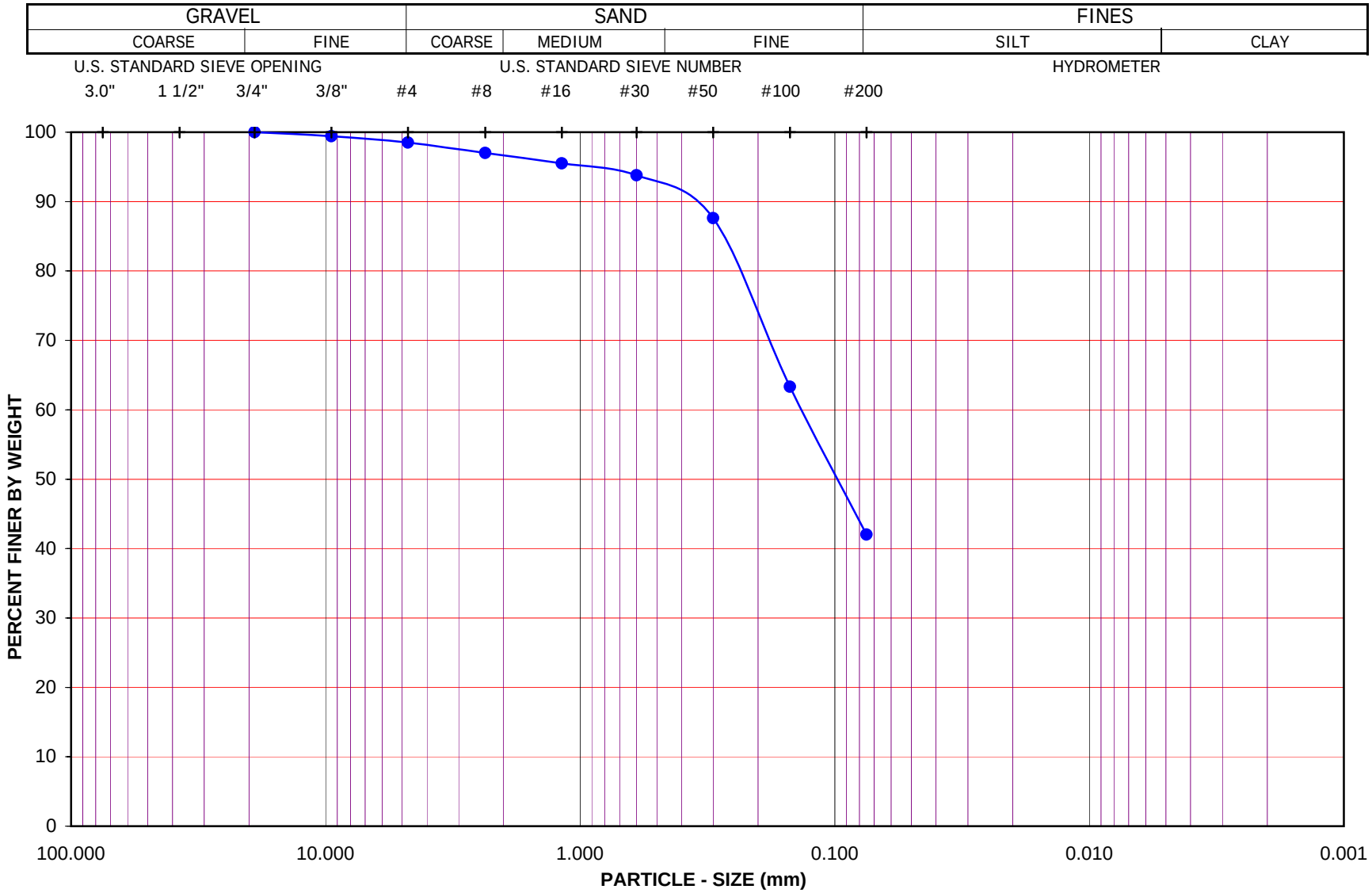
FINES: **42 %**

GROUP SYMBOL: **SC-SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-023 Sample No.: S-4

Depth (feet): 20.0 Soil Type : SC-SM

Soil Identification: Olive gray silty, clayey sand (SC-SM)

GR:SA:FI : (%) 2 : 56 : 42

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/28/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/02/08

Exploration No.: A-08-023

Sample No.: D-9 | Depth (feet) : 45.0

Soil Identification: Yellowish brown silty fine sand (SM)

% Gravel	0	Soil Type
% Sand	67	SM
% Fines	33	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	154.22
Wt.of Air-Dry Soil + Cont. (g)	546.17	Wt. of Container No.___ (g)	1.00	1.00	74.28
Wt. of Container	132.69	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	413.48	Wt. of Dry Soil (g)			79.94

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.10	100.0
Pan		

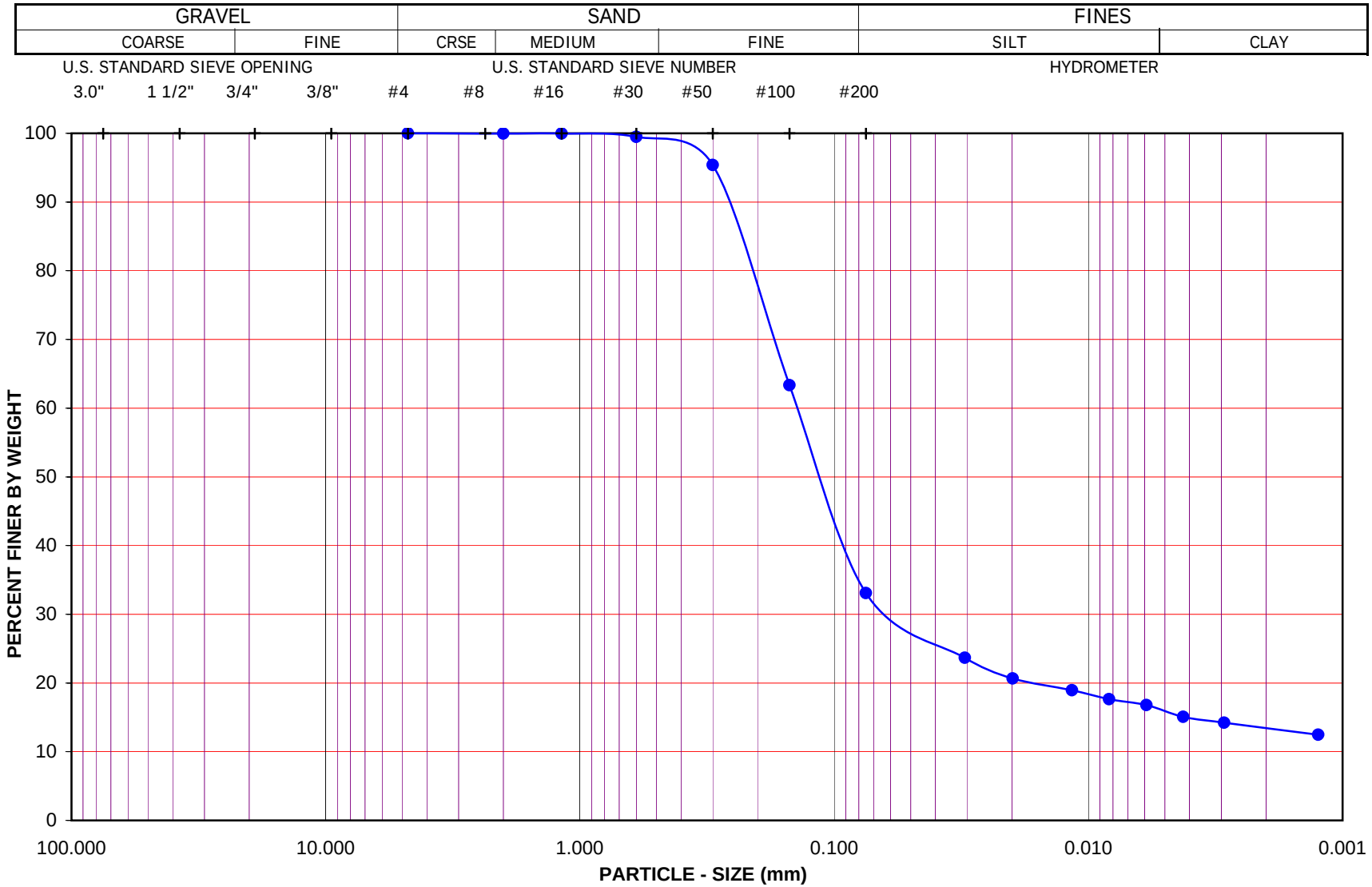
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.03	100.0	99.9
No. 30	0.56	99.5	99.5
No. 50	5.29	95.4	95.4
No. 100	42.21	63.4	63.4
No. 200	77.09	33.1	33.1
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 115.23 Wt. of Dry Soil (g) 115.23

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
28-Aug-08	9:14	0		7.5			
	9:16	2	21.8	7.5	35.0	23.7	0.0306
	9:19	5	21.7	7.5	31.5	20.7	0.0198
	9:29	15	21.8	7.5	29.5	18.9	0.0116
	9:44	30	21.7	7.5	28.0	17.6	0.0083
	10:14	60	21.7	7.5	27.0	16.8	0.0059
	11:14	120	21.6	7.5	25.0	15.1	0.0042
	13:24	250	22.1	7.5	24.0	14.2	0.0029
29-Aug-08	9:14	1440	21.6	8.0	22.0	12.5	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-023 Sample No.: D-9

Depth (feet) : 45.0 Soil Type : SM

Soil Identification: Yellowish brown silty fine sand (SM)

GR:SA:FI : (%) 0 : 67 : 33

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-023	Depth (feet):	50.0		
Sample No.:	S-10				
Soil Identification:	Brown poorly graded sand with silt (SP-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	KG	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	454.00	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	140.93	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	313.07	Moisture Content (%)	0.00

After Wet Sieve	Container No.	KG
	Wt. of Dry Soil + Container (g)	433.40
	Wt. of Container (g)	140.93
	Dry Wt. of Soil Retained on # 200 Sieve (g)	292.47

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	2.00	99.4
#8	2.360	6.40	98.0
#16	1.180	20.40	93.5
#30	0.600	78.50	74.9
#50	0.300	189.90	39.3
#100	0.150	269.30	14.0
#200	0.075	291.50	6.9
PAN			

GRAVEL: **1 %**

SAND: **92 %**

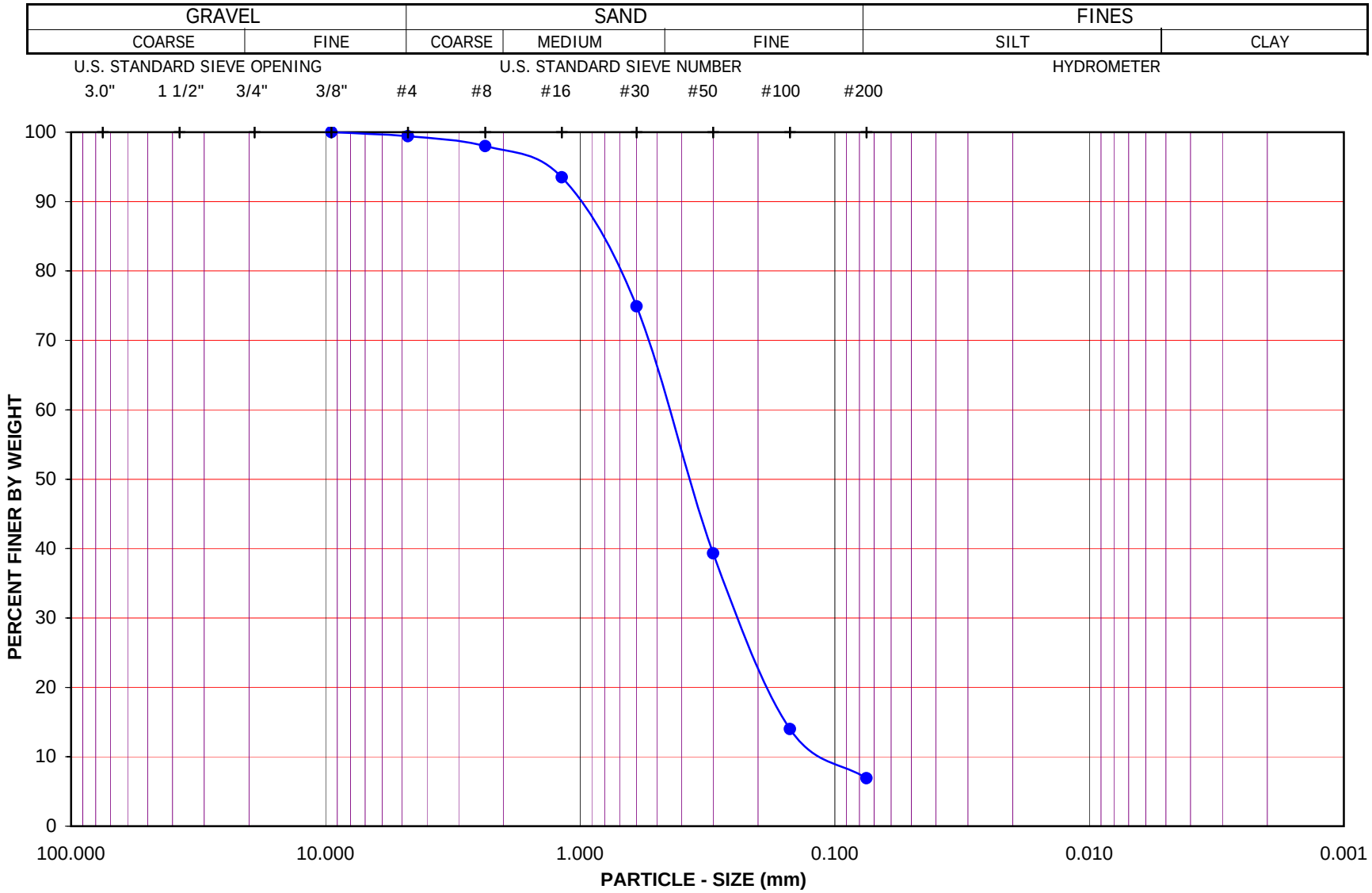
FINES: **7 %**

GROUP SYMBOL: **SP-SM**

Cu = D60/D10 = 3.75

Cc = $(D30)^2/(D60*D10)$ = 1.11

Remarks:



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-023 Sample No.: S-10

Depth (feet): 50.0 Soil Type : SP-SM

Soil Identification: Brown poorly graded sand with silt (SP-SM)

GR:SA:FI : (%) 1 : 92 : 7

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/28/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/03/08

Exploration No.: A-08-024

Sample No.: Bag-1 | Depth (feet) : 0-7

Soil Identification: Olive lean clay with sand (CL)s

% Gravel	2	Soil Type
% Sand	24	(CL)s
% Fines	74	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	92.75
Wt.of Air-Dry Soil + Cont. (g)	573.87	Wt. of Container No.___ (g)	1.00	1.00	76.38
Wt. of Container	75.94	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	497.93	Wt. of Dry Soil (g)			16.37

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	3.35	99.3
No. 4	9.09	98.2
No. 10	18.34	96.3
Pan		

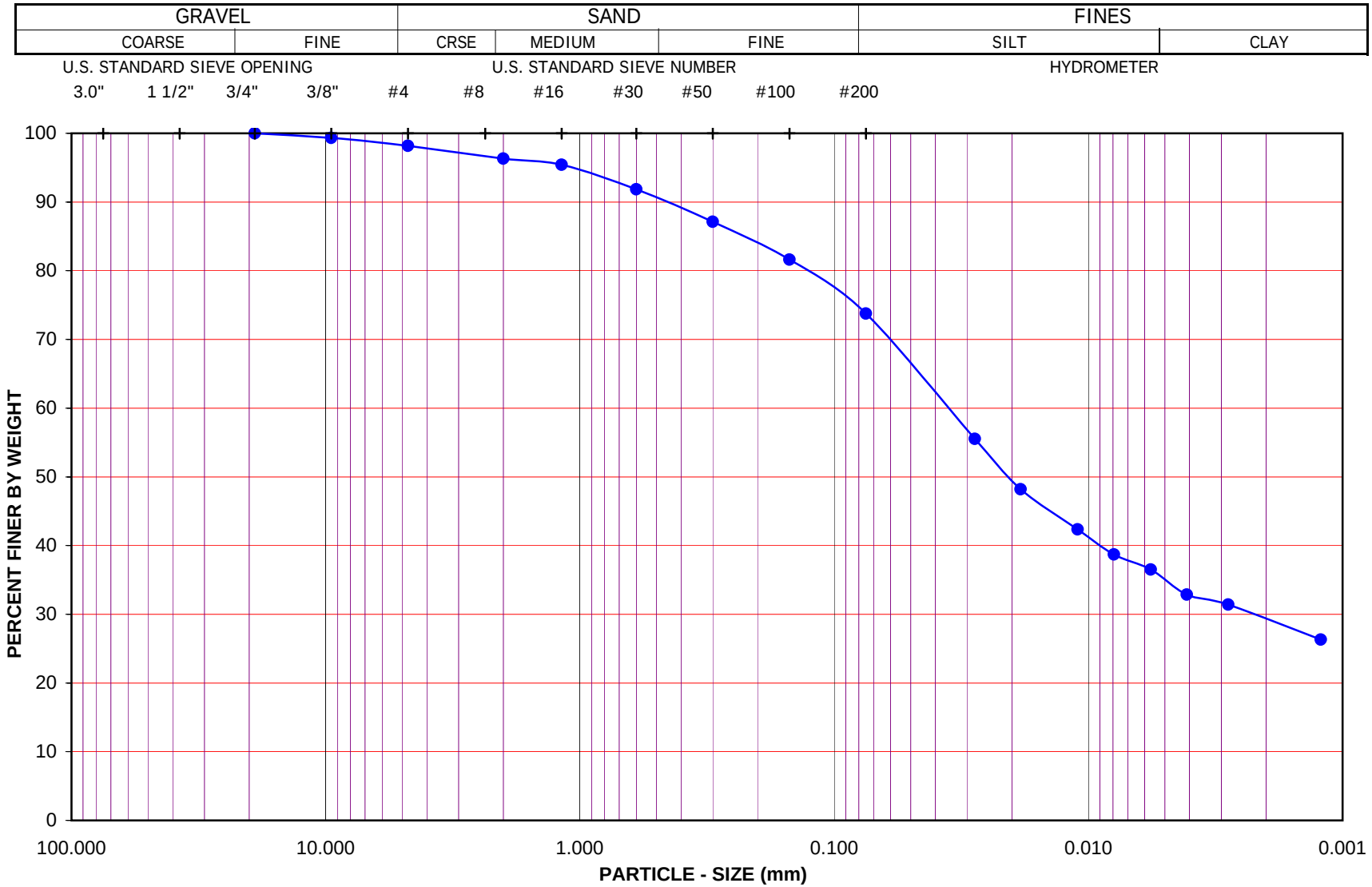
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	96.3
No. 16	0.60	99.1	95.4
No. 30	3.03	95.4	91.9
No. 50	6.23	90.5	87.1
No. 100	9.97	84.8	81.6
No. 200	15.31	76.6	73.8
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.40 Wt. of Dry Soil (g) 65.40

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
28-Aug-08	9:18	0		7.5			
	9:20	2	21.7	7.5	45.5	55.5	0.0279
	9:23	5	21.7	7.5	40.5	48.2	0.0185
	9:33	15	21.9	7.5	36.5	42.4	0.0110
	9:48	30	21.7	7.5	34.0	38.7	0.0079
	10:18	60	21.8	7.5	32.5	36.5	0.0057
	11:18	120	21.6	7.5	30.0	32.9	0.0041
	13:28	250	22.1	7.5	29.0	31.4	0.0028
29-Aug-08	9:18	1440	21.6	8.0	25.5	26.3	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-024 Sample No.: Bag-1

Depth (feet) : 0-7 Soil Type : (CL)s

Soil Identification: Olive lean clay with sand (CL)s

GR:SA:FI : (%) 2 : 24 : 74

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

SA & Hyd A-08-024, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 09/01/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/04/08

Exploration No.: A-08-024

Sample No.: D-1 | Depth (feet) : 5.0

Soil Identification: Olive brown sandy lean clay s(CL)

% Gravel	4	Soil Type
% Sand	30	s(CL)
% Fines	66	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	96.68
Wt.of Air-Dry Soil + Cont. (g)	742.12	Wt. of Container No.___ (g)	1.00	1.00	76.72
Wt. of Container	142.58	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	599.54	Wt. of Dry Soil (g)			19.96

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	15.14	97.5
No. 4	25.18	95.8
No. 10	40.13	93.3
Pan		

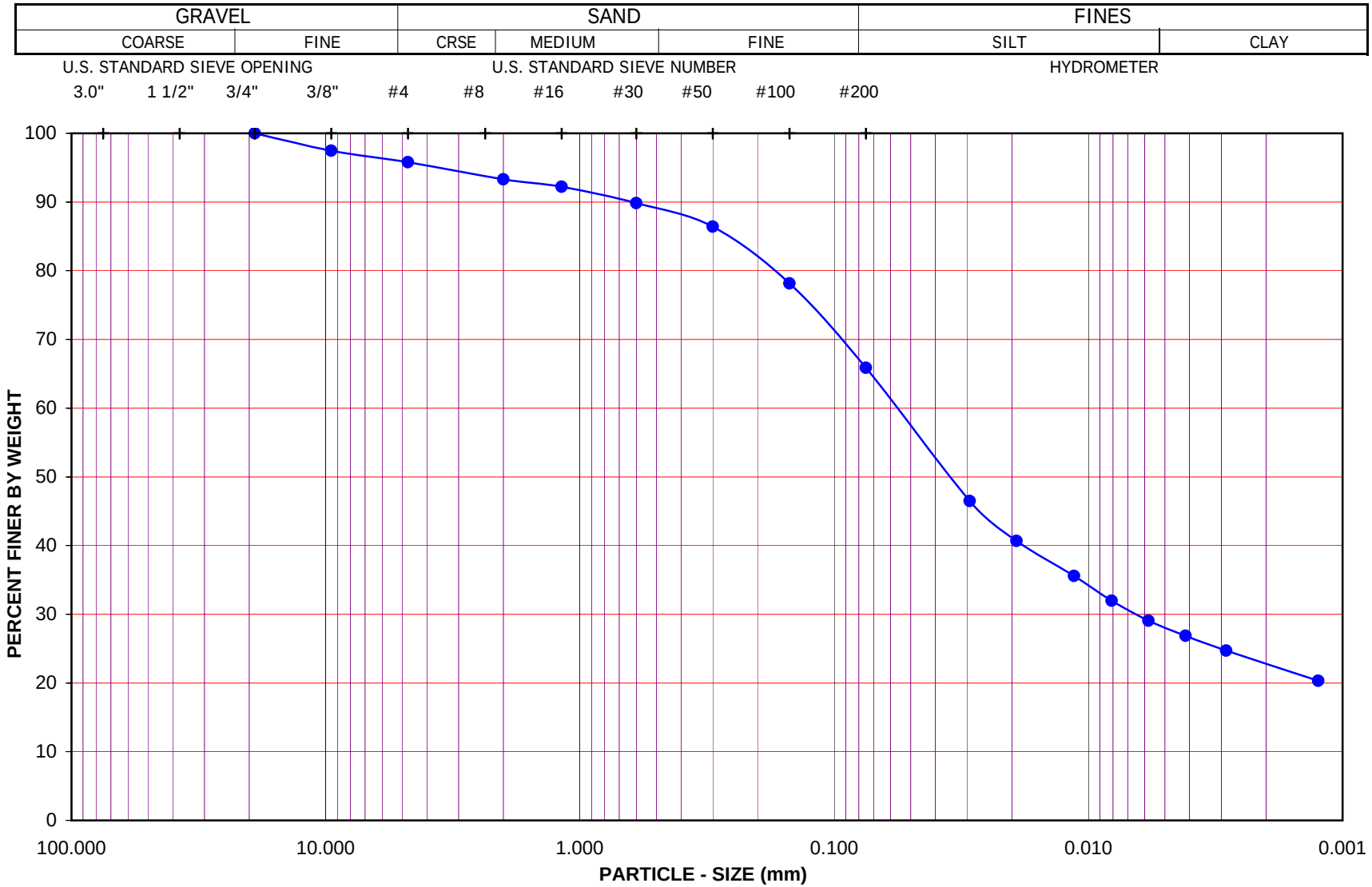
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	93.3
No. 16	0.75	98.8	92.2
No. 30	2.37	96.3	89.8
No. 50	4.71	92.6	86.4
No. 100	10.35	83.8	78.2
No. 200	18.73	70.6	65.9
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 63.72 Wt. of Dry Soil (g) 63.72

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
01-Sep-08	10:06	0		8.0			
	10:08	2	21.9	8.0	40.0	46.5	0.0292
	10:11	5	21.9	8.0	36.0	40.7	0.0192
	10:21	15	21.9	8.0	32.5	35.6	0.0114
	10:36	30	22.0	8.0	30.0	32.0	0.0081
	11:06	60	22.2	8.0	28.0	29.1	0.0058
	12:06	120	22.7	8.0	26.5	26.9	0.0041
	14:16	250	23.4	8.0	25.0	24.7	0.0029
02-Sep-08	10:06	1440	21.9	8.0	22.0	20.3	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-024 Sample No.: D-1

Depth (feet) : 5.0 Soil Type : s(CL)

Soil Identification: Olive brown sandy lean clay s(CL)

GR:SA:FI : (%) 4 : 30 : 66

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-024	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Olive gray clayey sand (SC)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	M	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	439.00	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	144.86	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	294.14	Moisture Content (%)	0.00

After Wet Sieve	Container No.	M
	Wt. of Dry Soil + Container (g)	310.60
	Wt. of Container (g)	144.86
	Dry Wt. of Soil Retained on # 200 Sieve (g)	165.74

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	1.90	99.4
#4	4.750	17.60	94.0
#8	2.360	32.70	88.9
#16	1.180	47.00	84.0
#30	0.600	62.20	78.9
#50	0.300	82.80	71.9
#100	0.150	124.90	57.5
#200	0.075	164.50	44.1
PAN			

GRAVEL: **6 %**

SAND: **50 %**

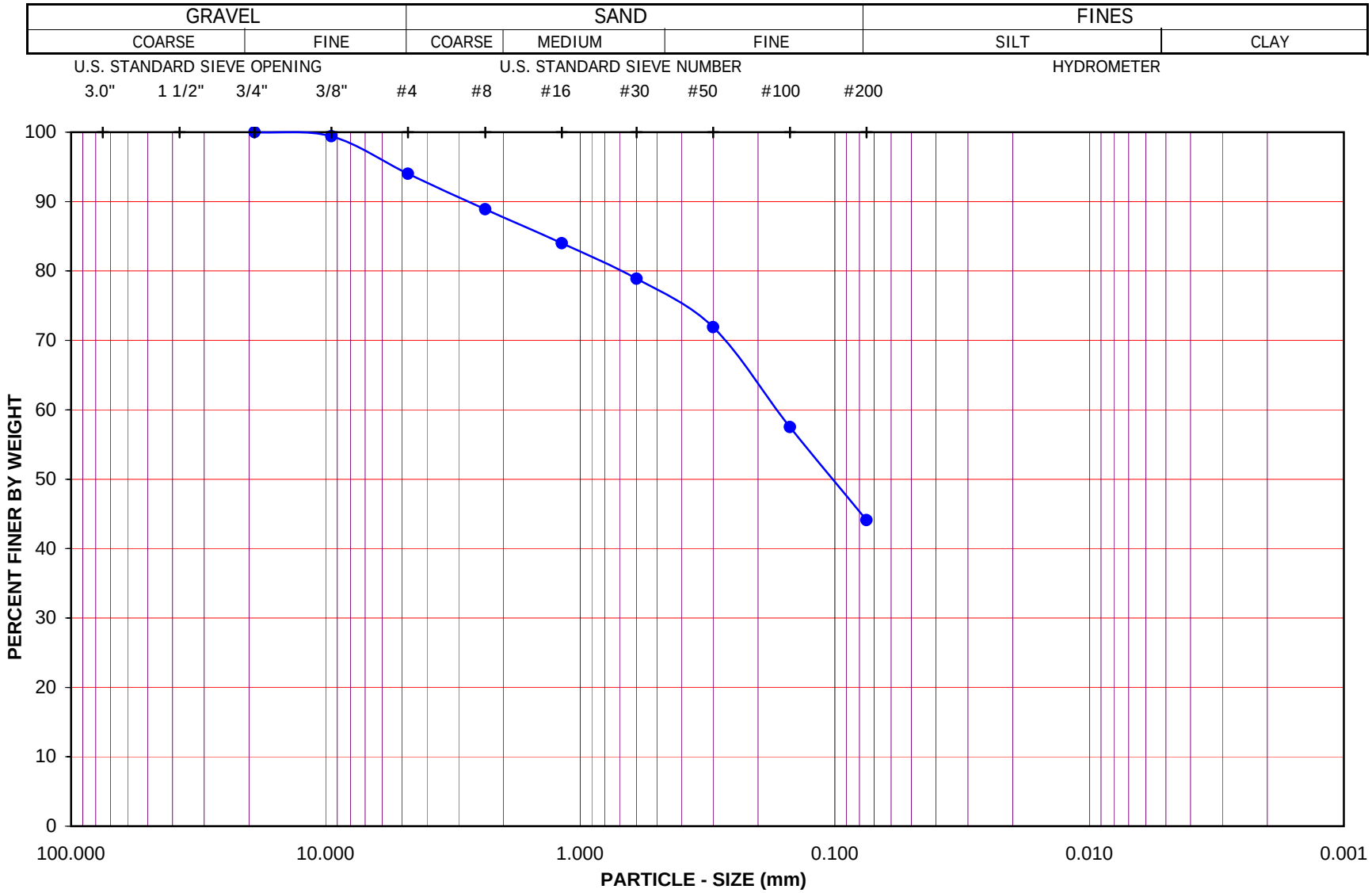
FINES: **44 %**

GROUP SYMBOL: **SC**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-024 Sample No.: S-2

Depth (feet): 10.0 Soil Type : SC

Soil Identification: Olive gray clayey sand (SC)

GR:SA:FI : (%) 6 : 50 : 44

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-024, S-2

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/08/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Exploration No.:	A-08-024	Depth (feet):	30.0		
Sample No.:	S-6				
Soil Identification:	Light gray clayey sand (SC)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	J	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	591.10	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	140.70	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	450.40	Moisture Content (%)	0.00

After Wet Sieve	Container No.	J
	Wt. of Dry Soil + Container (g)	401.20
	Wt. of Container (g)	140.70
	Dry Wt. of Soil Retained on # 200 Sieve (g)	260.50

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	4.70	99.0
#4	4.750	14.10	96.9
#8	2.360	20.80	95.4
#16	1.180	27.30	93.9
#30	0.600	35.50	92.1
#50	0.300	57.40	87.3
#100	0.150	150.80	66.5
#200	0.075	255.00	43.4
PAN			

GRAVEL: **3 %**

SAND: **54 %**

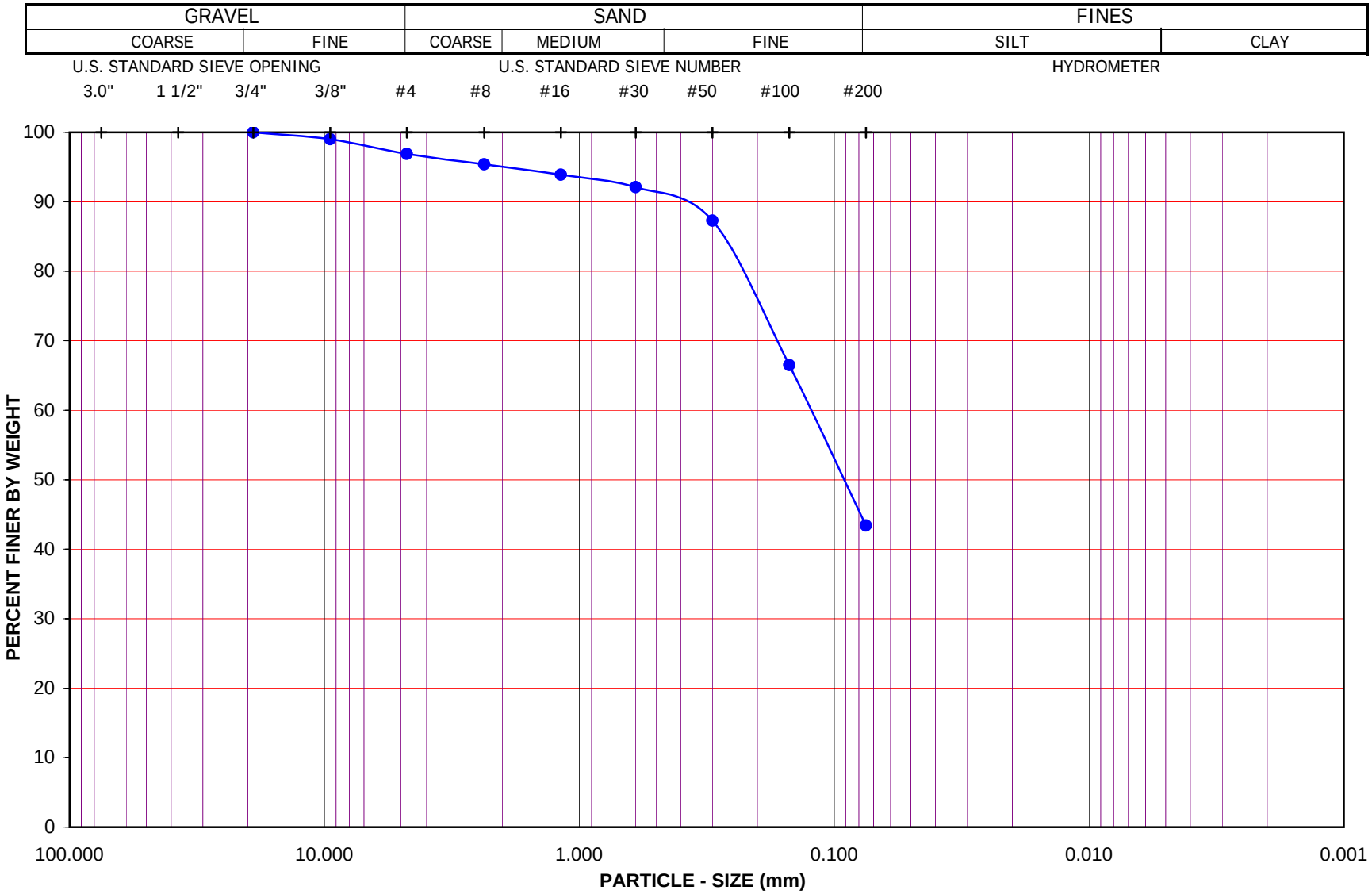
FINES: **43 %**

GROUP SYMBOL: **SC**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-024 Sample No.: S-6

Depth (feet): 30.0 Soil Type : SC

Soil Identification: Light gray clayey sand (SC)

GR:SA:FI : (%) 3 : 54 : 43

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-024, S-6

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/19/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/21/08

Exploration No.: A-08-025

Sample No.: D-1 | Depth (feet) : 5.0

Soil Identification: Olive lean clay with sand (CL)s

% Gravel	1	Soil Type
% Sand	21	(CL)s
% Fines	78	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	91.81
Wt.of Air-Dry Soil + Cont. (g)	320.03	Wt. of Container No.___ (g)	1.00	1.00	77.16
Wt. of Container	38.80	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	281.23	Wt. of Dry Soil (g)			14.65

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	2.93	99.0
No. 4	3.51	98.8
No. 10	6.97	97.5
Pan		

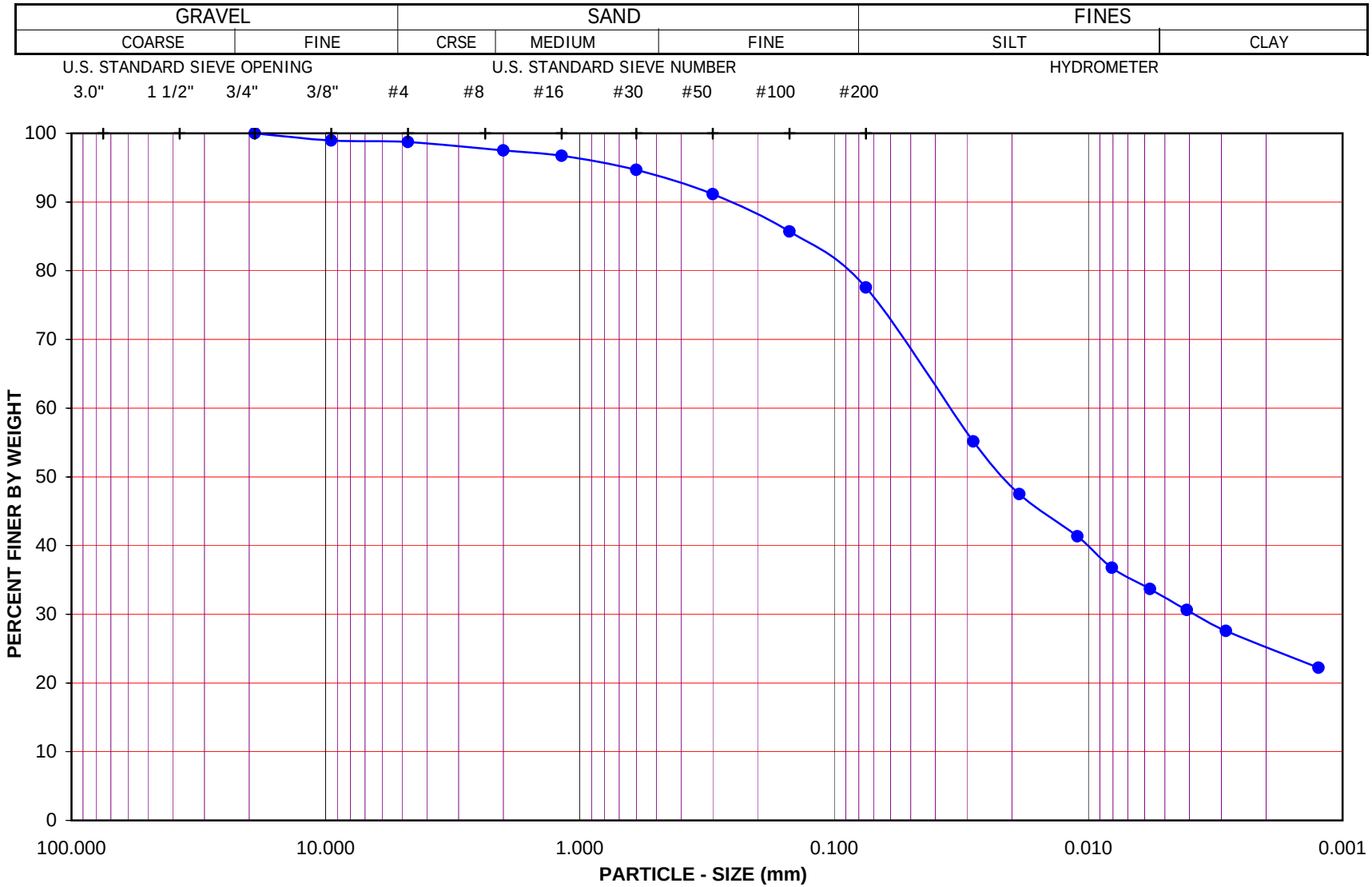
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	97.5
No. 16	0.52	99.2	96.7
No. 30	1.84	97.1	94.7
No. 50	4.12	93.5	91.2
No. 100	7.64	87.9	85.7
No. 200	12.92	79.5	77.6
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 63.16 Wt. of Dry Soil (g) 63.16

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Aug-08	10:26	0		8.0			
	10:28	2	21.8	8.0	44.0	55.1	0.0283
	10:31	5	21.9	8.0	39.0	47.5	0.0187
	10:41	15	22.0	8.0	35.0	41.4	0.0110
	10:56	30	21.9	8.0	32.0	36.8	0.0081
	11:26	60	22.0	8.0	30.0	33.7	0.0057
	12:26	120	22.4	8.0	28.0	30.6	0.0041
	14:36	250	22.9	8.0	26.0	27.6	0.0029
20-Aug-08	10:26	1440	21.6	8.0	22.5	22.2	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-025 Sample No.: D-1

Depth (feet) : 5.0 Soil Type : (CL)s

Soil Identification: Olive lean clay with sand (CL)s

GR:SA:FI : (%) 1 : 21 : 78

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/26/08
Exploration No.:	A-08-025	Depth (feet):	45.0		
Sample No.:	D-9				
Soil Identification:	Gray well-graded sand with silt and gravel (SW-SM)g				

		Moisture Content of Total Air - Dry Soil	
Container No.:	VO	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	970.00	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	234.80	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	735.20	Moisture Content (%)	0.00

After Wet Sieve	Container No.	VO
	Wt. of Dry Soil + Container (g)	920.40
	Wt. of Container (g)	234.80
	Dry Wt. of Soil Retained on # 200 Sieve (g)	685.60

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	100.0
3/4"	19.000	17.20	97.7
3/8"	9.500	147.50	79.9
#4	4.750	323.80	56.0
#8	2.360	450.30	38.8
#16	1.180	538.30	26.8
#30	0.600	599.70	18.4
#50	0.300	636.30	13.5
#100	0.150	664.40	9.6
#200	0.075	684.80	6.9
PAN			

GRAVEL: **44 %**

SAND: **49 %**

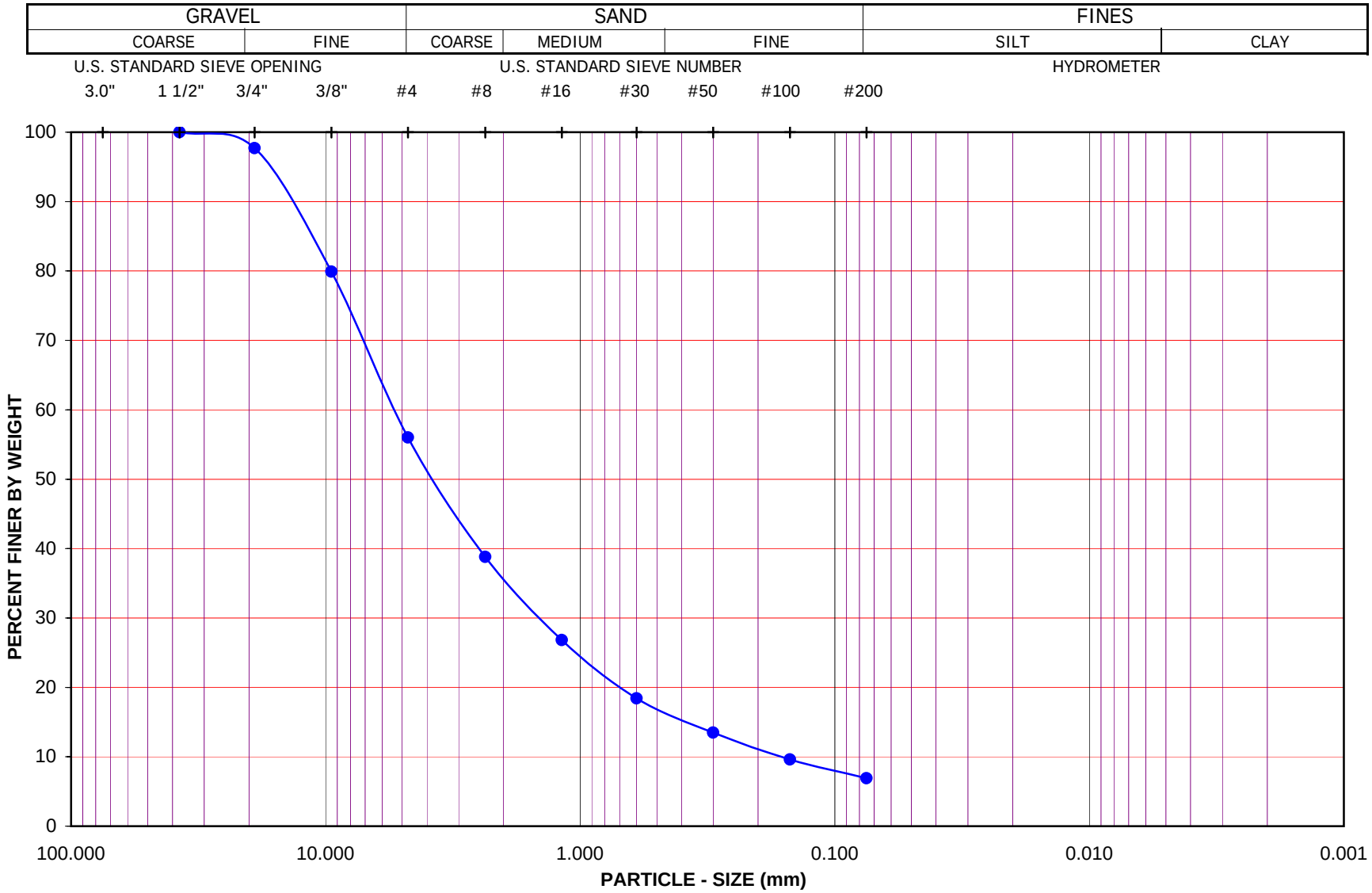
FINES: **7 %**

GROUP SYMBOL: **(SW-SM)g**

Cu = D60/D10 = 36.00

Cc = $(D30)^2/(D60*D10)$ = 2.78

Remarks:



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-025 Sample No.: D-9

Depth (feet): 45.0 Soil Type : (SW-SM)g

Soil Identification: Gray well-graded sand with silt and gravel (SW-SM)g

GR:SA:FI : (%) 44 : 49 : 7

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 09/01/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/04/08

Exploration No.: A-08-025

Sample No.: D-13 | Depth (feet) : 65.0

Soil Identification: Brown sandy lean clay s(CL)

% Gravel	3	Soil Type
% Sand	44	s(CL)
% Fines	53	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	105.38
Wt.of Air-Dry Soil + Cont. (g)	731.18	Wt. of Container No.___ (g)	1.00	1.00	76.36
Wt. of Container	139.98	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	591.20	Wt. of Dry Soil (g)			29.02

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	4.98	99.2
No. 4	17.00	97.1
No. 10	29.68	95.0
Pan		

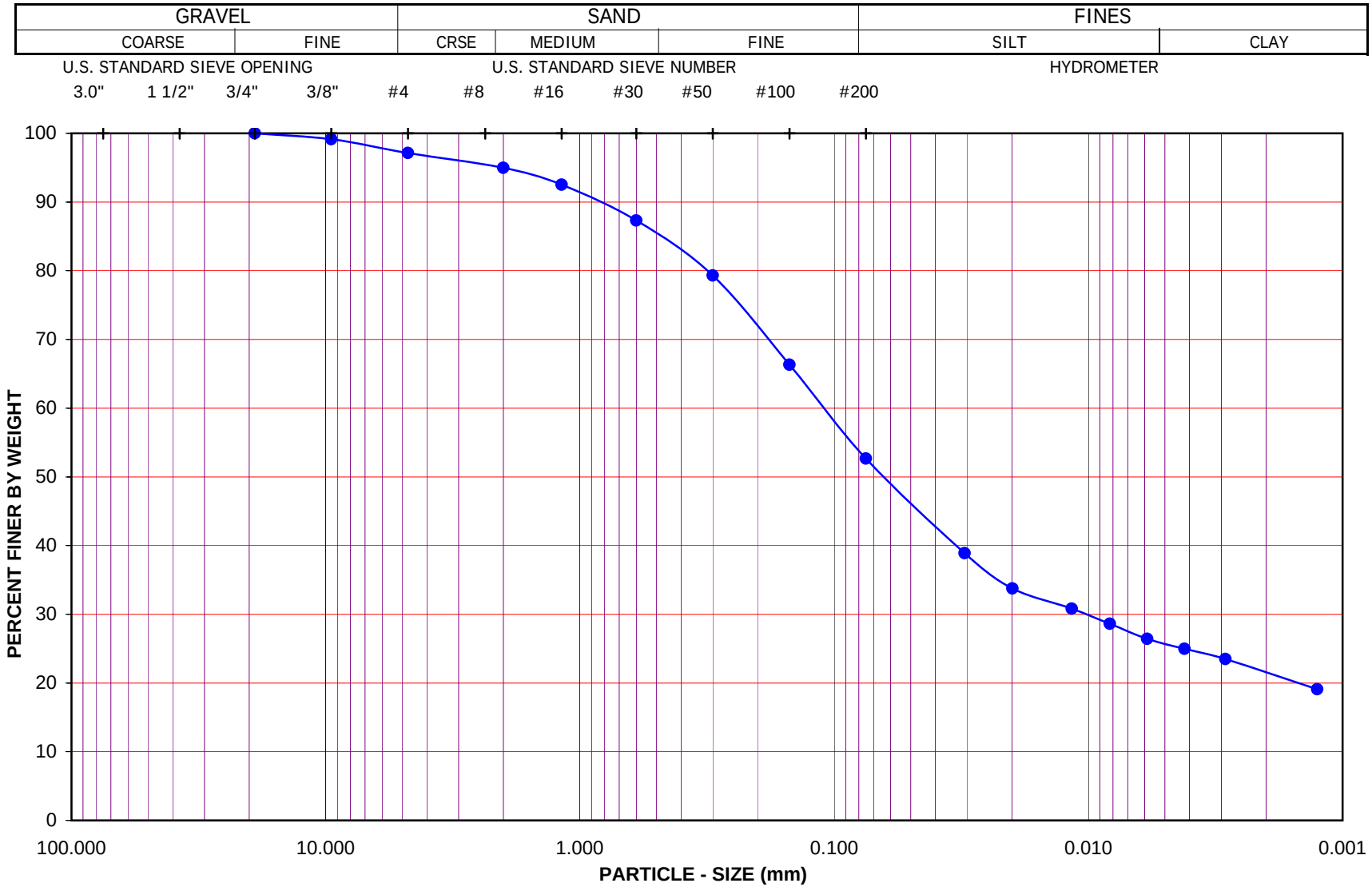
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	95.0
No. 16	1.66	97.4	92.5
No. 30	5.19	91.9	87.3
No. 50	10.59	83.5	79.3
No. 100	19.37	69.8	66.3
No. 200	28.59	55.5	52.7
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 64.18 Wt. of Dry Soil (g) 64.18

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
01-Sep-08	10:10	0		8.0			
	10:12	2	21.9	8.0	34.5	38.9	0.0306
	10:15	5	21.9	8.0	31.0	33.8	0.0199
	10:25	15	21.9	8.0	29.0	30.8	0.0116
	10:40	30	22.0	8.0	27.5	28.6	0.0082
	11:10	60	22.3	8.0	26.0	26.4	0.0059
	12:10	120	22.7	8.0	25.0	25.0	0.0042
	14:20	250	23.4	8.0	24.0	23.5	0.0029
02-Sep-08	10:10	1440	21.9	8.0	21.0	19.1	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-025 Sample No.: D-13

Depth (feet) : 65.0 Soil Type : s(CL)

Soil Identification: Brown sandy lean clay s(CL)

GR:SA:FI : (%) 3 : 44 : 53

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 09/19/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/25/08

Exploration No.: A-08-026

Sample No.: Bag-1 | Depth (feet) : 5-10

Soil Identification: Yellowish brown sandy lean clay s(CL)

% Gravel	2	Soil Type
% Sand	31	s(CL)
% Fines	67	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	96.21
Wt.of Air-Dry Soil + Cont. (g)	1336.90	Wt. of Container No.___ (g)	1.00	1.00	76.37
Wt. of Container	223.59	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	1113.31	Wt. of Dry Soil (g)			19.84

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	8.54	99.2
No. 4	26.44	97.6
No. 10	52.70	95.3
Pan		

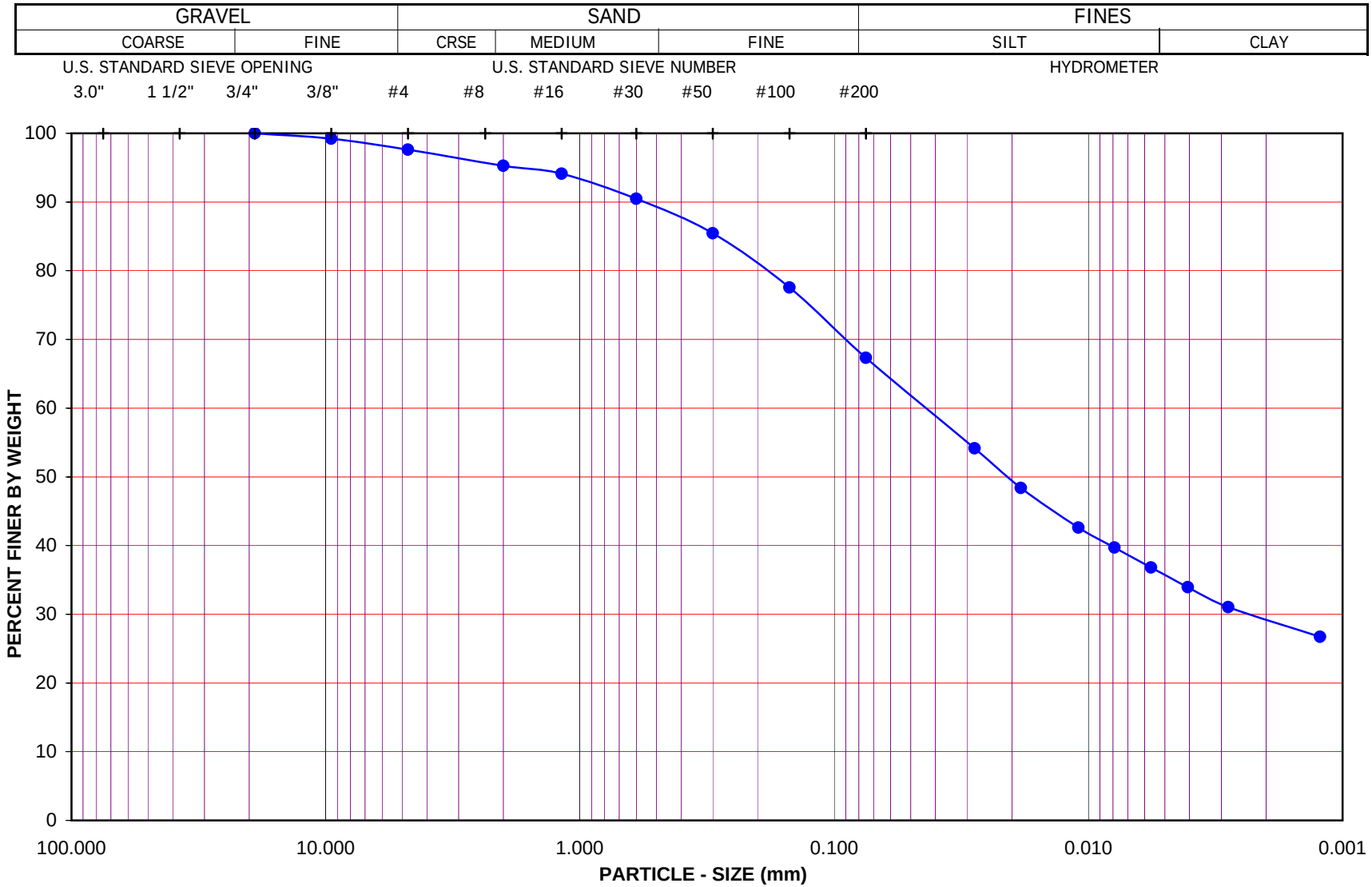
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	95.3
No. 16	0.80	98.8	94.1
No. 30	3.29	95.0	90.5
No. 50	6.75	89.7	85.4
No. 100	12.17	81.4	77.6
No. 200	19.19	70.7	67.3
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.45 Wt. of Dry Soil (g) 65.45

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Sep-08	8:50	0		7.5			
	8:52	2	21.5	7.5	45.0	54.1	0.0280
	8:55	5	21.5	7.5	41.0	48.4	0.0184
	9:05	15	21.6	7.5	37.0	42.6	0.0110
	9:20	30	21.6	7.5	35.0	39.7	0.0079
	9:50	60	21.7	7.5	33.0	36.8	0.0057
	10:50	120	21.9	7.5	31.0	33.9	0.0041
	13:00	250	22.5	7.5	29.0	31.0	0.0028
20-Sep-08	8:50	1440	20.8	7.5	26.0	26.7	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-026 Sample No.: Bag-1

Depth (feet) : 5-10 Soil Type : s(CL)

Soil Identification: Yellowish brown sandy lean clay s(CL)

GR:SA:FI : (%) 2 : 31 : 67

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

SA & Hyd A-08-026, Bag-1

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 09/19/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/25/08

Exploration No.: A-08-026

Sample No.: S-3 | Depth (feet) : 15.0

Soil Identification: Light olive brown silty sand with gravel (SM)g

% Gravel	27	Soil Type
% Sand	51	(SM)g
% Fines	22	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	145.17
Wt.of Air-Dry Soil + Cont. (g)	509.94	Wt. of Container No.___ (g)	1.00	1.00	73.66
Wt. of Container	79.39	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	430.55	Wt. of Dry Soil (g)			71.51

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	40.74	90.5
3/8"	64.16	85.1
No. 4	117.53	72.7
No. 10	169.16	60.7
Pan		

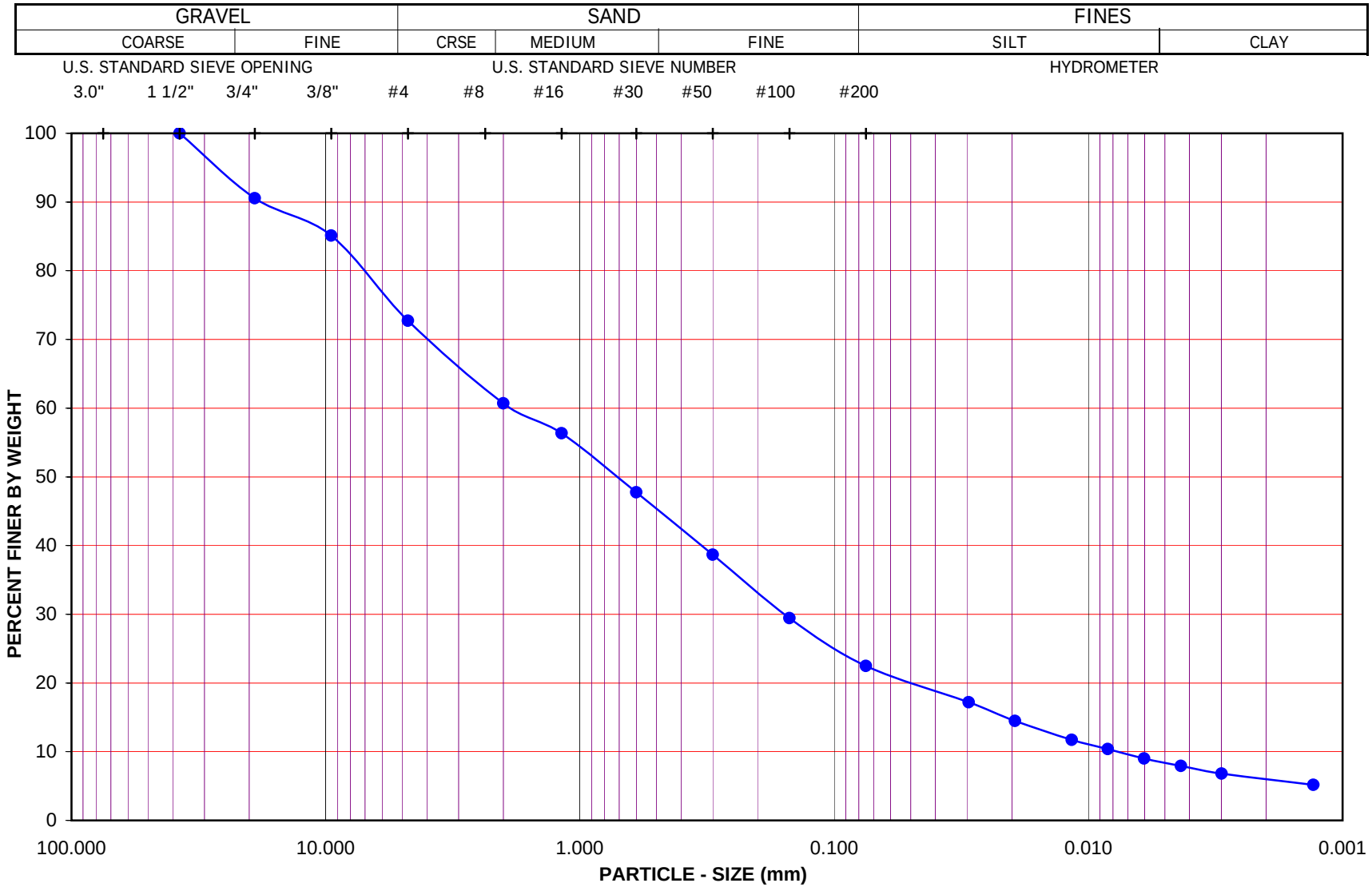
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	60.7
No. 16	7.92	92.8	56.4
No. 30	23.56	78.7	47.8
No. 50	40.08	63.7	38.7
No. 100	56.85	48.5	29.4
No. 200	69.50	37.0	22.5
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 110.36 Wt. of Dry Soil (g) 110.36

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Sep-08	8:46	0		7.5			
	8:48	2	21.5	7.5	39.0	17.2	0.0295
	8:51	5	21.4	7.5	34.0	14.5	0.0194
	9:01	15	21.5	7.5	29.0	11.7	0.0116
	9:16	30	21.5	7.5	26.5	10.4	0.0084
	9:46	60	21.6	7.5	24.0	9.0	0.0060
	10:46	120	21.9	7.5	22.0	7.9	0.0043
	12:56	250	22.5	7.5	20.0	6.8	0.0030
20-Sep-08	8:46	1440	20.8	7.5	17.0	5.2	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-026 Sample No.: S-3

Depth (feet) : 15.0 Soil Type : (SM)g

Soil Identification: Light olive brown silty sand with gravel (SM)g

GR:SA:FI : (%) 27 : 51 : 22

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 09/19/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/25/08

Exploration No.: A-08-026

Sample No.: S-5 | Depth (feet) : 25.0

Soil Identification: Light olive brown sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	45	s(CL)
% Fines	55	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	104.82
Wt.of Air-Dry Soil + Cont. (g)	278.43	Wt. of Container No.___ (g)	1.00	1.00	76.56
Wt. of Container	204.16	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	74.27	Wt. of Dry Soil (g)			28.26

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	2.68	96.4
Pan		

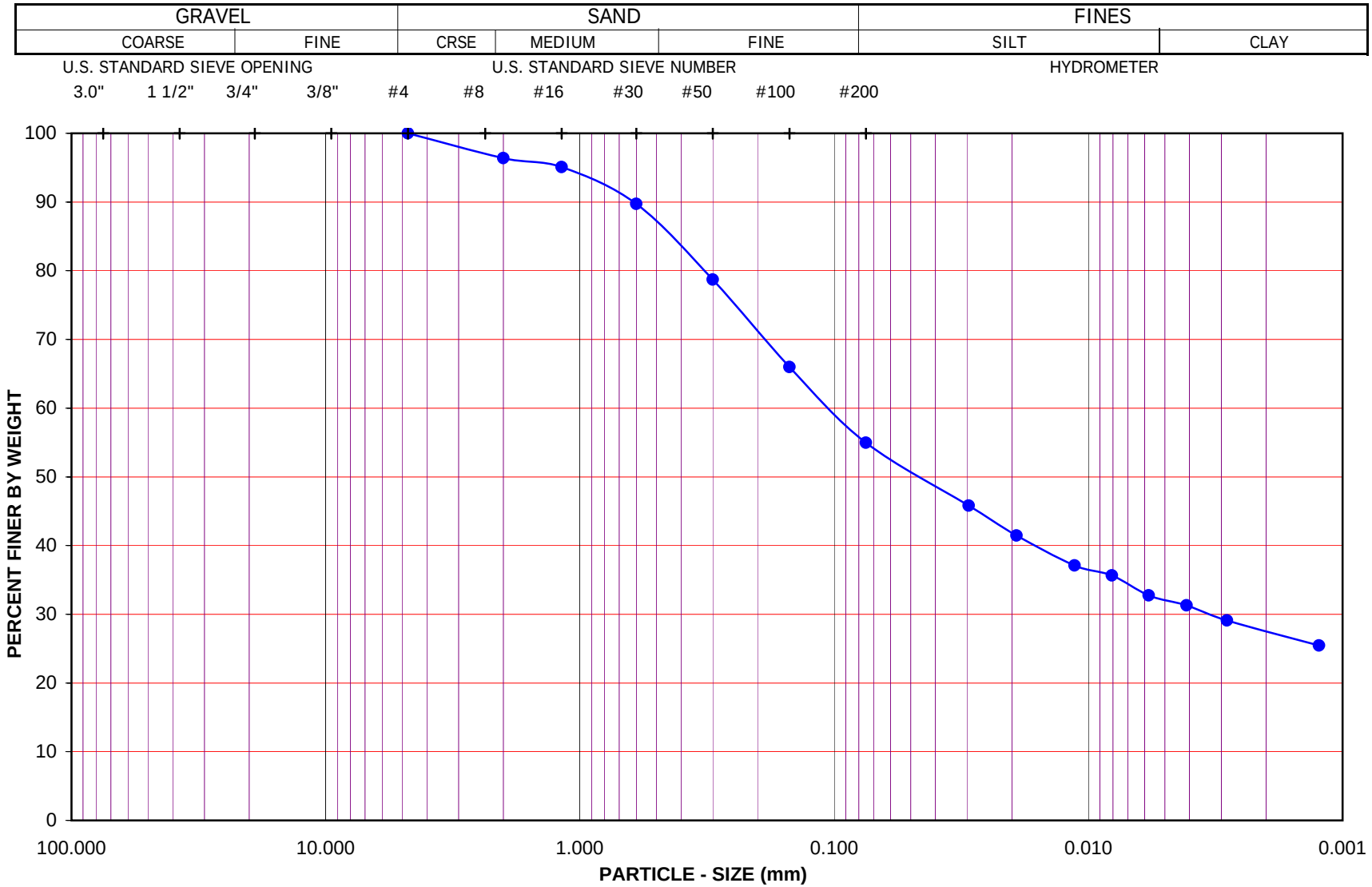
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	96.4
No. 16	0.90	98.6	95.1
No. 30	4.54	93.1	89.7
No. 50	12.06	81.6	78.7
No. 100	20.72	68.5	66.0
No. 200	28.23	57.0	55.0
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.72 Wt. of Dry Soil (g) 65.72

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
19-Sep-08	8:42	0		7.5			
	8:44	2	21.5	7.5	39.0	45.8	0.0295
	8:47	5	21.5	7.5	36.0	41.5	0.0192
	8:57	15	21.5	7.5	33.0	37.1	0.0113
	9:12	30	21.5	7.5	32.0	35.6	0.0081
	9:42	60	21.6	7.5	30.0	32.7	0.0058
	10:42	120	21.9	7.5	29.0	31.3	0.0041
	12:52	250	22.5	7.5	27.5	29.1	0.0029
20-Sep-08	8:42	1440	20.8	7.5	25.0	25.5	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-026 Sample No.: S-5

Depth (feet) : 25.0 Soil Type : s(CL)

Soil Identification: Light olive brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 45 : 55

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 09/26/08

Project No. : 370900.02.GE.0S | Data Input By: J. Ward | Date: 09/30/08

Exploration No.: A-08-026

Sample No.: D-8 | Depth (feet) : N/A

Soil Identification: Yellowish brown clayey sand (SC)

% Gravel	4	Soil Type
% Sand	54	SC
% Fines	42	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	130.08
Wt.of Air-Dry Soil + Cont. (g)	326.22	Wt. of Container No.___ (g)	1.00	1.00	77.38
Wt. of Container	39.90	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	286.32	Wt. of Dry Soil (g)			52.70

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	5.98	97.9
No. 4	10.72	96.3
No. 10	12.80	95.5
Pan		

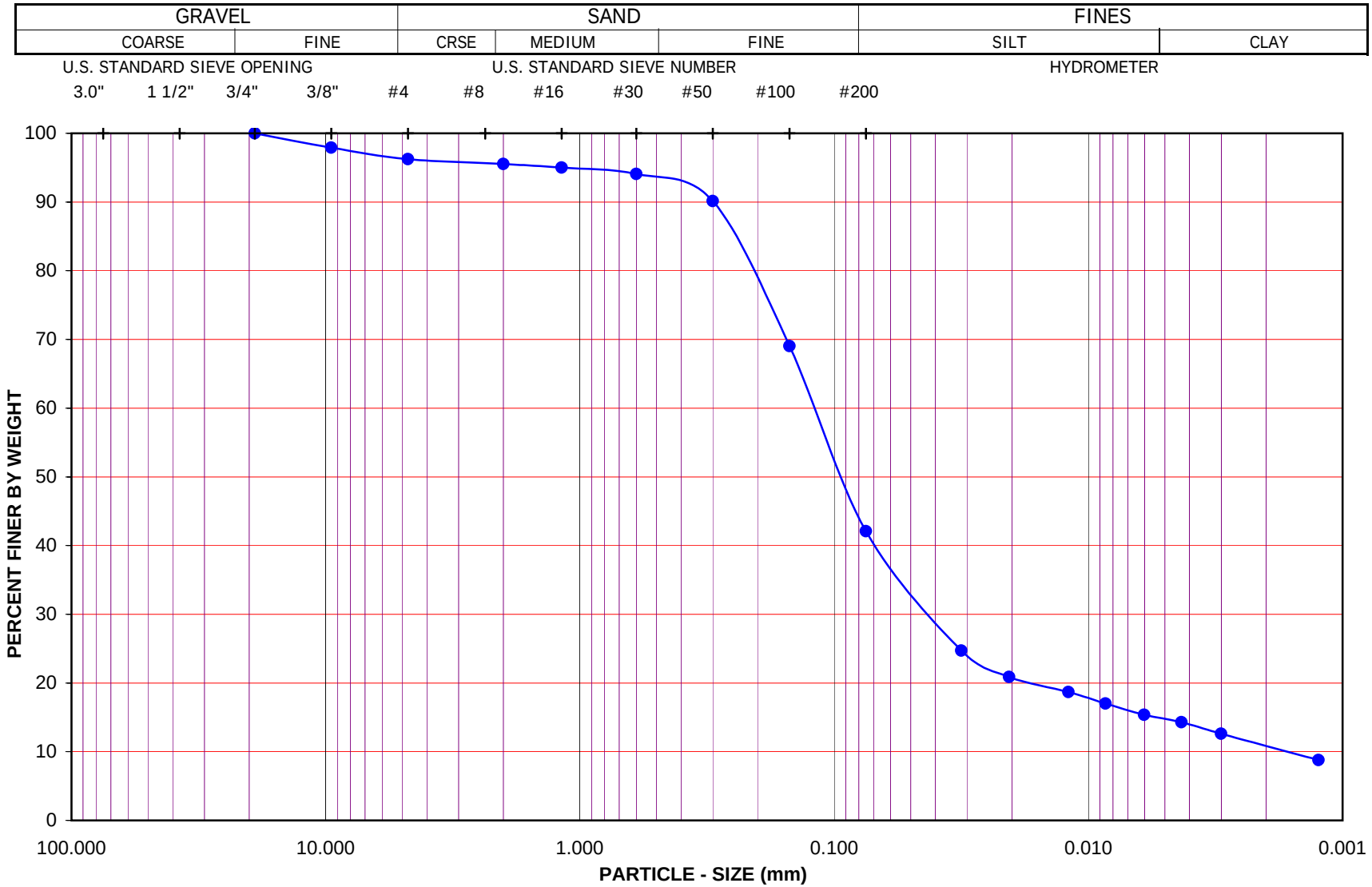
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	95.5
No. 16	0.46	99.5	95.0
No. 30	1.30	98.5	94.1
No. 50	4.86	94.4	90.2
No. 100	23.94	72.3	69.0
No. 200	48.27	44.1	42.1
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 86.31 Wt. of Dry Soil (g) 86.31

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
26-Sep-08	10:22	0		8.0			
	10:24	2	21.7	8.0	30.5	24.7	0.0316
	10:27	5	21.7	8.0	27.0	20.9	0.0205
	10:37	15	21.7	8.0	25.0	18.7	0.0120
	10:52	30	21.8	8.0	23.5	17.0	0.0086
	11:22	60	22.0	8.0	22.0	15.4	0.0060
	12:22	120	22.2	8.0	21.0	14.3	0.0043
	14:32	250	22.8	8.0	19.5	12.6	0.0030
27-Sep-08	12:22	1560	21.3	8.0	16.0	8.8	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-026 Sample No.: D-8

Depth (feet) : N/A Soil Type : SC

Soil Identification: Yellowish brown clayey sand (SC)

GR:SA:FI : (%) 4 : 54 : 42

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	09/18/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/25/08
Exploration No.:	A-08-026	Depth (feet):	65.0		
Sample No.:	S-13				
Soil Identification:	Yellowish brown poorly graded sand with silt (SP-SM)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	989	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	670.10	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	110.50	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	559.60	Moisture Content (%)	0.00

After Wet Sieve	Container No.	989
	Wt. of Dry Soil + Container (g)	609.70
	Wt. of Container (g)	110.50
	Dry Wt. of Soil Retained on # 200 Sieve (g)	499.20

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500		
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	2.10	99.6
#8	2.360	3.80	99.3
#16	1.180	6.40	98.9
#30	0.600	28.30	94.9
#50	0.300	183.20	67.3
#100	0.150	425.20	24.0
#200	0.075	496.90	11.2
PAN			

GRAVEL: **0 %**

SAND: **89 %**

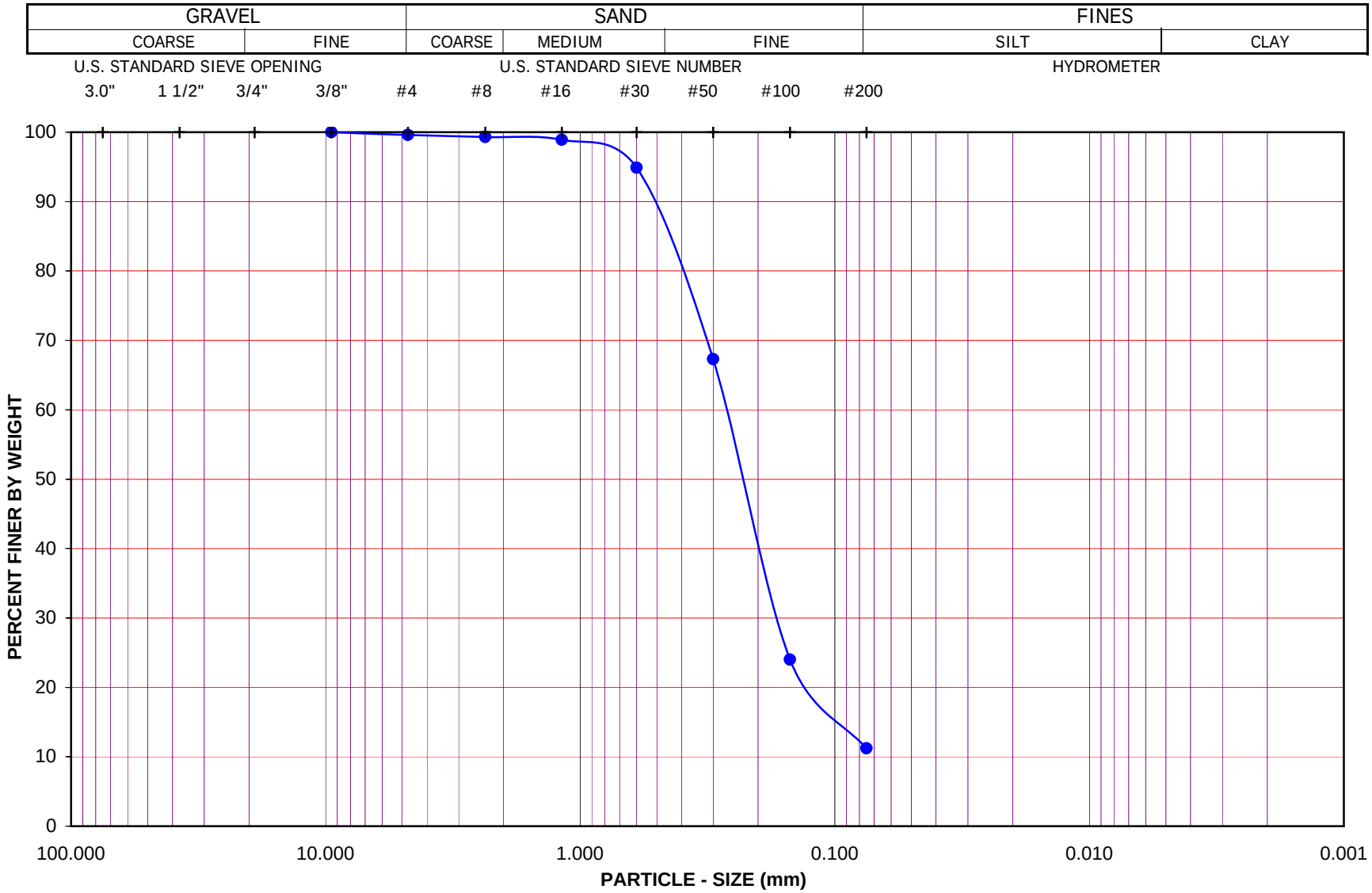
FINES: **11 %**

GROUP SYMBOL: **SP-SM**

Cu = D60/D10 = 4.00

Cc = $(D30)^2/(D60*D10)$ = 1.71

Remarks:



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-026 Sample No.: S-13

Depth (feet): 65.0 Soil Type : SP-SM

Soil Identification: Yellowish brown poorly graded sand with silt (SP-SM)

GR:SA:FI : (%) 0 : 89 : 11

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/07/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/14/08

Exploration No.: A-08-027

Sample No.: BAG-1 | Depth (feet) : 0-7

Soil Identification: Pale olive sandy lean clay s(CL)_

% Gravel	8	Soil Type
% Sand	39	s(CL)
% Fines	53	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	104.41
Wt.of Air-Dry Soil + Cont. (g)	716.50	Wt. of Container No.___ (g)	1.00	1.00	74.49
Wt. of Container	82.80	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	633.70	Wt. of Dry Soil (g)			29.92

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	25.20	96.0
3/8"	30.70	95.2
No. 4	47.90	92.4
No. 10	66.80	89.5
Pan		

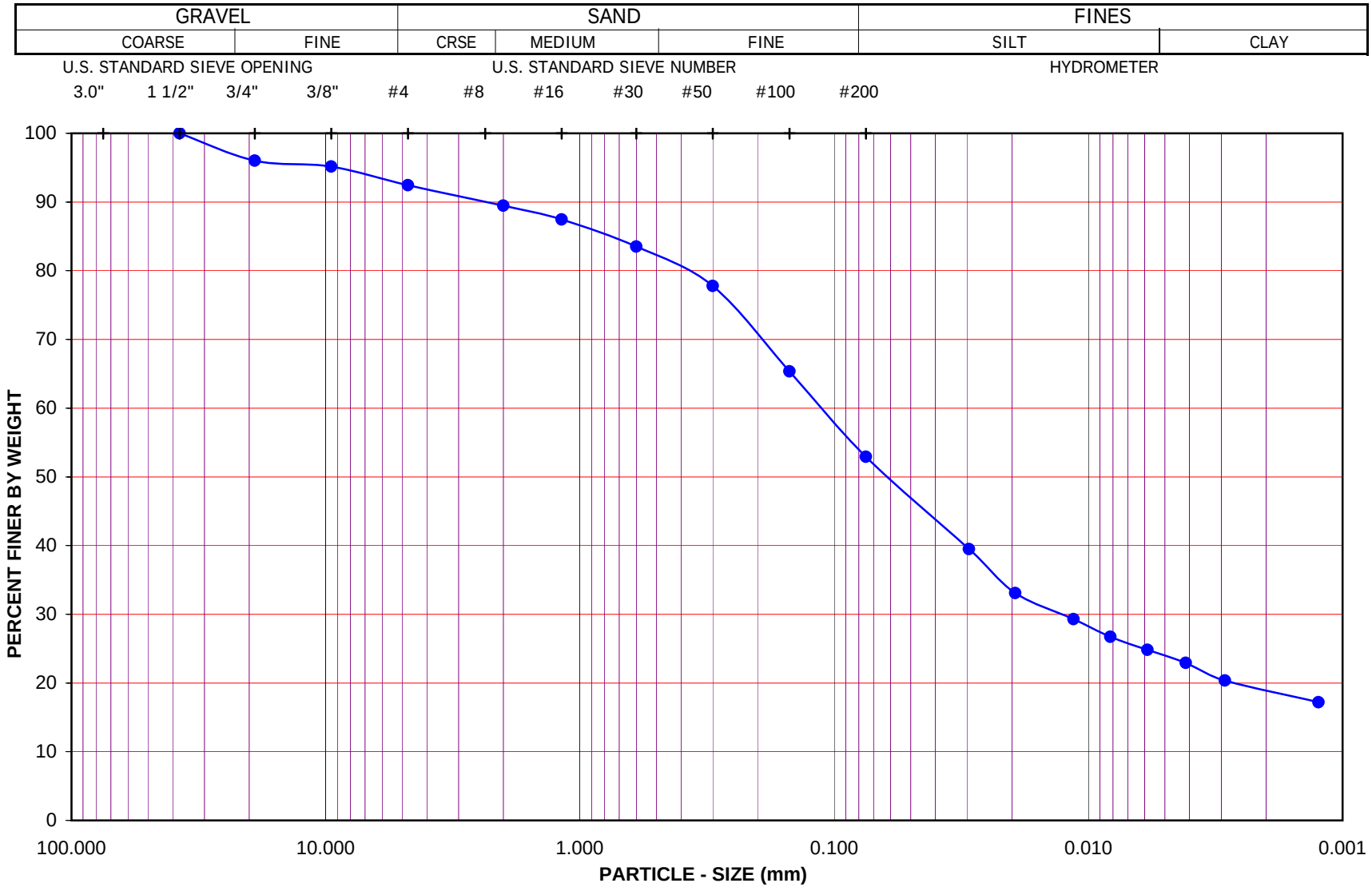
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	89.5
No. 16	1.56	97.8	87.5
No. 30	4.63	93.4	83.5
No. 50	9.11	86.9	77.8
No. 100	18.77	73.1	65.4
No. 200	28.46	59.2	52.9
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 69.70 Wt. of Dry Soil (g) 69.70

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
07-Aug-08	9:42	0		7.0			
	9:44	2	22.1	7.0	38.0	39.5	0.0295
	9:47	5	22.1	7.0	33.0	33.1	0.0194
	9:57	15	22.1	7.0	30.0	29.3	0.0114
	10:12	30	22.2	7.0	28.0	26.7	0.0082
	10:42	60	22.5	7.0	26.5	24.8	0.0059
	11:42	120	23.0	7.0	25.0	22.9	0.0041
	13:52	250	23.5	7.0	23.0	20.4	0.0029
08-Aug-08	9:42	1440	22.3	7.0	20.5	17.2	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-027 Sample No.: BAG-1

Depth (feet) : 0-7 Soil Type : s(CL)

Soil Identification: Pale olive sandy lean clay s(CL)

GR:SA:FI : (%) 8 : 39 : 53

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/01/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/06/08
Exploration No.:	A-08-027	Depth (feet):	10.0		
Sample No.:	S-2				
Soil Identification:	Olive brown silty, clayey sand (SC-SM) with caliche				

		Moisture Content of Total Air - Dry Soil	
Container No.:	K	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	521.76	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	138.52	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	383.24	Moisture Content (%)	0.00

After Wet Sieve	Container No.	K
	Wt. of Dry Soil + Container (g)	360.10
	Wt. of Container (g)	138.52
	Dry Wt. of Soil Retained on # 200 Sieve (g)	221.58

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	11.90	96.9
#4	4.750	22.10	94.2
#8	2.360	31.60	91.8
#16	1.180	44.30	88.4
#30	0.600	65.40	82.9
#50	0.300	96.70	74.8
#100	0.150	163.20	57.4
#200	0.075	219.40	42.8
PAN			

GRAVEL: **6 %**

SAND: **51 %**

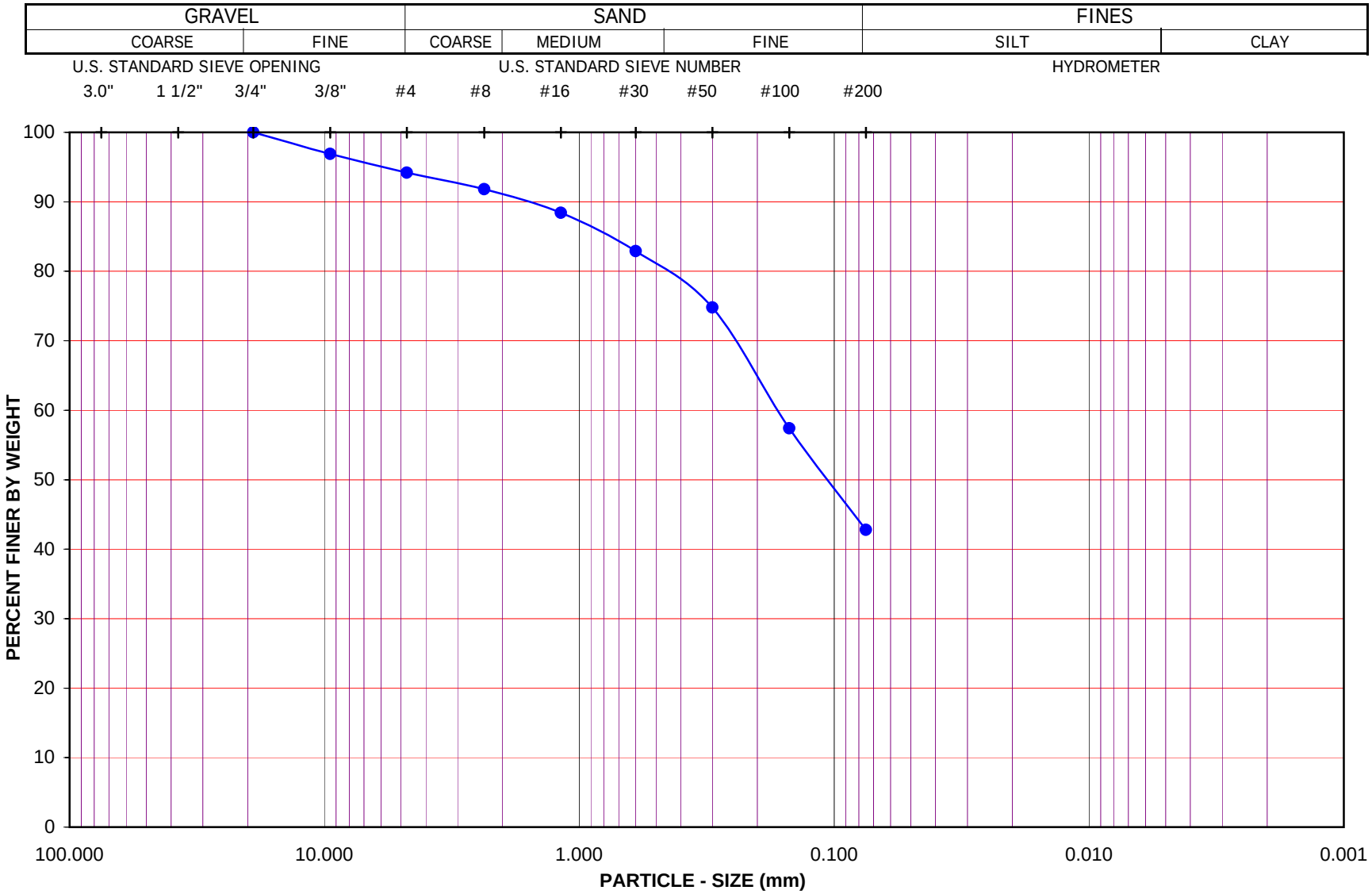
FINES: **43 %**

GROUP SYMBOL: **SC-SM**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-027 Sample No.: S-2

Depth (feet): 10.0 Soil Type : SC-SM

Soil Identification: Olive brown silty, clayey sand (SC-SM) with caliche

GR:SA:FI : (%) 6 : 51 : 43

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-027, S-2

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	07/29/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Exploration No.:	A-08-027	Depth (feet):	15.0		
Sample No.:	D-3				
Soil Identification:	Dark brown sandy lean clay s(CL)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	WR	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	673.80	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	238.40	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	435.40	Moisture Content (%)	0.00

After Wet Sieve	Container No.	WR
	Wt. of Dry Soil + Container (g)	425.00
	Wt. of Container (g)	238.40
	Dry Wt. of Soil Retained on # 200 Sieve (g)	186.60

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	0.90	99.8
#4	4.750	1.30	99.7
#8	2.360	5.90	98.6
#16	1.180	12.30	97.2
#30	0.600	24.70	94.3
#50	0.300	48.20	88.9
#100	0.150	113.50	73.9
#200	0.075	184.50	57.6
PAN			

GRAVEL: **0 %**

SAND: **42 %**

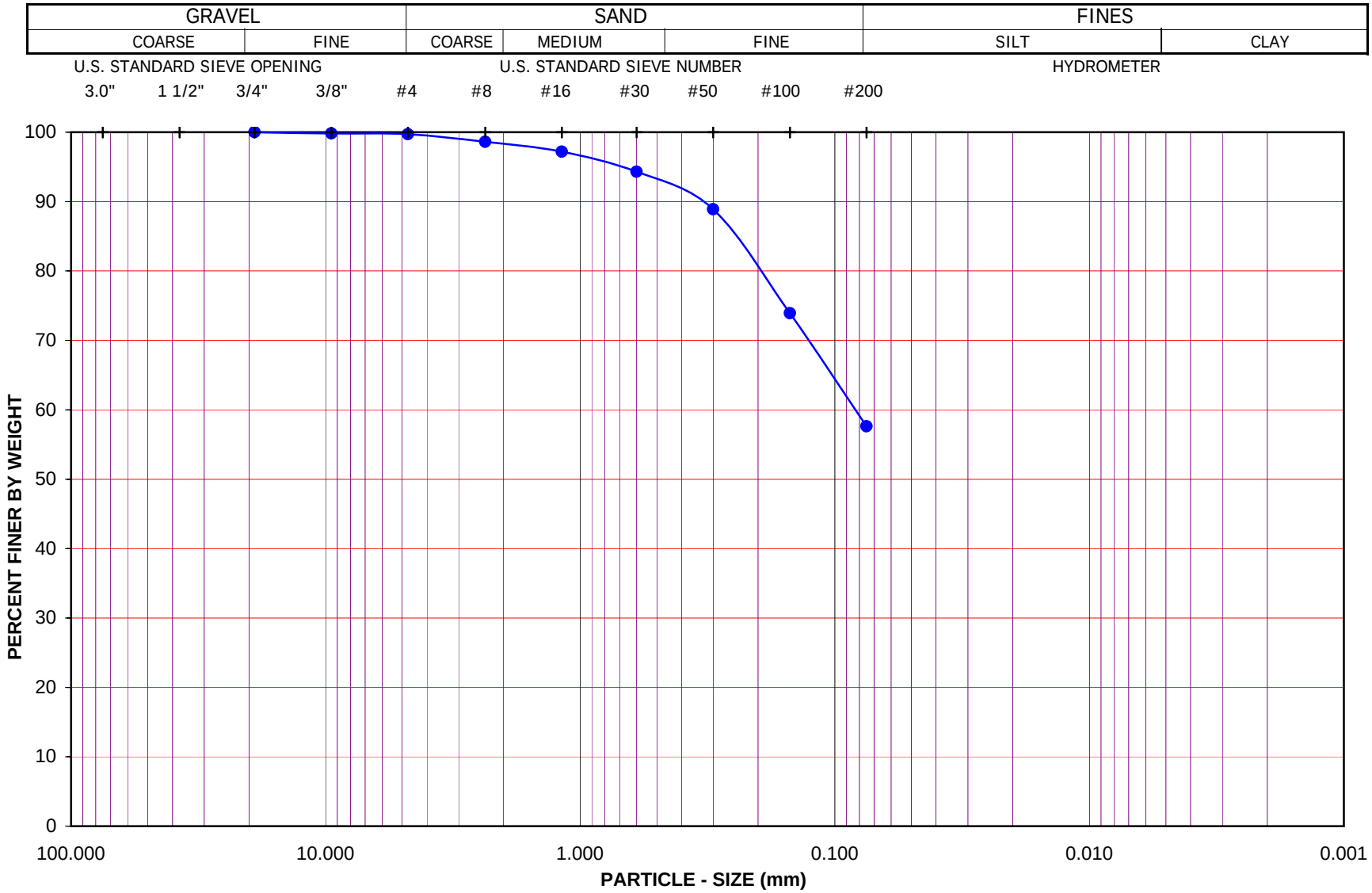
FINES: **58 %**

GROUP SYMBOL: **s(CL)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-027 Sample No.: D-3

Depth (feet): 15.0 Soil Type : s(CL)

Soil Identification: Dark brown sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 42 : 58

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jul-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 09/10/08

Exploration No.: A-08-027

Sample No.: S-4 | Depth (feet) : 20.0

Soil Identification: Olive brown clayey sand with gravel (SC)g

% Gravel	20	Soil Type
% Sand	38	(SC)g
% Fines	42	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	108.23
Wt.of Air-Dry Soil + Cont. (g)	359.70	Wt. of Container No.___ (g)	1.00	1.00	76.40
Wt. of Container	39.50	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	320.20	Wt. of Dry Soil (g)			31.83

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	62.00	80.6
3/8"	62.00	80.6
No. 4	63.40	80.2
No. 10	66.60	79.2
Pan		

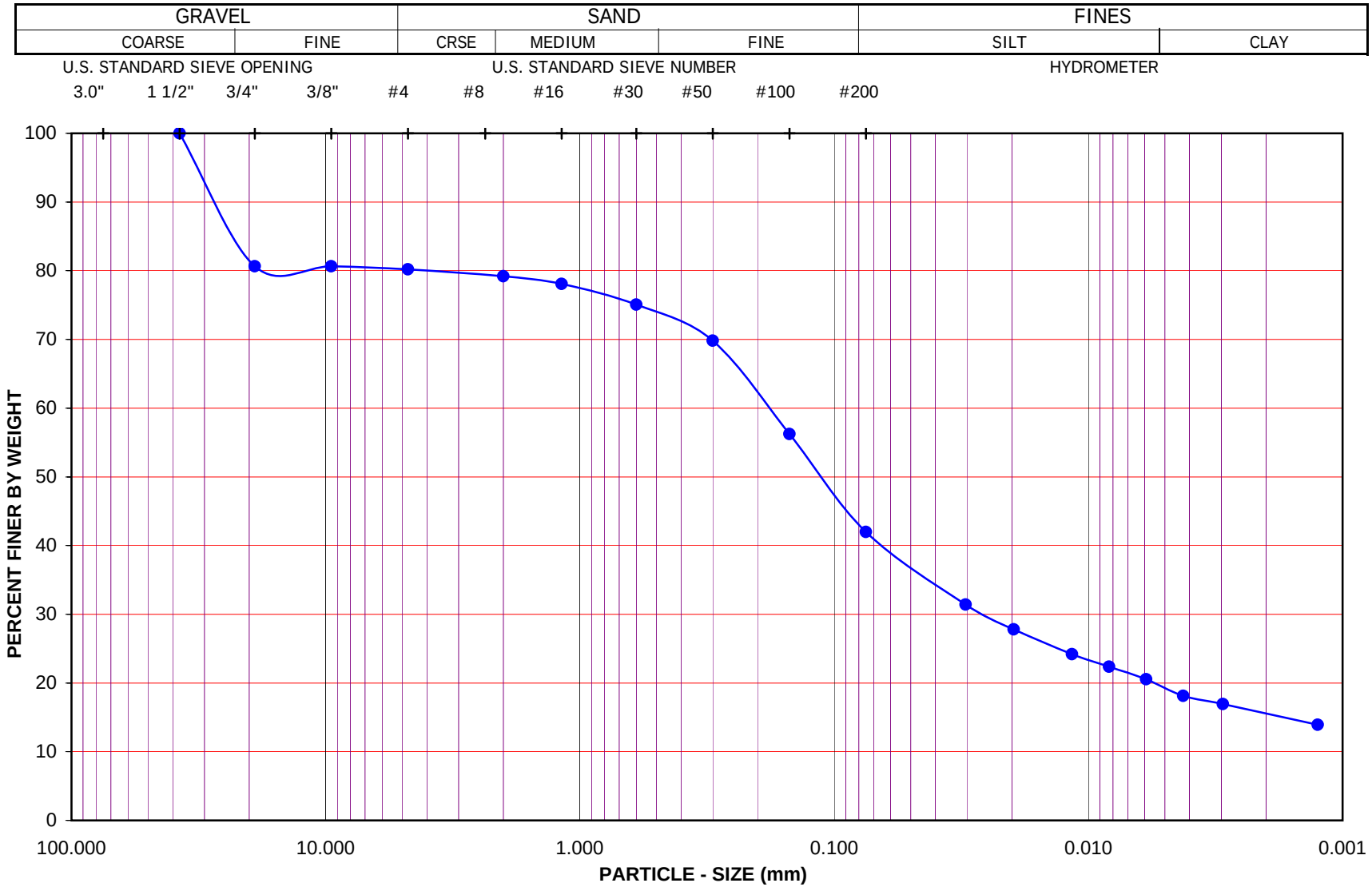
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	79.2
No. 16	0.93	98.6	78.1
No. 30	3.38	94.8	75.1
No. 50	7.69	88.2	69.8
No. 100	18.84	71.0	56.2
No. 200	30.54	53.0	42.0
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.00 Wt. of Dry Soil (g) 65.00

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	11:22	0		8.0			
	11:24	2	22.2	8.0	34.0	31.4	0.0304
	11:27	5	22.2	8.0	31.0	27.8	0.0196
	11:37	15	22.2	8.0	28.0	24.2	0.0116
	11:52	30	22.2	8.0	26.5	22.4	0.0083
	12:22	60	22.3	8.0	25.0	20.5	0.0059
	13:22	120	22.6	8.0	23.0	18.1	0.0042
	15:32	250	22.7	8.0	22.0	16.9	0.0030
12-Aug-08	11:22	1440	22.7	8.0	19.5	13.9	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-027 Sample No.: S-4

Depth (feet) : 20.0 Soil Type : (SC)g

Soil Identification: Olive brown clayey sand with gravel (SC)g

GR:SA:FI : (%) 20 : 38 : 42

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/15/08

Exploration No.: A-08-028

Sample No.: Bag-1 | Depth (feet) : 0-7

Soil Identification: Olive sandy lean clay with gravel s(CL)g

% Gravel	16	Soil Type
% Sand	23	s(CL)g
% Fines	61	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	95.00
Wt.of Air-Dry Soil + Cont. (g)	642.00	Wt. of Container No.___ (g)	1.00	1.00	76.74
Wt. of Container	76.90	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	565.10	Wt. of Dry Soil (g)			18.26

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	65.30	88.4
3/8"	79.80	85.9
No. 4	90.50	84.0
No. 10	98.20	82.6
Pan		

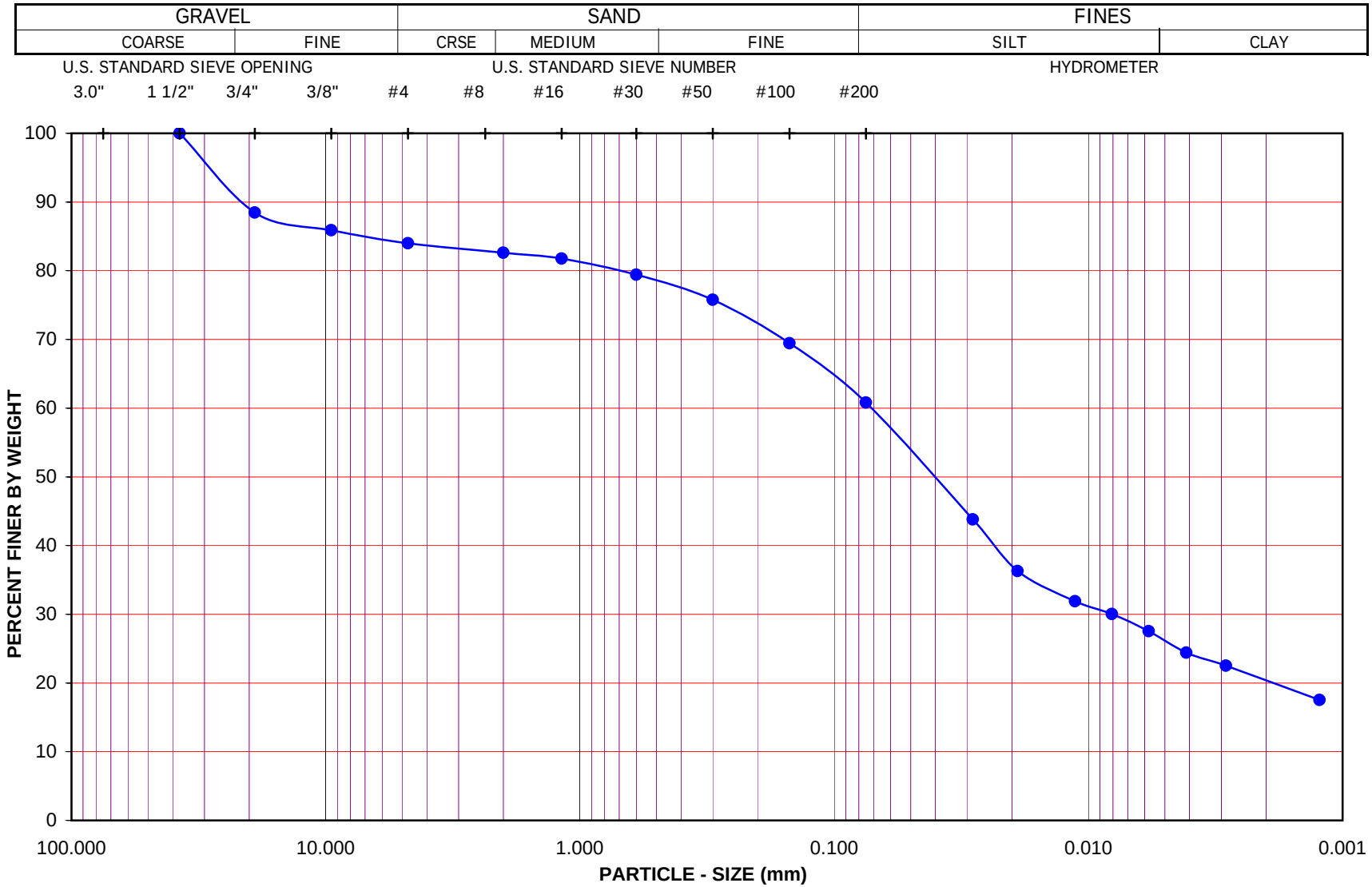
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	82.6
No. 16	0.67	99.0	81.8
No. 30	2.54	96.1	79.4
No. 50	5.43	91.7	75.8
No. 100	10.45	84.0	69.4
No. 200	17.30	73.6	60.8
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.50 Wt. of Dry Soil (g) 65.50

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	9:10	0		8.0			
	9:12	2	21.7	8.0	43.0	43.8	0.0285
	9:15	5	21.6	8.0	37.0	36.3	0.0190
	9:25	15	21.5	8.0	33.5	31.9	0.0113
	9:40	30	21.6	8.0	32.0	30.0	0.0081
	10:10	60	21.7	8.0	30.0	27.5	0.0058
	11:10	120	22.0	8.0	27.5	24.4	0.0041
	13:20	250	22.6	8.0	26.0	22.5	0.0029
12-Aug-08	9:10	1440	22.2	8.0	22.0	17.5	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-028 Sample No.: Bag-1

Depth (feet) : 0-7 Soil Type : s(CL)g

Soil Identification: Olive sandy lean clay with gravel s(CL)g

GR:SA:FI : (%) 16 : 23 : 61

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/06/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Exploration No.:	A-08-028	Depth (feet):	5.0		
Sample No.:	D-1				
Soil Identification:	Olive lean clay with sand (CL)s				

		Moisture Content of Total Air - Dry Soil	
Container No.:	WR	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	615.70	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	238.40	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	377.30	Moisture Content (%)	0.00

After Wet Sieve	Container No.	WR
	Wt. of Dry Soil + Container (g)	337.90
	Wt. of Container (g)	238.40
	Dry Wt. of Soil Retained on # 200 Sieve (g)	99.50

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	
3/8"	9.500	0.00	100.0
#4	4.750	1.80	99.5
#8	2.360	5.90	98.4
#16	1.180	10.10	97.3
#30	0.600	18.30	95.1
#50	0.300	32.20	91.5
#100	0.150	56.70	85.0
#200	0.075	94.10	75.1
PAN			

GRAVEL: **1 %**

SAND: **24 %**

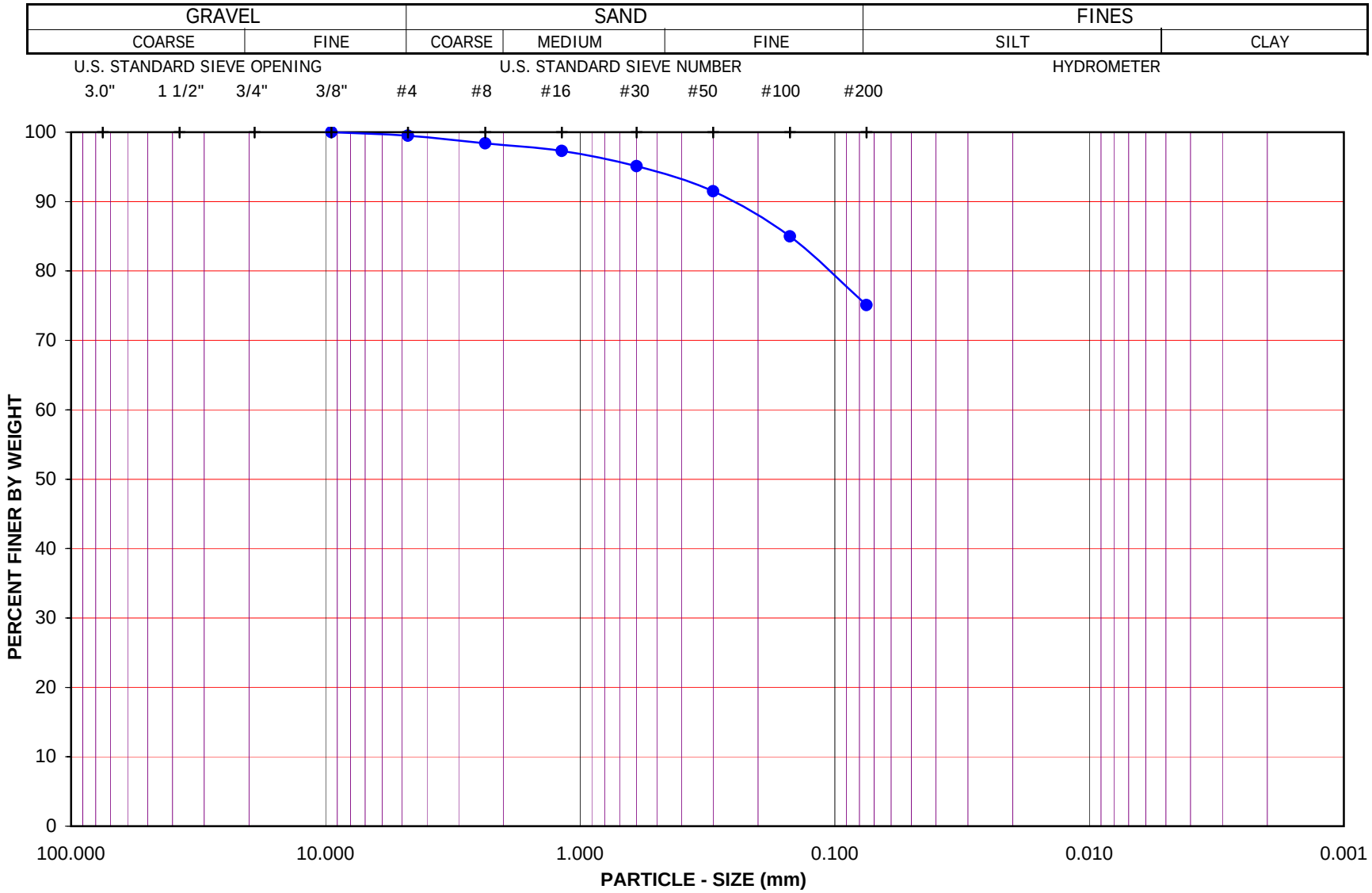
FINES: **75 %**

GROUP SYMBOL: **(CL)s**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-028 Sample No.: D-1

Depth (feet): 5.0 Soil Type : (CL)s

Soil Identification: Olive lean clay with sand (CL)s

GR:SA:FI : (%) 1 : 24 : 75

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/07/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/13/08

Exploration No.: A-08-028

Sample No.: S-2 | Depth (feet) : 10.0

Soil Identification: Olive sandy lean clay s(CL)_

% Gravel	0	Soil Type
% Sand	36	s(CL)
% Fines	64	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	100.31
Wt.of Air-Dry Soil + Cont. (g)	319.50	Wt. of Container No.___ (g)	1.00	1.00	76.13
Wt. of Container	39.40	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	280.10	Wt. of Dry Soil (g)			24.18

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.30	99.9
No. 10	1.40	99.5
Pan		

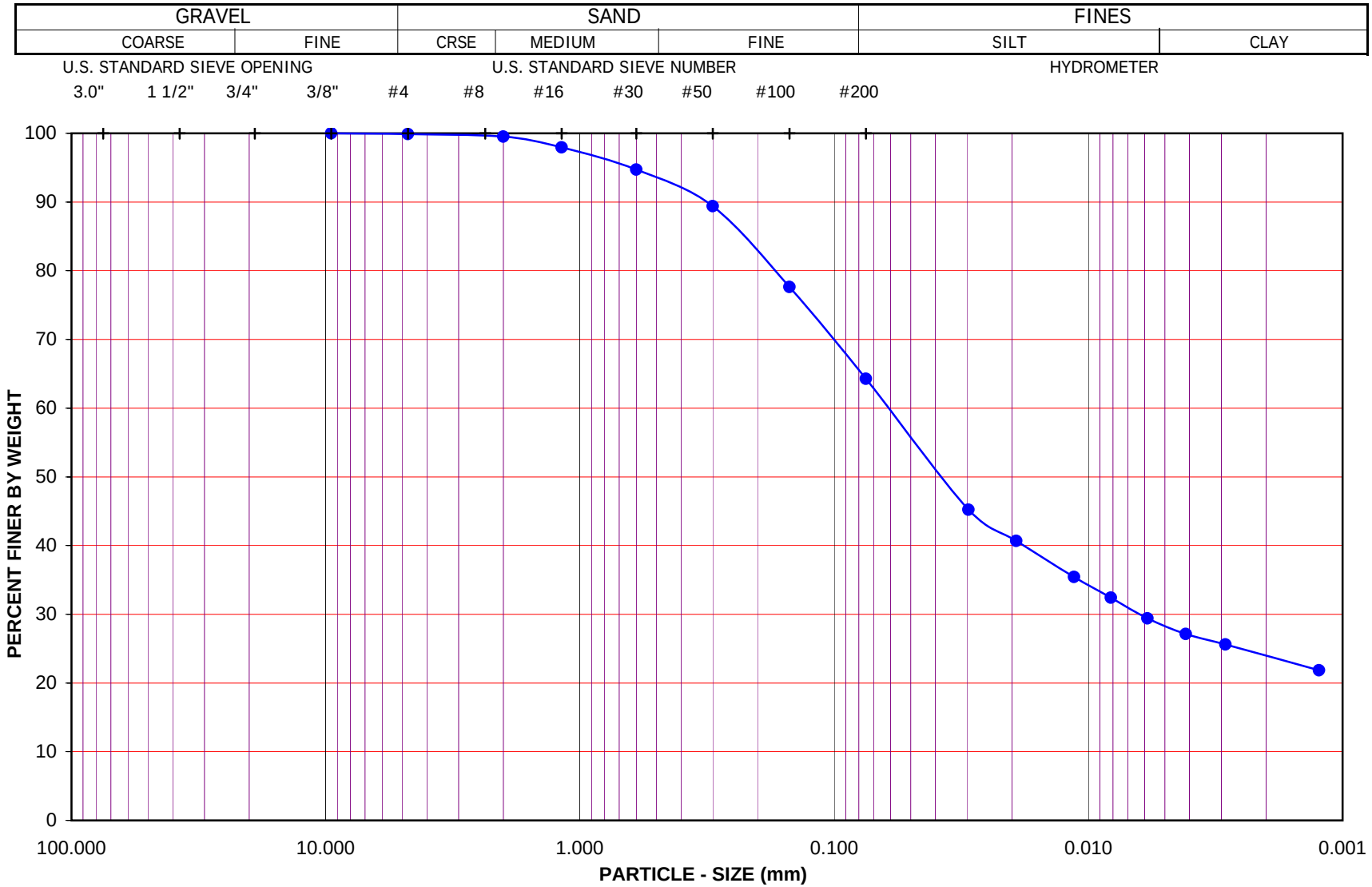
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.5
No. 16	1.01	98.5	98.0
No. 30	3.14	95.2	94.7
No. 50	6.66	89.8	89.4
No. 100	14.39	78.0	77.6
No. 200	23.20	64.6	64.3
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.50 Wt. of Dry Soil (g) 65.50

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
07-Aug-08	9:46	0		7.0			
	9:48	2	22.1	7.0	37.0	45.2	0.0296
	9:51	5	22.1	7.0	34.0	40.7	0.0192
	10:01	15	22.1	7.0	30.5	35.4	0.0114
	10:16	30	22.3	7.0	28.5	32.4	0.0082
	10:46	60	22.5	7.0	26.5	29.4	0.0059
	11:46	120	23.0	7.0	25.0	27.1	0.0041
	13:56	250	23.5	7.0	24.0	25.6	0.0029
08-Aug-08	9:46	1440	22.3	7.0	21.5	21.9	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-028 Sample No.: S-2

Depth (feet) : 10.0 Soil Type : s(CL)

Soil Identification: Olive sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 36 : 64

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/04/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/06/08
Exploration No.:	A-08-028	Depth (feet):	15.0		
Sample No.:	D-3				
Soil Identification:	Grayish brown clayey sand (SC)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	XY	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	717.90	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	249.00	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	468.90	Moisture Content (%)	0.00

After Wet Sieve	Container No.	XY
	Wt. of Dry Soil + Container (g)	499.40
	Wt. of Container (g)	249.00
	Dry Wt. of Soil Retained on # 200 Sieve (g)	250.40

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	3.40	99.3
#4	4.750	8.60	98.2
#8	2.360	11.30	97.6
#16	1.180	14.70	96.9
#30	0.600	22.90	95.1
#50	0.300	49.20	89.5
#100	0.150	153.30	67.3
#200	0.075	245.50	47.6
PAN			

GRAVEL: **2 %**

SAND: **50 %**

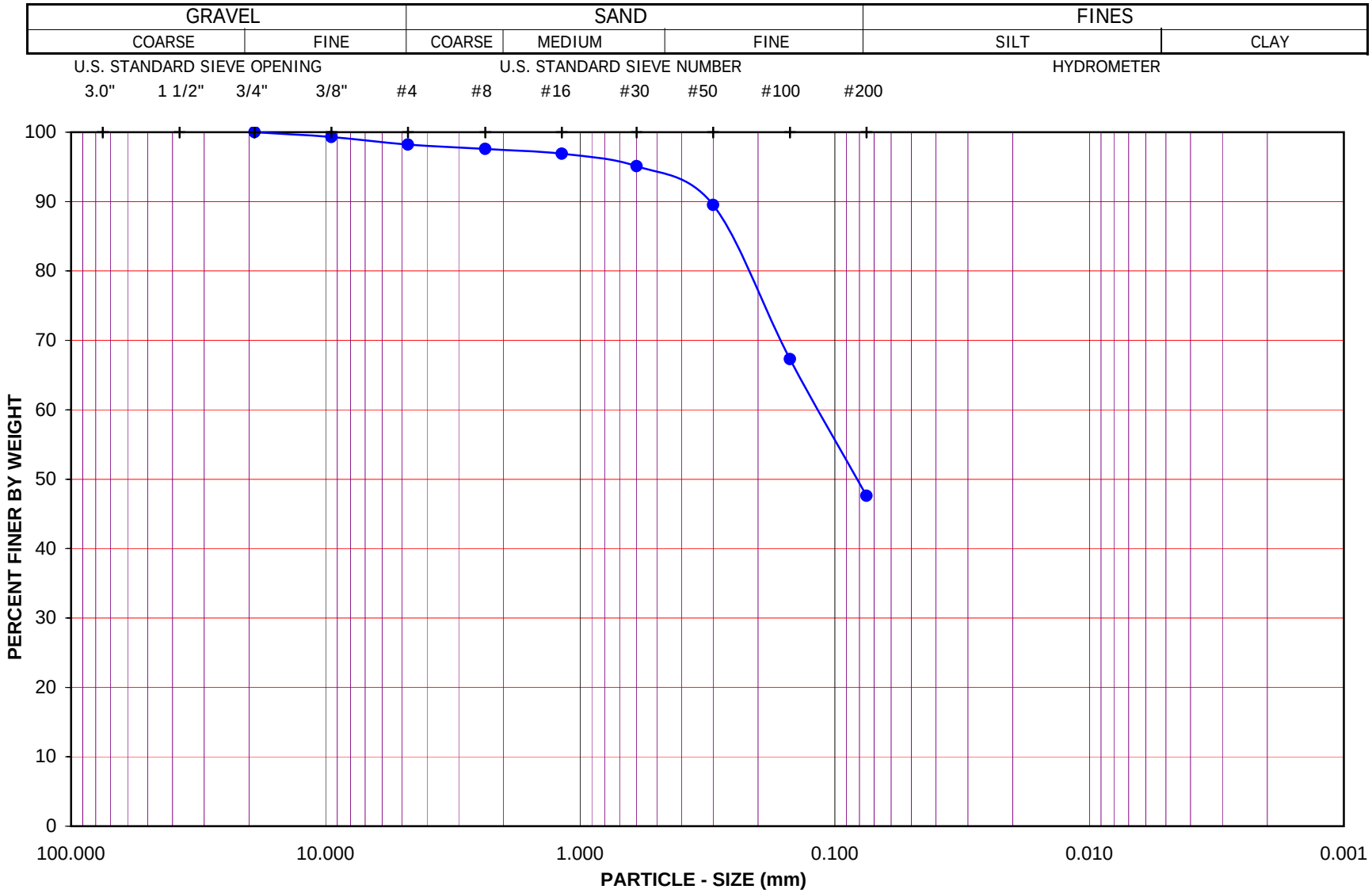
FINES: **48 %**

GROUP SYMBOL: **SC**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-028 Sample No.: D-3

Depth (feet): 15.0 Soil Type : SC

Soil Identification: Grayish brown clayey sand (SC)

GR:SA:FI : (%) 2 : 50 : 48

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/15/08

Exploration No.: A-08-028

Sample No.: S-4 | Depth (feet) : 20.0

Soil Identification: Pale olive clayey sand (SC)

% Gravel	14	Soil Type
% Sand	41	SC
% Fines	45	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	112.90
Wt.of Air-Dry Soil + Cont. (g)	309.30	Wt. of Container No.___ (g)	1.00	1.00	82.43
Wt. of Container	39.40	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	269.90	Wt. of Dry Soil (g)			30.47

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	16.75	93.8
3/8"	33.36	87.6
No. 4	37.91	86.0
No. 10	43.92	83.7
Pan		

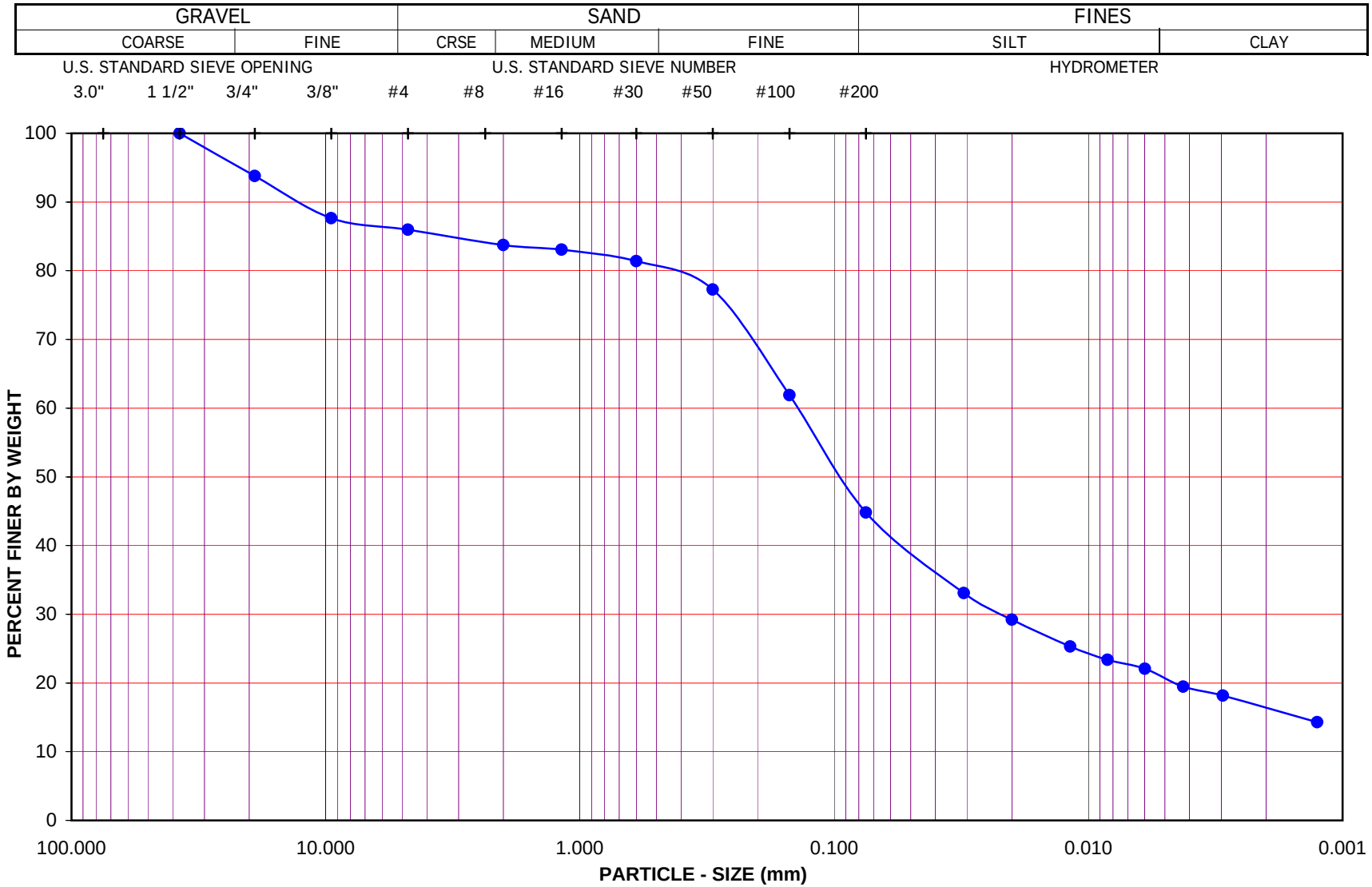
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	83.7
No. 16	0.51	99.2	83.1
No. 30	1.78	97.2	81.4
No. 50	4.95	92.3	77.3
No. 100	16.70	73.9	61.9
No. 200	29.76	53.5	44.8
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 64.00 Wt. of Dry Soil (g) 64.00

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	9:02	0		8.0			
	9:04	2	21.6	8.0	33.5	33.1	0.0309
	9:07	5	21.7	8.0	30.5	29.2	0.0200
	9:17	15	21.6	8.0	27.5	25.3	0.0118
	9:32	30	21.7	8.0	26.0	23.4	0.0084
	10:02	60	21.7	8.0	25.0	22.1	0.0060
	11:02	120	22.1	8.0	23.0	19.5	0.0042
	13:12	250	22.6	8.0	22.0	18.2	0.0030
12-Aug-08	9:02	1440	22.2	8.0	19.0	14.3	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-028 Sample No.: S-4

Depth (feet) : 20.0 Soil Type : SC

Soil Identification: Pale olive clayey sand (SC)

GR:SA:FI : (%) 14 : 41 : 45

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/07/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/12/08

Exploration No.: A-08-030

Sample No.: S-4 | Depth (feet) : 20.0

Soil Identification: Olive clayey sand (SC)

% Gravel	0	Soil Type
% Sand	58	SC
% Fines	42	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	116.84
Wt.of Air-Dry Soil + Cont. (g)	290.70	Wt. of Container No.___ (g)	1.00	1.00	74.94
Wt. of Container	39.20	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	251.50	Wt. of Dry Soil (g)			41.90

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.20	99.9
Pan		

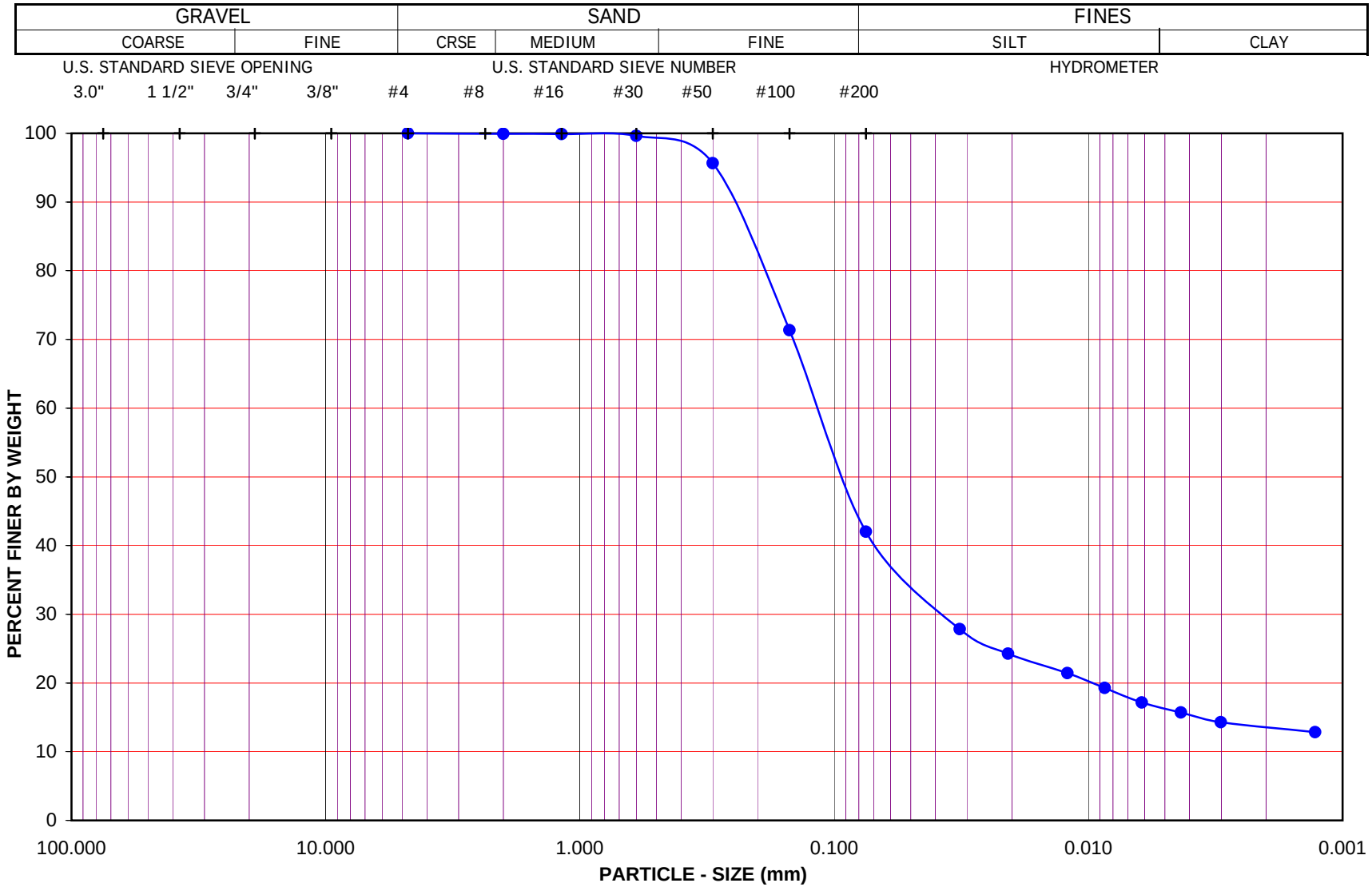
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.9
No. 16	0.02	100.0	99.9
No. 30	0.21	99.7	99.6
No. 50	2.96	95.7	95.7
No. 100	19.85	71.4	71.3
No. 200	40.21	42.1	42.0
Pan			

Hydrometer Wt. of Air-Dry Soil (g): 69.40 Wt. of Dry Soil (g): 69.40

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
07-Aug-08	9:50	0		7.0			
	9:52	2	22.1	7.0	26.5	27.9	0.0321
	9:55	5	22.1	7.0	24.0	24.3	0.0207
	10:05	15	22.2	7.0	22.0	21.4	0.0121
	10:20	30	22.3	7.0	20.5	19.3	0.0086
	10:50	60	22.6	7.0	19.0	17.1	0.0062
	11:50	120	23.1	7.0	18.0	15.7	0.0043
	14:00	250	23.5	7.0	17.0	14.3	0.0030
08-Aug-08	9:50	1440	22.3	7.0	16.0	12.9	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-030 Sample No.: S-4

Depth (feet) : 20.0 Soil Type : SC

Soil Identification: Olive clayey sand (SC)

GR:SA:FI : (%) 0 : 58 : 42

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/05/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/07/08
Exploration No.:	A-08-030	Depth (feet):	25 - 30		
Sample No.:	Bag-2				

Soil Identification: Light olive brown sandy lean clay s(CL) / with caliche

Calculation of Dry Weights	Whole Sample	Sample Passing #4	Moisture Contents	Whole Sample	Sample passing #4
Container No.:	IF	VO	Wt. of Air-Dry Soil + Cont.(g)	0.00	0.00
Wt. Air-Dried Soil + Cont.(g)	2238.70	774.00	Wt. of Dry Soil + Cont. (g)	0.00	0.00
Wt. of Container (g)	224.30	234.80	Wt. of Container No._____(g)	1.00	1.00
Dry Wt. of Soil (g)	2014.40	539.20	Moisture Content (%)	0.00	0.00

Passing #4 Material After Wet Sieve		
	Container No.	VO
	Wt. of Dry Soil + Container (g)	473.50
	Wt. of Container (g)	234.80
	Dry Wt. of Soil Retained on # 200 Sieve (g)	238.70

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	0.00		
1 1/2	37.500	0.00		
3/4"	19.000	0.00		100.0
3/8"	9.500	7.60		99.6
#4	4.750	15.40		99.2
#8	2.360		1.10	99.0
#16	1.180		2.60	98.7
#30	0.600		7.80	97.8
#50	0.300		38.40	92.1
#100	0.150		145.30	72.5
#200	0.075		236.90	55.6
PAN				

GRAVEL: **1 %**

SAND: **43 %**

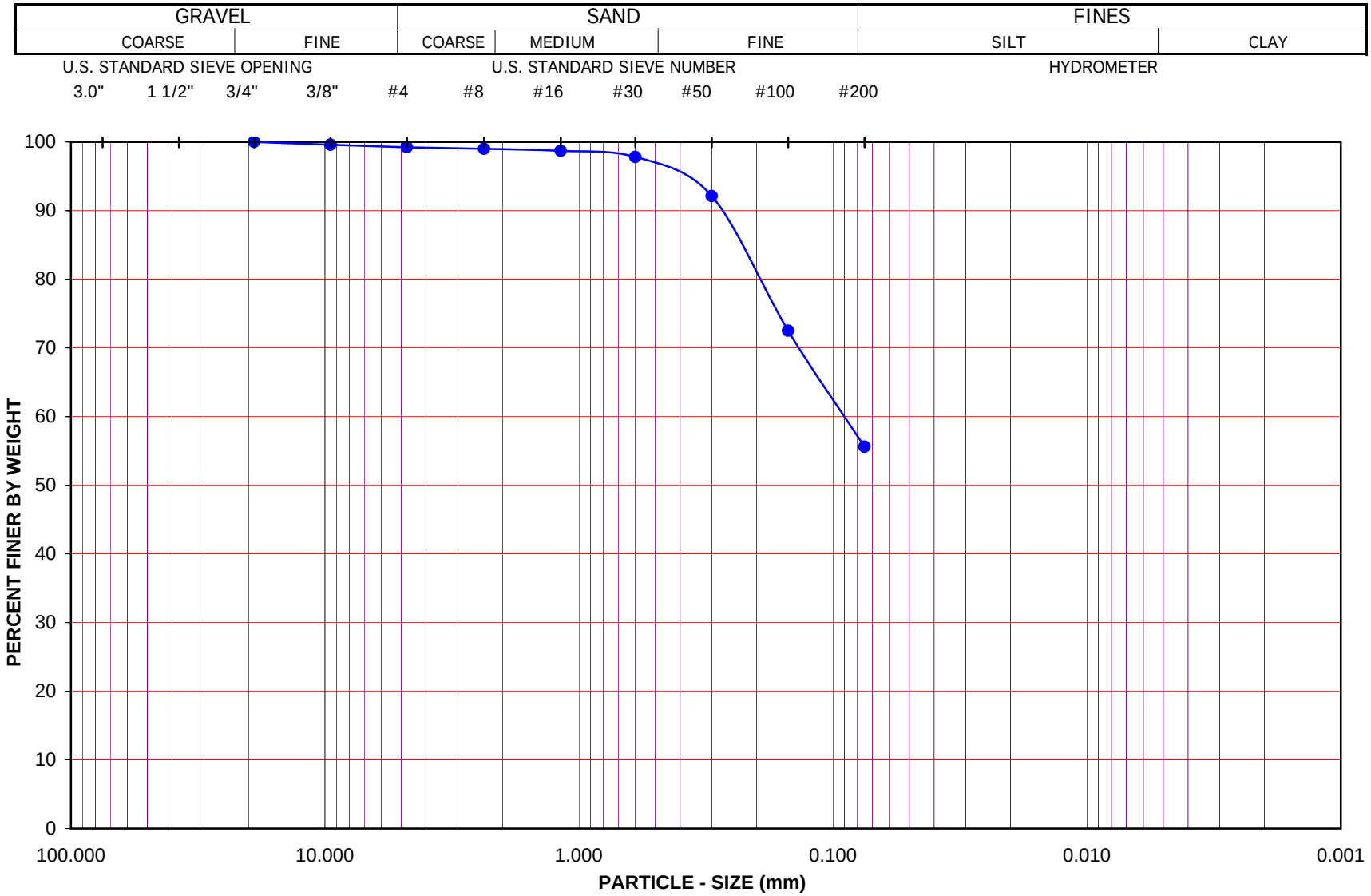
FINES: **56 %**

GROUP SYMBOL **s(CL)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-030 Sample No.: Bag-2

Depth (feet): 25 - 30 Soil Type : s(CL)

Soil Identification: Light olive brown sandy lean clay s(CL) / with caliche

GR:SA:FI : (%) 1 : 43 : 56

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

SA A-08-030, Bag-2

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/20/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/27/08

Exploration No.: A-08-030

Sample No.: D-7 | Depth (feet) : 35.0

Soil Identification: Yellowish brown lean clay with sand (CL)s

% Gravel	0	Soil Type
% Sand	15	(CL)s
% Fines	85	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	87.44
Wt.of Air-Dry Soil + Cont. (g)	852.47	Wt. of Container No.___ (g)	1.00	1.00	75.18
Wt. of Container	108.14	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	744.33	Wt. of Dry Soil (g)			12.26

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.08	100.0
Pan		

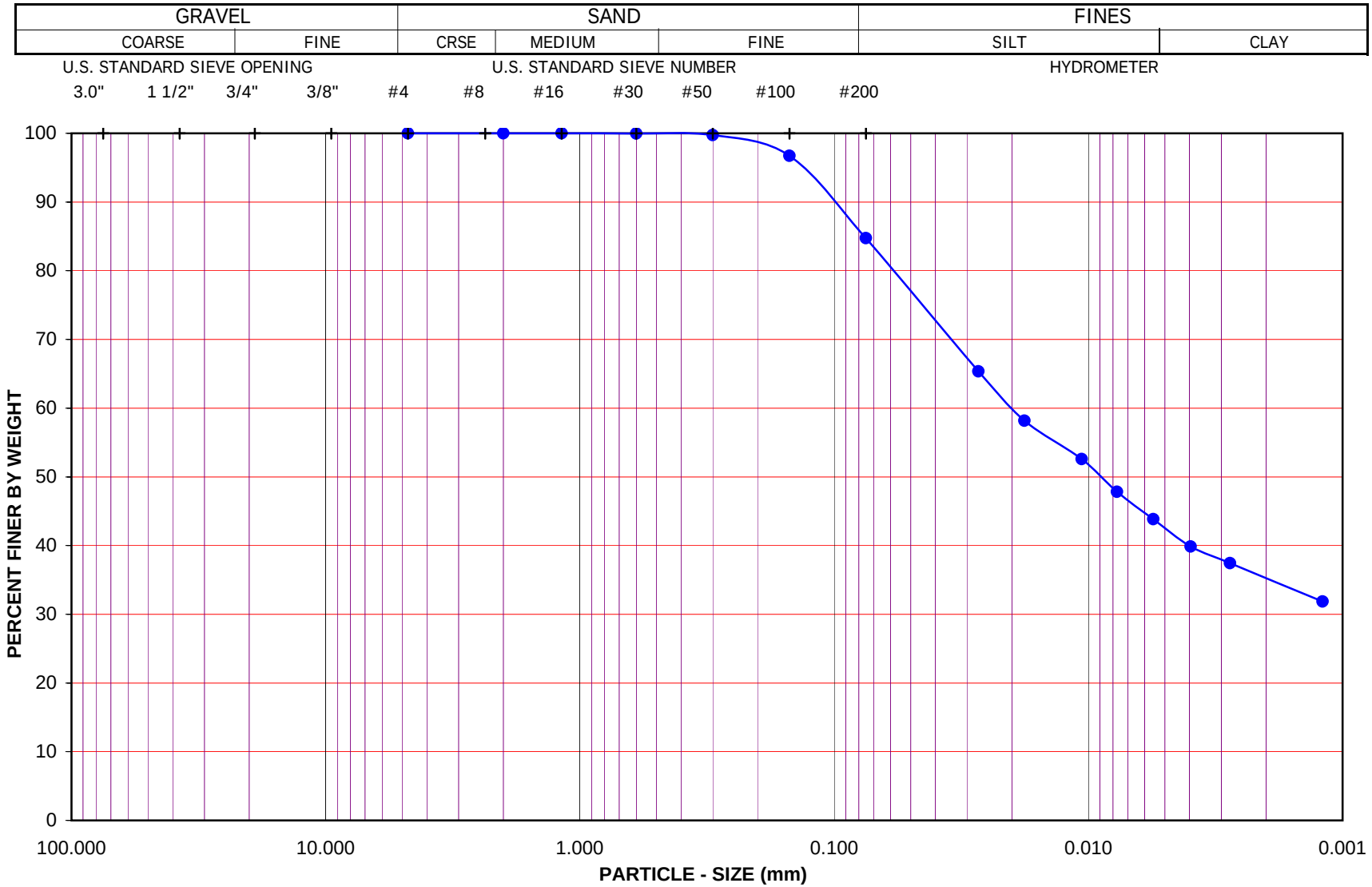
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.00	100.0	100.0
No. 30	0.02	100.0	100.0
No. 50	0.16	99.7	99.7
No. 100	2.04	96.7	96.7
No. 200	9.49	84.8	84.7
Pan			

Hydrometer Wt. of Air-Dry Soil (g): 62.24 Wt. of Dry Soil (g): 62.24

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
20-Aug-08	9:50	0		8.0			
	9:52	2	21.6	8.0	49.0	65.3	0.0271
	9:55	5	21.6	8.0	44.5	58.2	0.0178
	10:05	15	21.5	8.0	41.0	52.6	0.0106
	10:20	30	21.5	8.0	38.0	47.8	0.0077
	10:50	60	21.6	8.0	35.5	43.8	0.0056
	11:50	120	22.0	8.0	33.0	39.8	0.0040
	14:00	250	22.5	8.0	31.5	37.5	0.0028
21-Aug-08	9:50	1440	21.6	8.0	28.0	31.9	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-030 Sample No.: D-7

Depth (feet) : 35.0 Soil Type : (CL)s

Soil Identification: Yellowish brown lean clay with sand (CL)s

GR:SA:FI : (%) 0 : 15 : 85

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/11/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/15/08

Exploration No.: A-08-030

Sample No.: S-8 | Depth (feet) : 40.0

Soil Identification: Olive sandy lean clay s(CL)

% Gravel	0	Soil Type
% Sand	30	s(CL)
% Fines	70	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	103.47
Wt.of Air-Dry Soil + Cont. (g)	333.10	Wt. of Container No.___ (g)	1.00	1.00	82.74
Wt. of Container	38.90	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	294.20	Wt. of Dry Soil (g)			20.73

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.15	99.9
Pan		

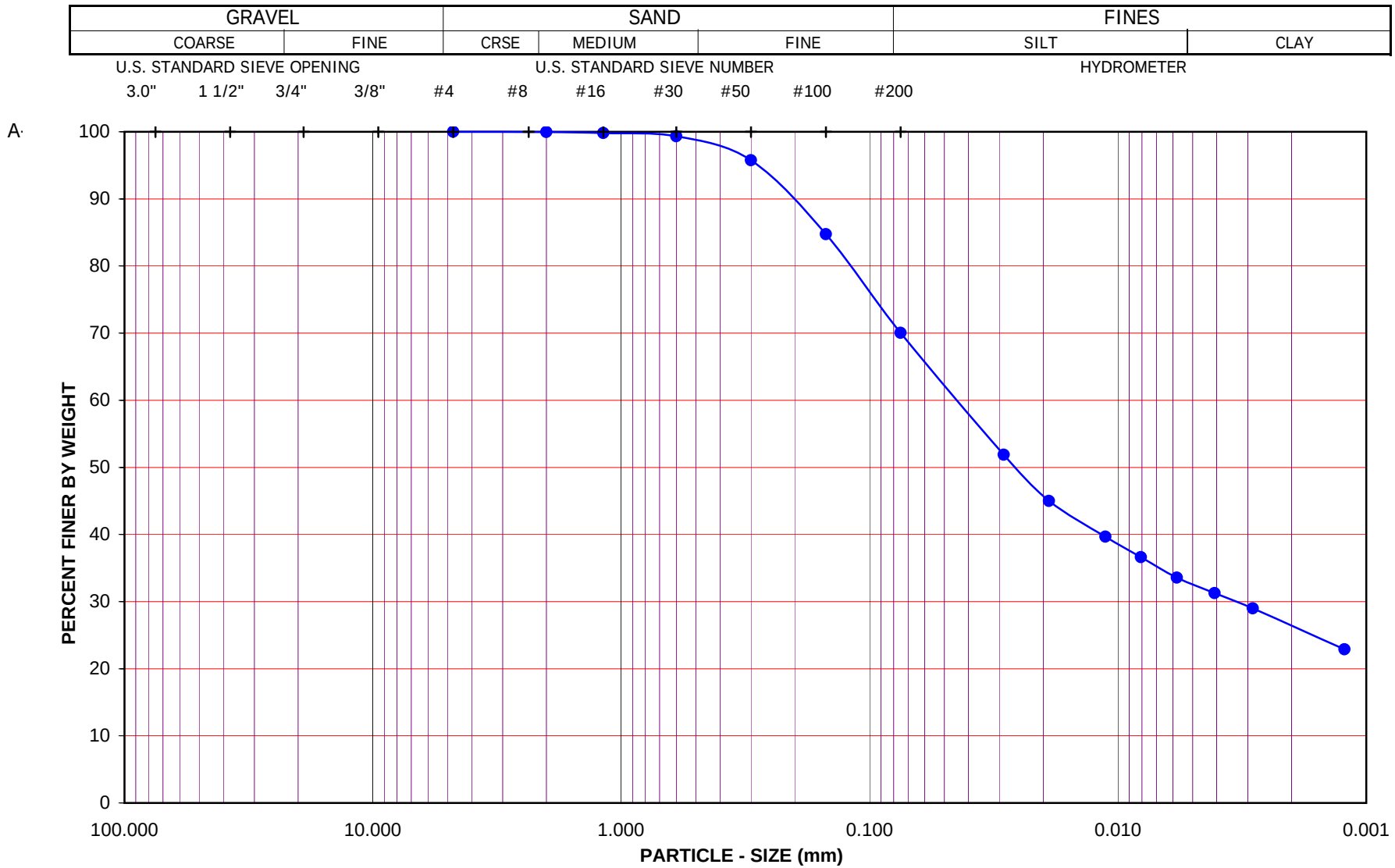
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.9
No. 16	0.08	99.9	99.8
No. 30	0.41	99.4	99.3
No. 50	2.73	95.8	95.8
No. 100	9.89	84.8	84.7
No. 200	19.44	70.1	70.1
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.00 Wt. of Dry Soil (g) 65.00

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
11-Aug-08	8:58	0		8.0			
	9:00	2	21.6	8.0	42.0	51.9	0.0288
	9:03	5	21.6	8.0	37.5	45.0	0.0189
	9:13	15	21.6	8.0	34.0	39.7	0.0112
	9:28	30	21.6	8.0	32.0	36.6	0.0081
	9:58	60	21.7	8.0	30.0	33.6	0.0058
	10:58	120	22.1	8.0	28.5	31.3	0.0041
	13:08	250	22.6	8.0	27.0	29.0	0.0029
12-Aug-08	8:58	1440	22.2	8.0	23.0	22.9	0.0012



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-030 Sample No.: S-8

Depth (feet) : 40.0 Soil Type : s(CL)

Soil Identification: Olive sandy lean clay s(CL)

GR:SA:FI : (%) 0 : 30 : 70

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: SR-57 Widening | Tested By : G. Berdy | Date: 08/01/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/06/08

Exploration No.: A-08-030

Sample No.: D-11 | Depth (feet) : 55.0

Soil Identification: Yellowish brown lean clay with sand (CL)s

% Gravel	0	Soil Type
% Sand	15	(CL)s
% Fines	85	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	0.00	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	0.00	88.50
Wt.of Air-Dry Soil + Cont. (g)	393.10	Wt. of Container No.___ (g)	1.00	1.00	76.00
Wt. of Container	144.80	Moisture Content (%)	0.00	0.00	
Dry Wt. of Soil (g)	248.30	Wt. of Dry Soil (g)			12.50

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.00	100.0
No. 10	0.00	100.0
Pan		

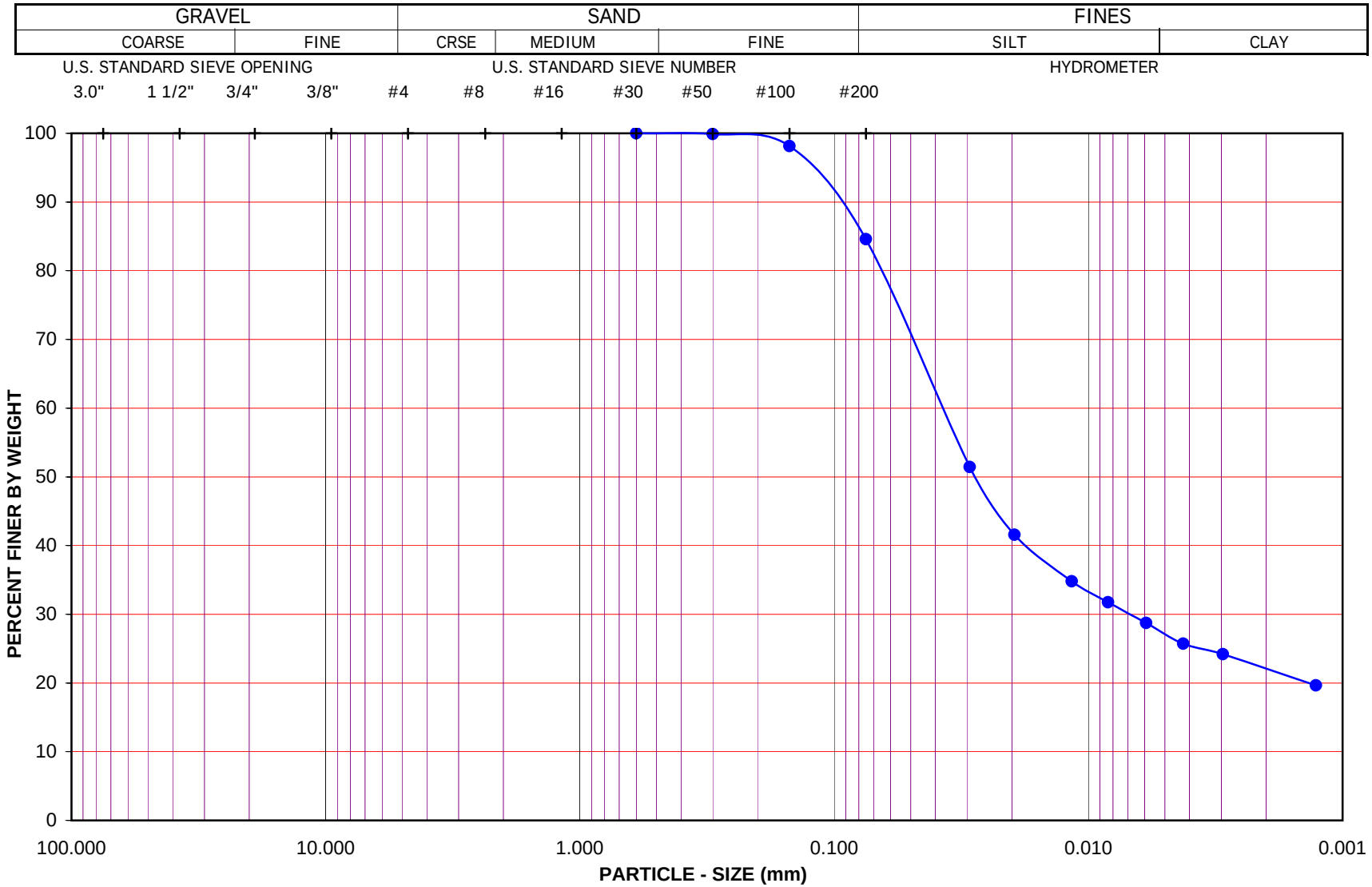
Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	100.0
No. 16	0.00	100.0	100.0
No. 30	0.00	100.0	100.0
No. 50	0.07	99.9	99.9
No. 100	1.22	98.1	98.1
No. 200	10.10	84.6	84.6
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 65.60 Wt. of Dry Soil (g) 65.60

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
01-Aug-08	9:58	0		6.0			
	10:00	2	21.8	6.0	40.0	51.4	0.0292
	10:03	5	21.7	6.0	33.5	41.6	0.0195
	10:13	15	21.7	6.0	29.0	34.8	0.0116
	10:28	30	21.9	6.0	27.0	31.8	0.0084
	10:58	60	22.0	6.0	25.0	28.7	0.0059
	11:58	120	22.1	6.0	23.0	25.7	0.0042
	14:08	250	22.7	6.0	22.0	24.2	0.0030
02-Aug-08	9:58	1440	21.6	6.0	19.0	19.7	0.0013



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-030 Sample No.: D-11

Depth (feet) : 55.0 Soil Type : (CL)s

Soil Identification: Yellowish brown lean clay with sand (CL)s

GR:SA:FI : (%) 0 : 15 : 85

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

PARTICLE-SIZE ANALYSIS of SOILS
ASTM D 422

Project Name:	SR-57 Widening	Tested By:	S. Felter	Date:	08/04/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/06/08
Exploration No.:	A-08-030	Depth (feet):	60.0		
Sample No.:	S-12				
Soil Identification:	Olive brown sandy lean clay s(CL)				

		Moisture Content of Total Air - Dry Soil	
Container No.:	KG	Wt. of Air-Dry Soil + Cont. (g)	0.00
Wt. of Air-Dried Soil + Cont.(g)	448.02	Wt. of Dry Soil + Cont. (g)	0.00
Wt. of Container (g)	140.93	Wt. of Container No._____ (g)	1.00
Dry Wt. of Soil (g)	307.09	Moisture Content (%)	0.00

After Wet Sieve	Container No.	KG
	Wt. of Dry Soil + Container (g)	275.00
	Wt. of Container (g)	140.93
	Dry Wt. of Soil Retained on # 200 Sieve (g)	134.07

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
6"	152.400		
3"	75.000		
1 1/2	37.500	0.00	
3/4"	19.000	0.00	100.0
3/8"	9.500	3.30	98.9
#4	4.750	6.90	97.8
#8	2.360	8.90	97.1
#16	1.180	10.40	96.6
#30	0.600	12.70	95.9
#50	0.300	20.90	93.2
#100	0.150	68.10	77.8
#200	0.075	130.90	57.4
PAN			

GRAVEL: **2 %**

SAND: **41 %**

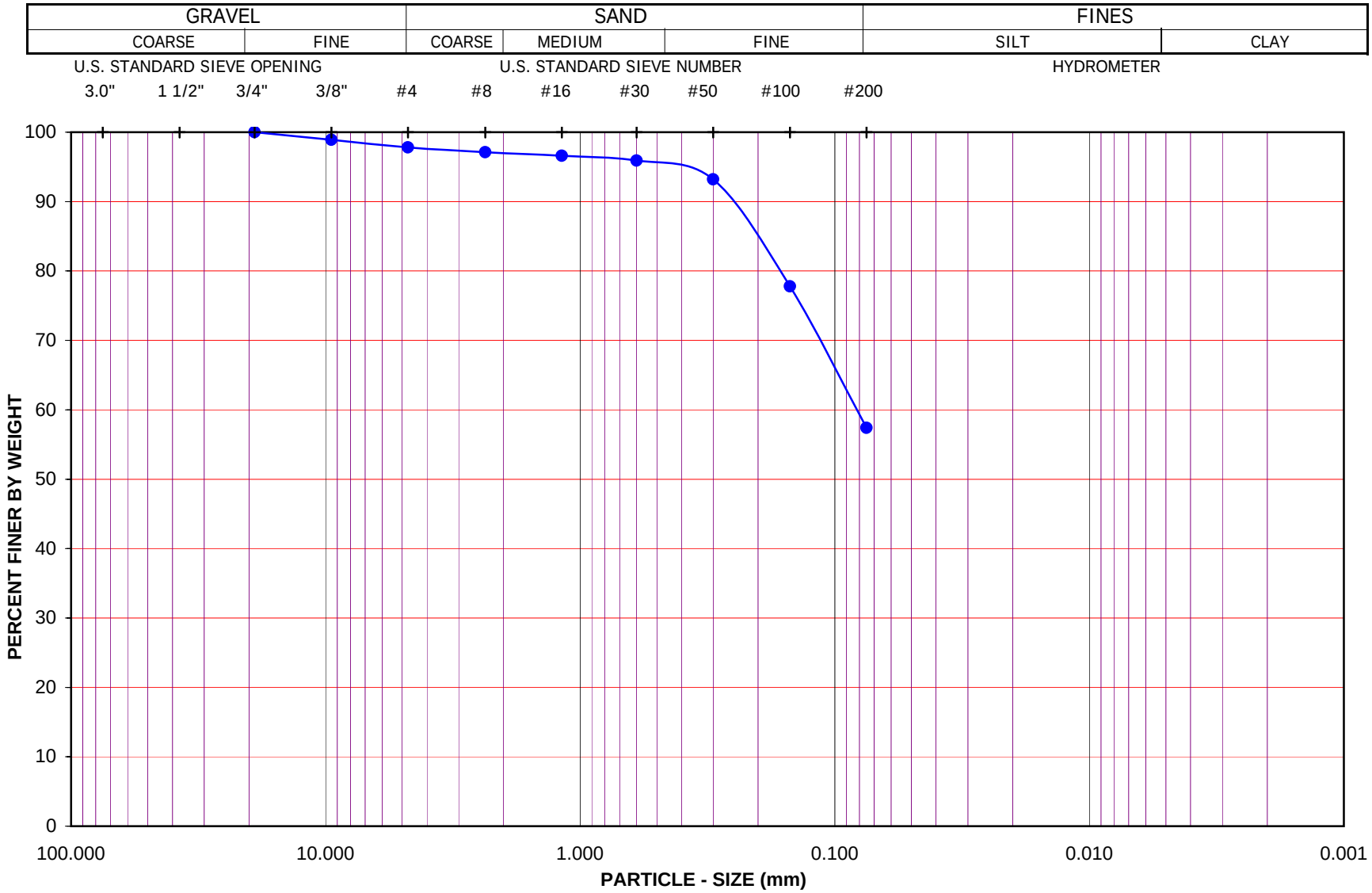
FINES: **57 %**

GROUP SYMBOL: **s(CL)**

Cu = D60/D10 = _____

Cc = $(D30)^2/(D60*D10)$ = _____

Remarks: _____



Project Name: SR-57 Widening

Project No.: 370900.02.GE.0S

Exploration No.: A-08-030 Sample No.: S-12

Depth (feet): 60.0 Soil Type : s(CL)

Soil Identification: Olive brown sandy lean clay s(CL)

GR:SA:FI : (%) 2 : 41 : 57

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Aug-08

Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	G. Bathala	Date:	05/18/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/19/09
Boring No.:	A-08-002	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	2-7		
Soil Identification:	Dark grayish brown sandy lean clay s(CL)				

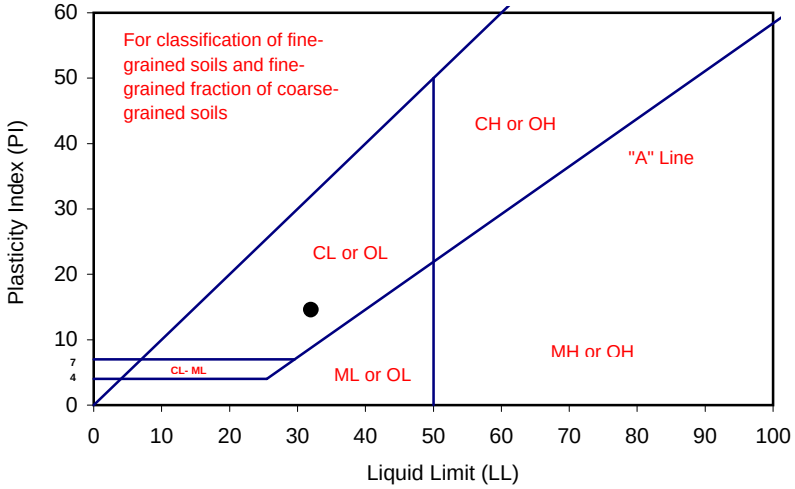
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	18	
Wet Wt. of Soil + Cont. (g)	12.05	13.08	14.56	15.52	13.24	
Dry Wt. of Soil + Cont. (g)	10.43	11.29	11.38	12.00	10.20	
Wt. of Container (g)	1.04	1.10	1.03	1.05	1.04	
Moisture Content (%) [Wn]	17.25	17.57	30.72	32.15	33.19	

Liquid Limit	**32**
Plastic Limit	**17**
Plasticity Index	**15**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.76

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



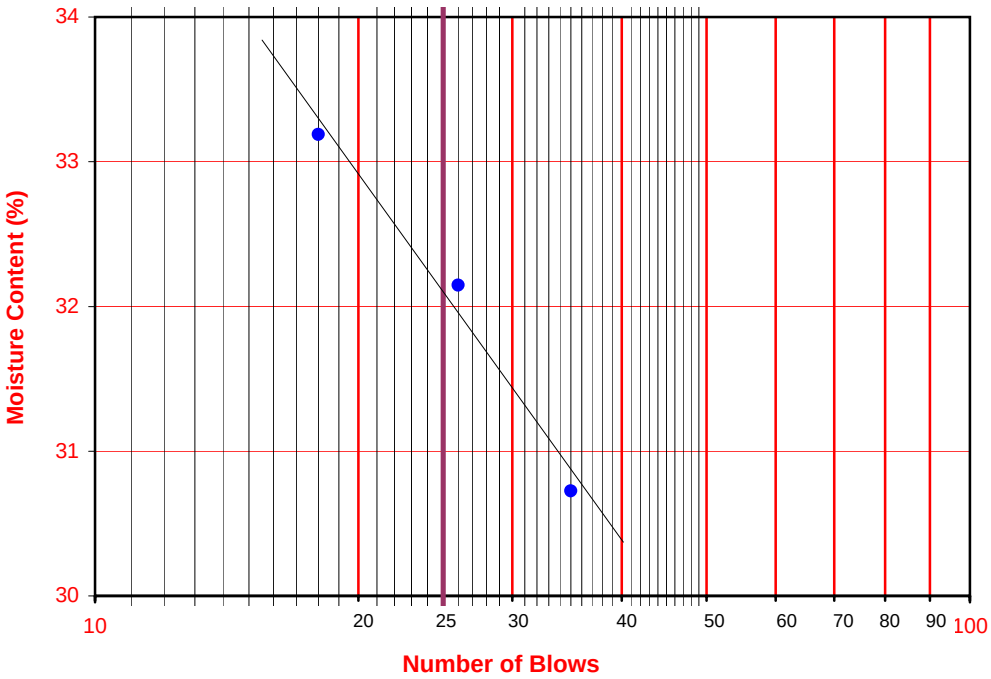
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	G. Bathala	Date:	08/07/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/08/08
Boring No.:	A-08-002	Checked By:	LF		
Sample No.:	D-3	Depth (ft.)	15.0		
Soil Identification:	Olive brown fat clay (CH)				

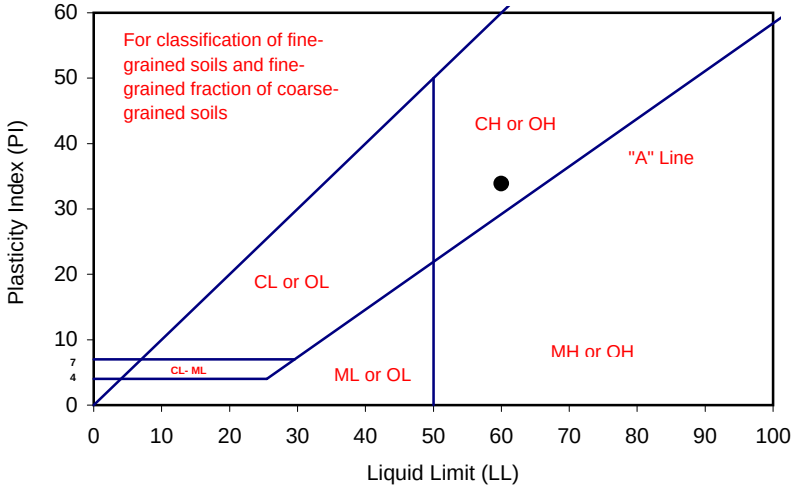
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	29	23	17
Wet Wt. of Soil + Cont. (g)	15.90	13.70	13.41	12.17	11.89	13.32
Dry Wt. of Soil + Cont. (g)	12.85	11.07	8.98	8.07	7.81	8.59
Wt. of Container (g)	1.10	1.08	1.14	1.09	1.06	1.04
Moisture Content (%) [Wn]	25.96	26.33	56.51	58.74	60.44	62.65

Liquid Limit	**60**
Plastic Limit	**26**
Plasticity Index	**34**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 29.2

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



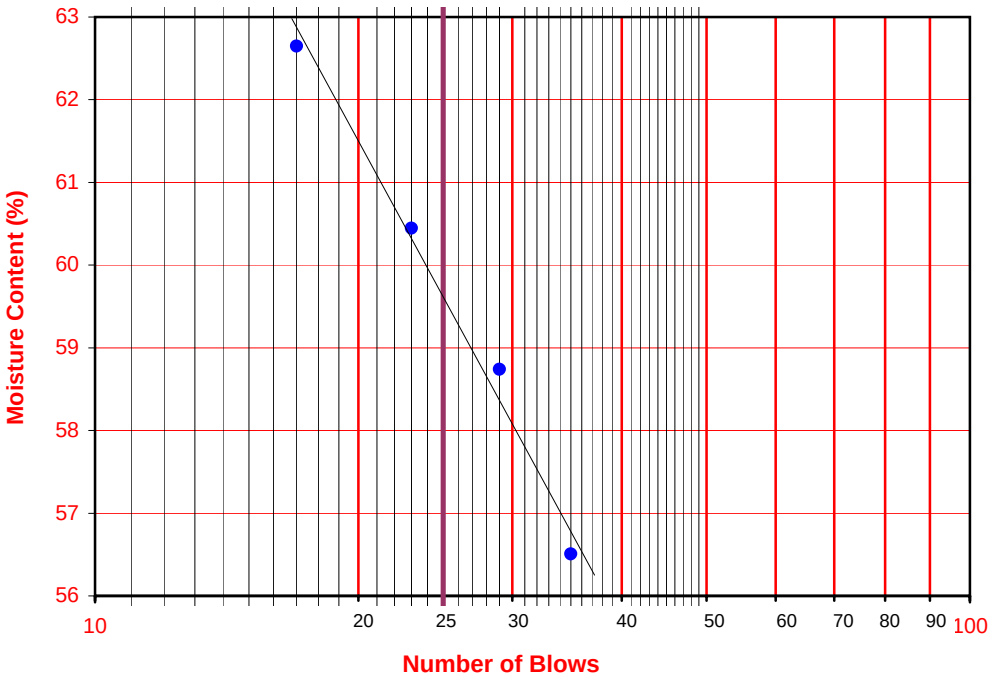
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/19/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/20/08
Boring No.:	A-08-002	Checked By:	LF		
Sample No.:	S-4	Depth (ft.)	20.0		
Soil Identification:	Olive sandy lean clay s(CL)				

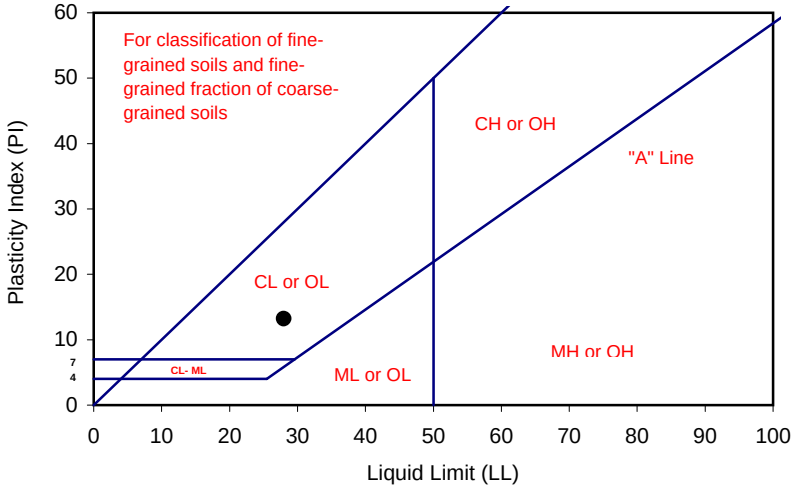
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	30	23	16
Wet Wt. of Soil + Cont. (g)	12.36	14.18	14.81	15.48	13.23	15.38
Dry Wt. of Soil + Cont. (g)	10.91	12.48	11.93	12.37	10.52	12.05
Wt. of Container (g)	1.06	1.06	1.08	1.10	1.07	1.01
Moisture Content (%) [Wn]	14.72	14.89	26.54	27.60	28.68	30.16

Liquid Limit	**28**
Plastic Limit	**15**
Plasticity Index	**13**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 5.84

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



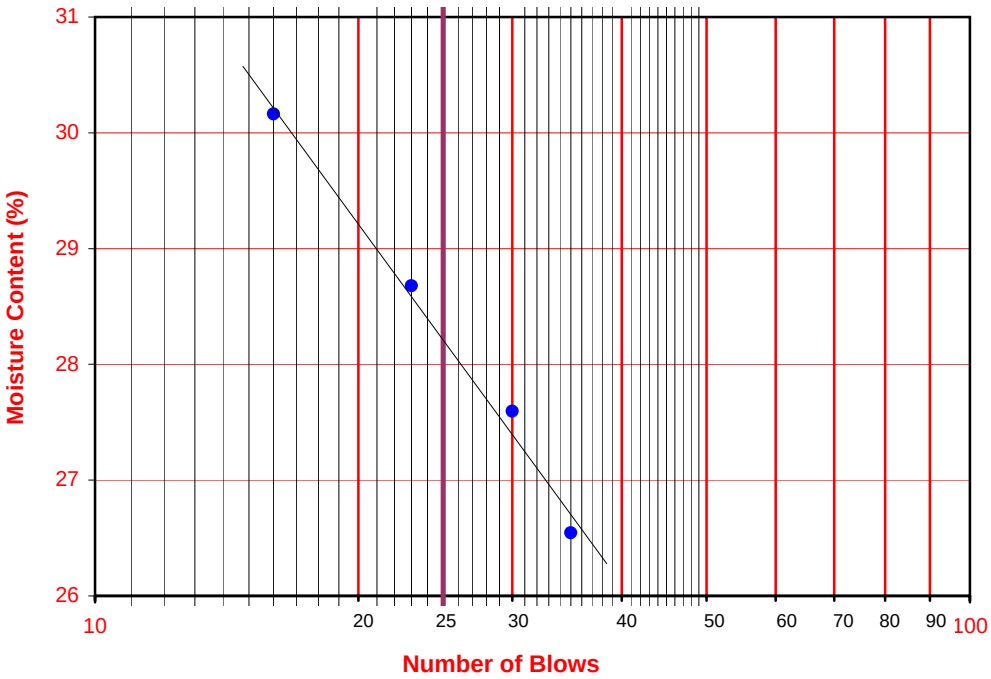
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/27/08
Boring No.:	A-08-003	Checked By:	LF		
Sample No.:	S-6	Depth (ft.)	30.0		
Soil Identification:	Yellowish brown sandy lean clay s(CL)				

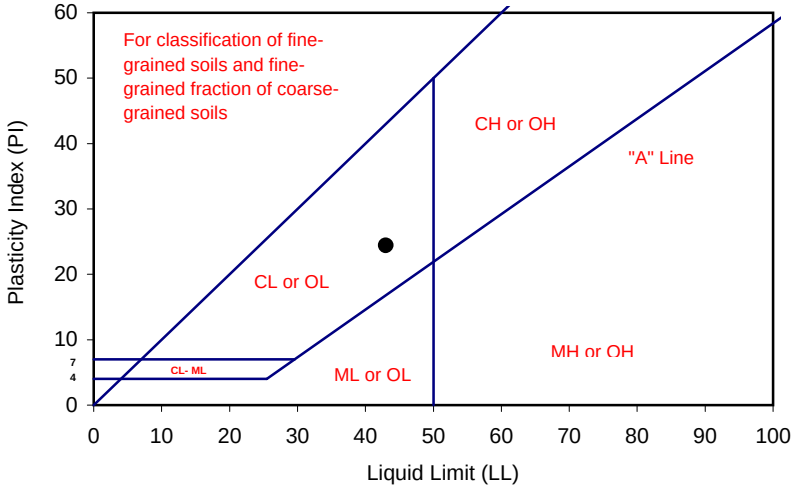
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	10.87	11.32	11.55	15.11	15.22	
Dry Wt. of Soil + Cont. (g)	9.33	9.70	8.49	10.91	10.88	
Wt. of Container (g)	1.02	1.00	1.03	1.02	1.04	
Moisture Content (%) [Wn]	18.53	18.62	41.02	42.47	44.11	

Liquid Limit	**43**
Plastic Limit	**19**
Plasticity Index	**24**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.79

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



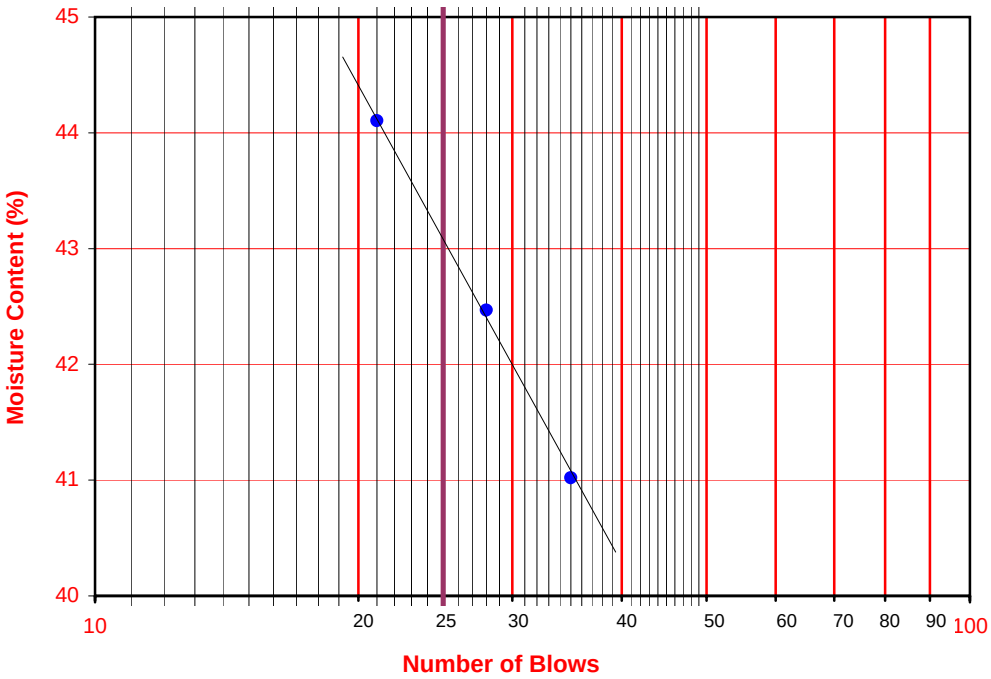
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	05/16/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/18/09
Boring No.:	A-08-004	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	0-7		

Soil Identification: Light olive brown poorly-graded sand with silt and gravel (SP-SM)g

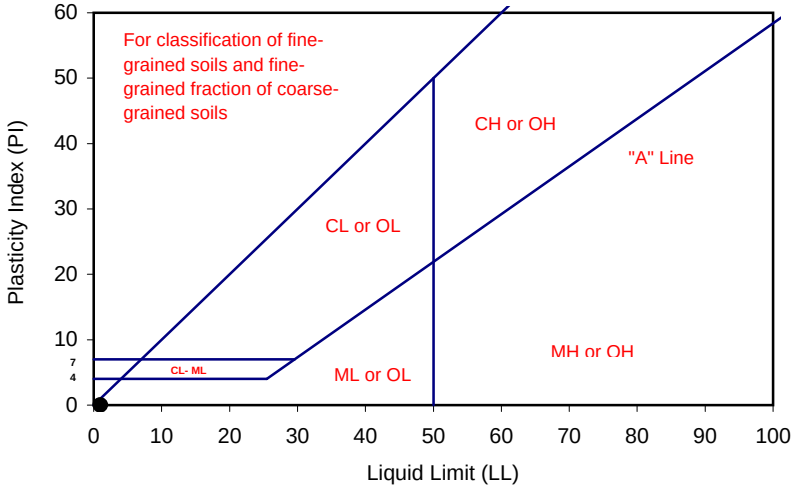
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			6			
Wet Wt. of Soil + Cont. (g)	**Cannot be rolled:**		18.75	**Cannot get more than 6 blows:**		
Dry Wt. of Soil + Cont. (g)	**NonPlastic**		15.86	**NonPlastic**		
Wt. of Container (g)			1.05			
Moisture Content (%) [Wn]			19.51			

Liquid Limit	**NP**
Plastic Limit	**NP**
Plasticity Index	**NP**
Classification	**NP**

PI at "A" - Line = 0.73(LL-20) =

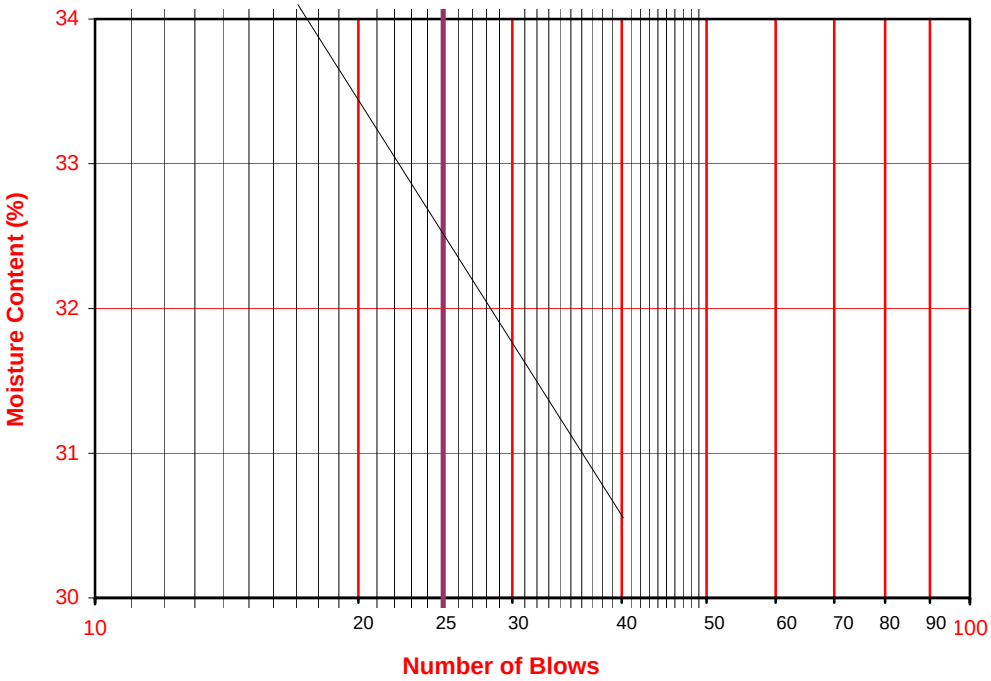
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



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:	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/27/08
Boring No.:	A-08-005	Checked By:	LF		
Sample No.:	D-3	Depth (ft.)	15.0		
Soil Identification:	Yellowish brown silty sand (SM)				

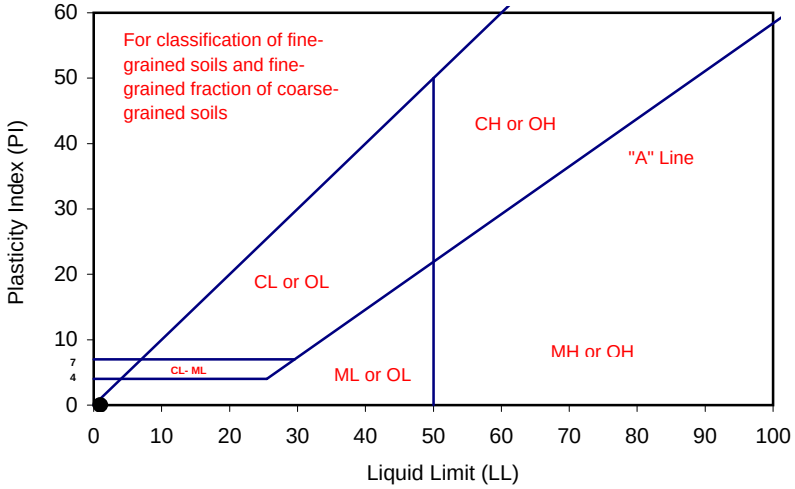
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			6			
Wet Wt. of Soil + Cont. (g)	Cannot be rolled		14.61	Cannot get >6 blows		
Dry Wt. of Soil + Cont. (g)	NonPlastic		12.13	NonPlastic		
Wt. of Container (g)			1.07			
Moisture Content (%) [Wn]			22.42			

Liquid Limit	**NP**
Plastic Limit	**NP**
Plasticity Index	**NP**
Classification	**NP**

PI at "A" - Line = 0.73(LL-20) #VALUE!

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



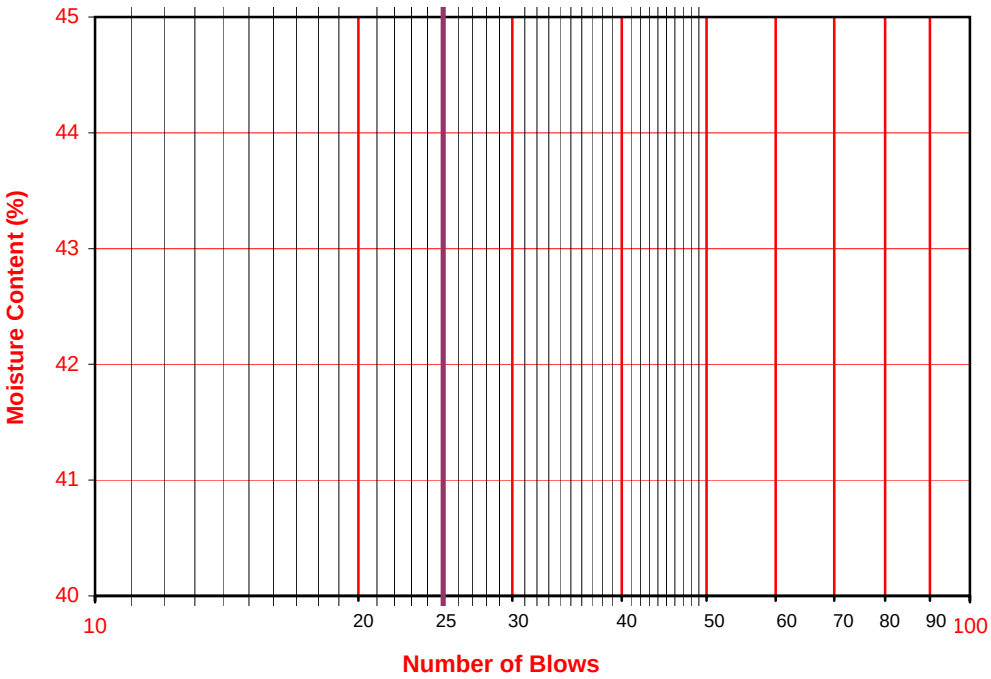
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/22/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/26/08
Boring No.:	A-08-005	Checked By:	LF		
Sample No.:	S-4	Depth (ft.)	20.0		
Soil Identification:	Olive brown sandy lean clay s(CL)				

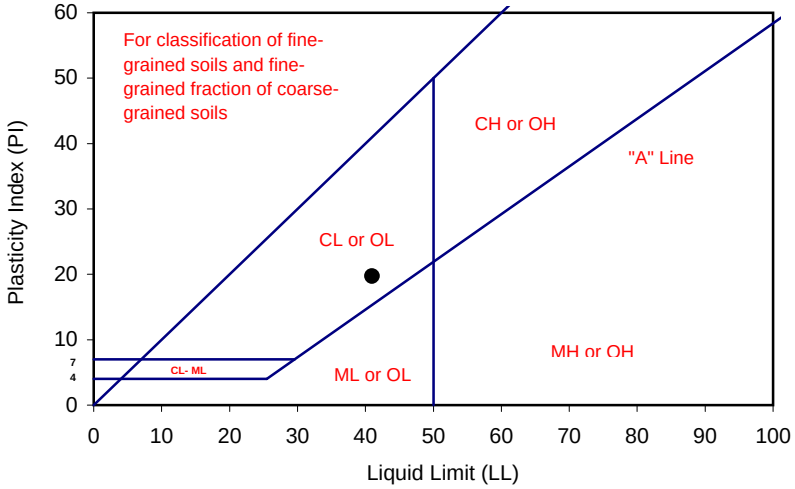
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	27	20	
Wet Wt. of Soil + Cont. (g)	14.78	13.66	14.88	13.51	15.64	
Dry Wt. of Soil + Cont. (g)	12.37	11.45	11.03	9.92	11.26	
Wt. of Container (g)	1.09	1.03	1.07	1.03	1.07	
Moisture Content (%) [Wn]	21.37	21.21	38.65	40.38	42.98	

Liquid Limit	**41**
Plastic Limit	**21**
Plasticity Index	**20**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 15.33

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



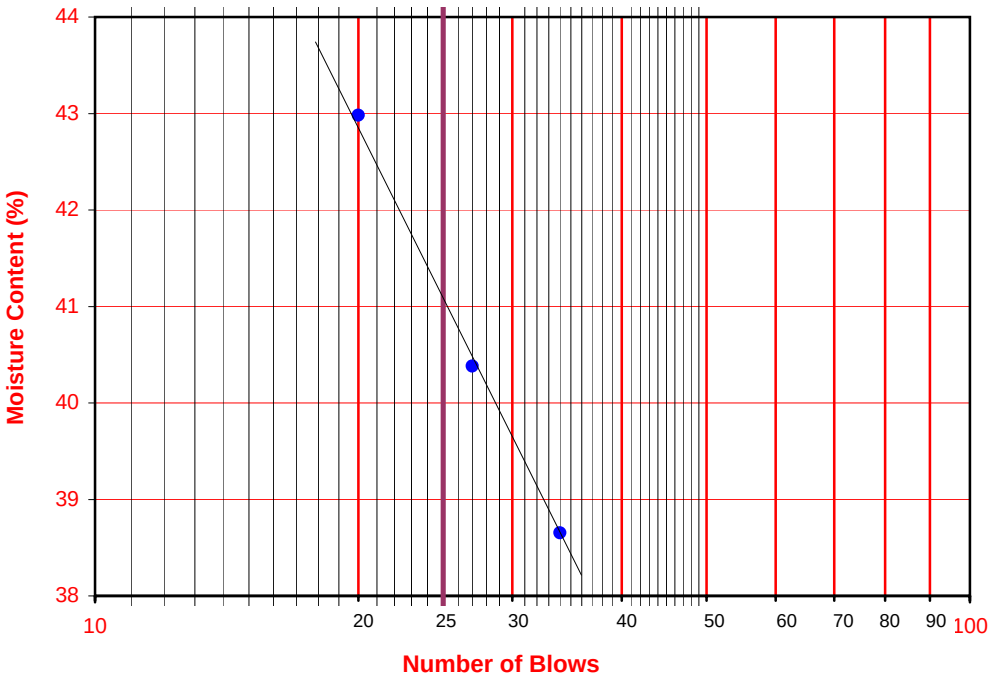
PROCEDURES USED

[ ] 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:	09/03/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/04/08
Boring No.:	A-08-005	Checked By:	LF		
Sample No.:	D-5	Depth (ft.)	25.0		
Soil Identification:	Yellowish brown lean clay (CL)				

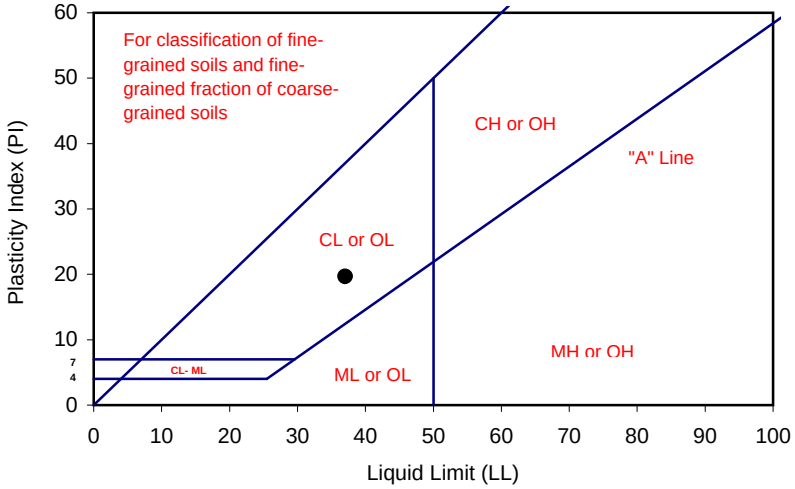
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	25	21	
Wet Wt. of Soil + Cont. (g)	9.94	10.25	20.47	20.41	21.32	
Dry Wt. of Soil + Cont. (g)	8.63	8.89	15.41	15.21	15.77	
Wt. of Container (g)	1.05	1.07	1.03	1.04	1.03	
Moisture Content (%) [Wn]	17.28	17.39	35.19	36.70	37.65	

Liquid Limit	**37**
Plastic Limit	**17**
Plasticity Index	**20**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 12.41

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



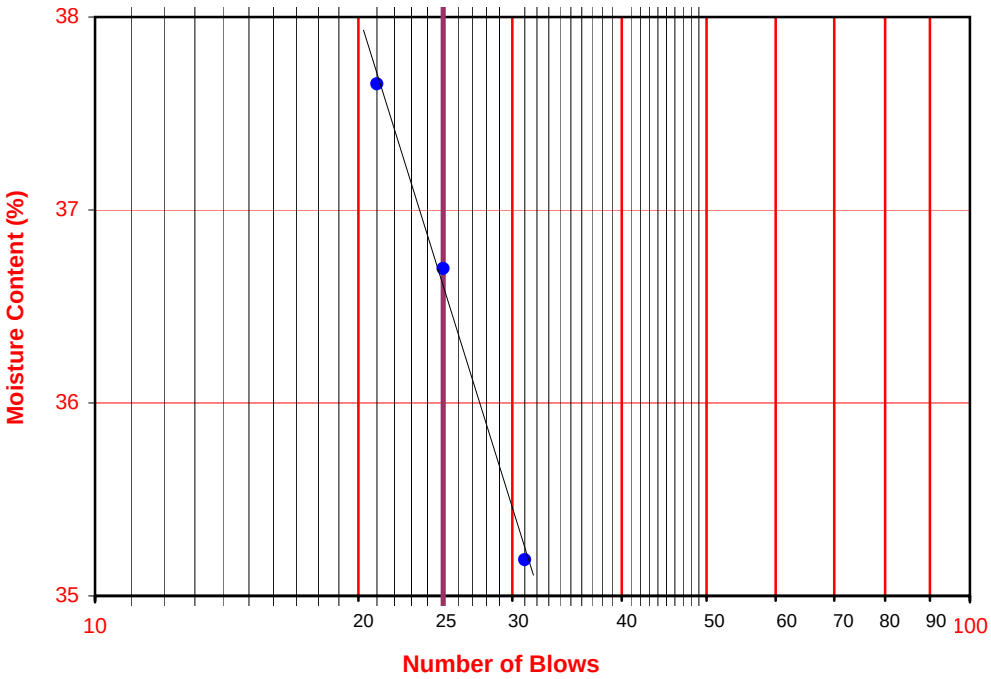
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	05/19/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/20/09
Boring No.:	A-08-008	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	0-7		
Soil Identification:	Yellowish brown fat clay with sand (CH)s				

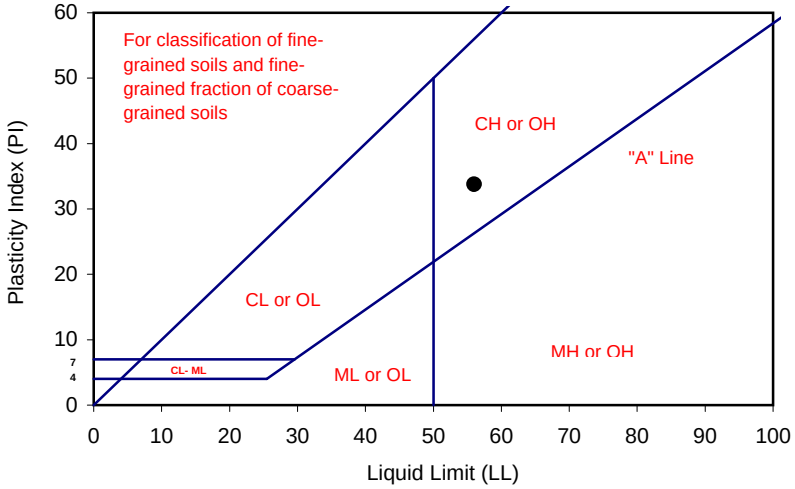
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	23	15
Wet Wt. of Soil + Cont. (g)	12.78	12.23	14.87	11.82	14.49	12.98
Dry Wt. of Soil + Cont. (g)	10.65	10.19	10.11	7.98	9.58	8.46
Wt. of Container (g)	1.06	1.04	1.04	1.03	1.04	1.06
Moisture Content (%) [Wn]	22.21	22.30	52.48	55.25	57.49	61.08

Liquid Limit	**56**
Plastic Limit	**22**
Plasticity Index	**34**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 26.28

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



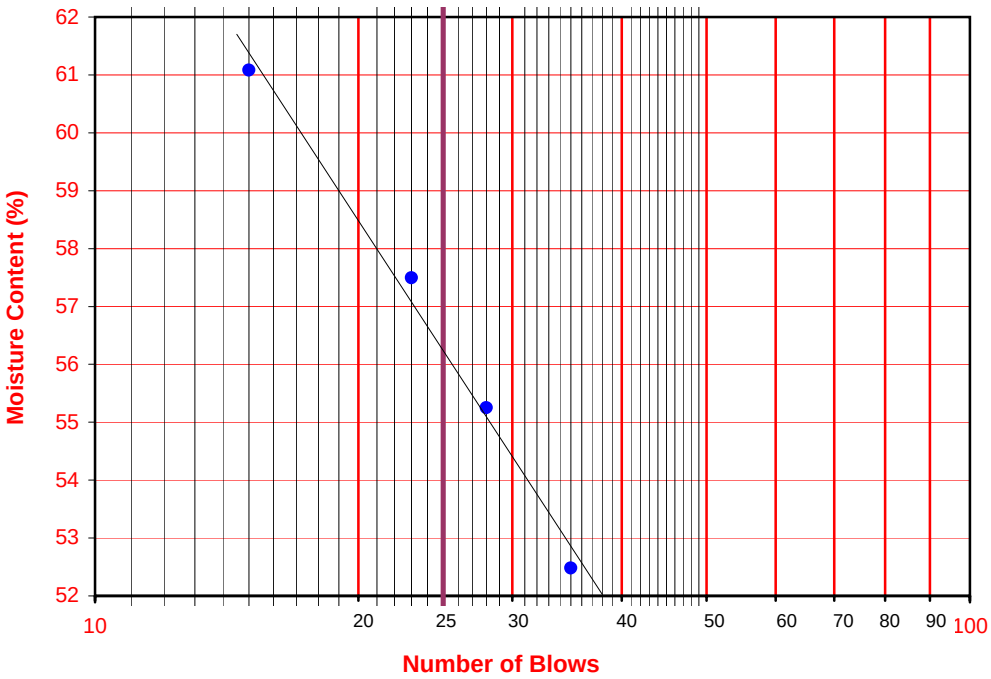
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/21/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/22/08
Boring No.:	A-08-008	Checked By:	LF		
Sample No.:	S-2	Depth (ft.)	10.0		
Soil Identification:	Yellowish brown fat clay (CH) with caliche				

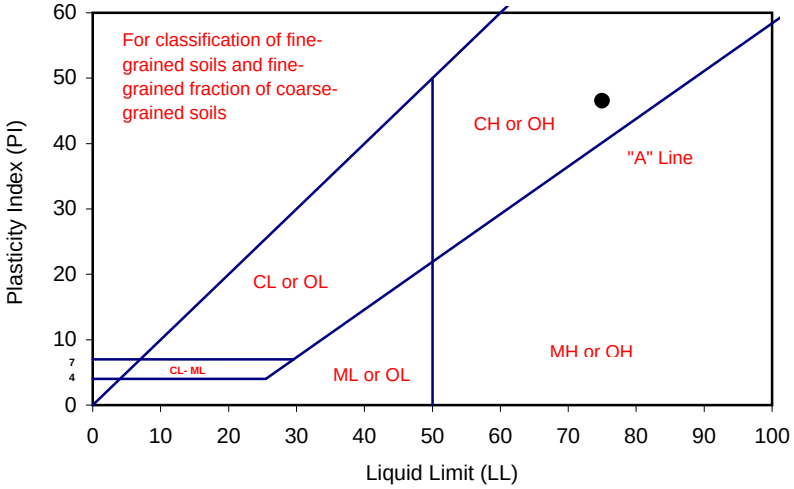
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	27	17	
Wet Wt. of Soil + Cont. (g)	11.63	10.79	12.04	13.40	13.89	
Dry Wt. of Soil + Cont. (g)	9.27	8.64	7.43	8.10	8.23	
Wt. of Container (g)	1.04	1.04	1.03	1.06	1.04	
Moisture Content (%) [Wn]	28.68	28.29	72.03	75.28	78.72	

Liquid Limit	**75**
Plastic Limit	**28**
Plasticity Index	**47**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 40.15

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



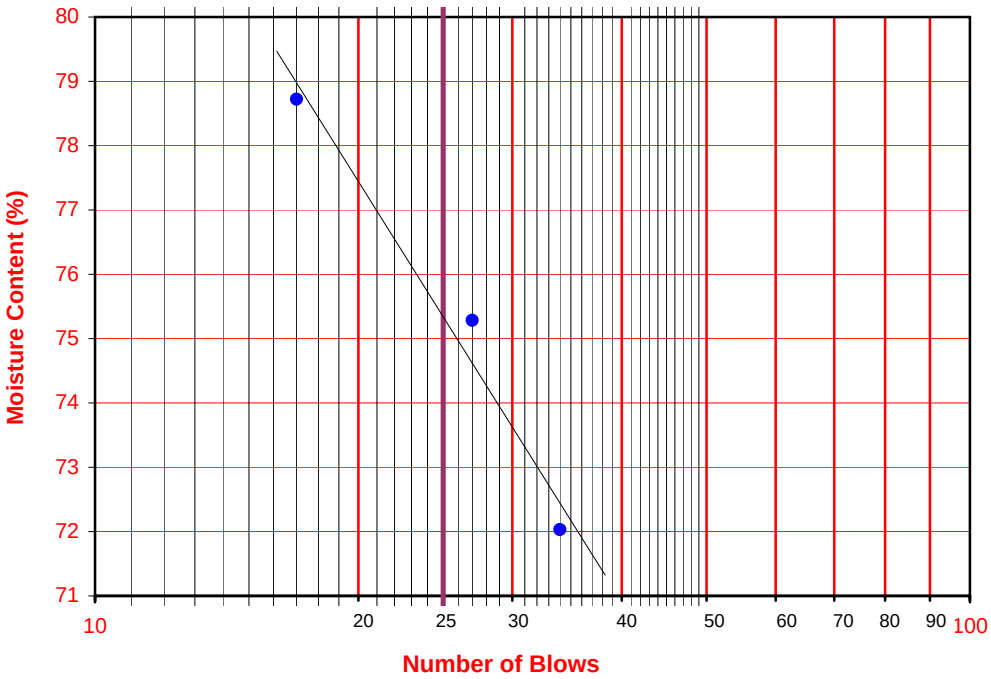
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	05/16/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/18/09
Boring No.:	A-08-010	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	0-7		
Soil Identification:	Yellowish brown clayey sand (SC)				

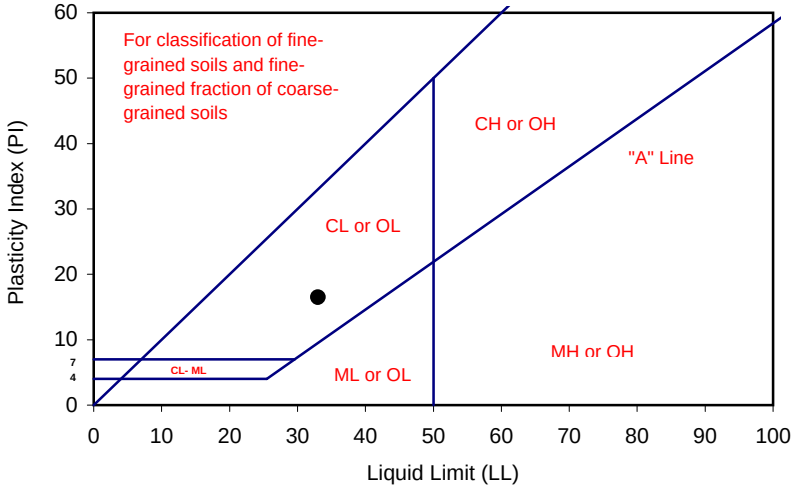
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	17	
Wet Wt. of Soil + Cont. (g)	12.52	14.26	13.58	15.30	15.59	
Dry Wt. of Soil + Cont. (g)	10.90	12.39	10.62	11.80	11.91	
Wt. of Container (g)	1.05	1.08	1.04	1.10	1.06	
Moisture Content (%) [Wn]	16.45	16.53	30.90	32.71	33.92	

Liquid Limit	**33**
Plastic Limit	**16**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 9.49

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



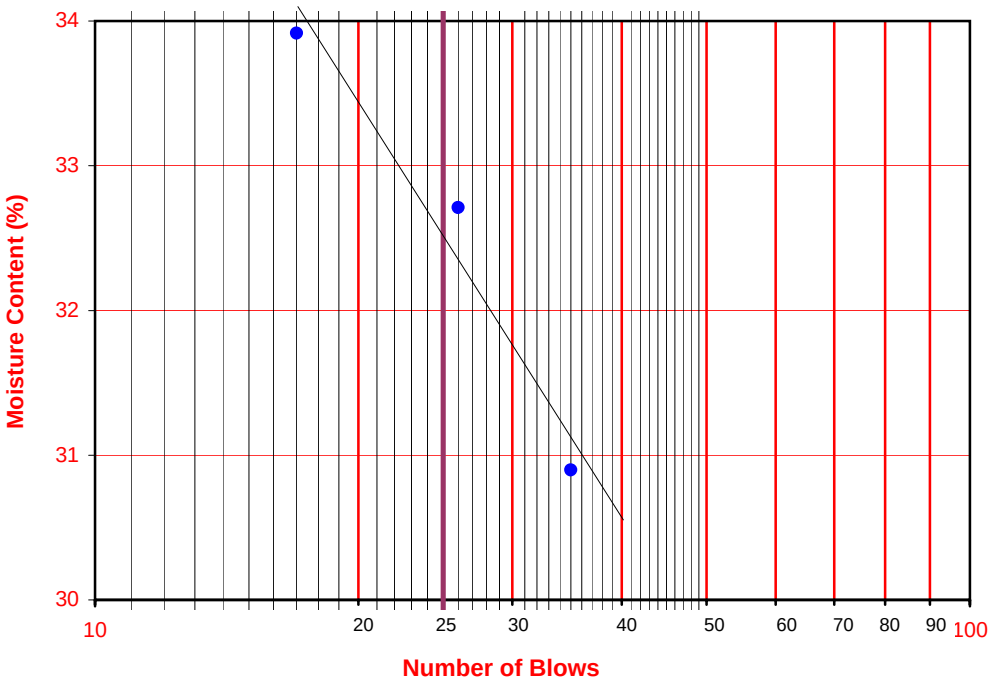
PROCEDURES USED

[ ] 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:	08/11/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/12/08
Boring No.:	A-08-010	Checked By:	LF		
Sample No.:	D-3	Depth (ft.)	15.0		
Soil Identification:	Yellowish brown lean clay (CL)				

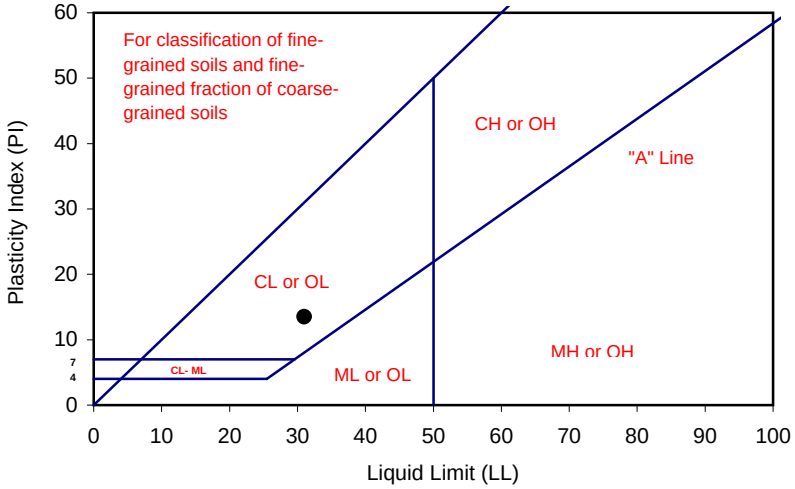
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	27	20	
Wet Wt. of Soil + Cont. (g)	12.18	11.70	18.89	20.64	21.87	
Dry Wt. of Soil + Cont. (g)	10.55	10.10	14.84	16.05	16.84	
Wt. of Container (g)	1.08	1.08	1.12	1.08	1.09	
Moisture Content (%) [Wn]	17.21	17.74	29.52	30.66	31.94	

Liquid Limit	**31**
Plastic Limit	**17**
Plasticity Index	**14**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.03

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



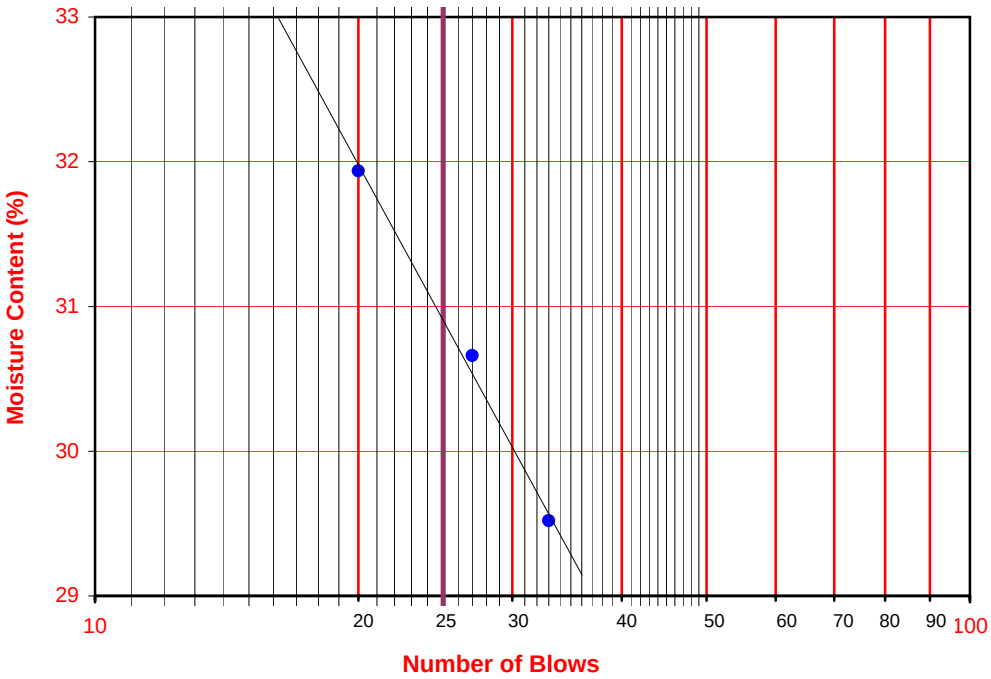
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/19/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/20/08
Boring No.:	A-08-010	Checked By:	LF		
Sample No.:	S-4	Depth (ft.)	20.0		
Soil Identification:	Dark brown sandy lean clay s(CL)				

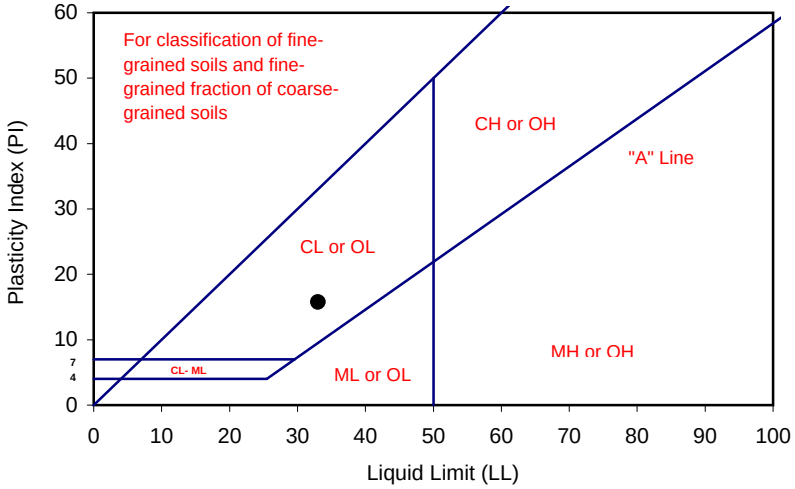
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	23	15	
Wet Wt. of Soil + Cont. (g)	13.73	14.22	15.03	15.26	18.13	
Dry Wt. of Soil + Cont. (g)	11.86	12.28	11.64	11.66	13.54	
Wt. of Container (g)	1.00	1.06	1.08	1.05	1.07	
Moisture Content (%) [Wn]	17.22	17.29	32.10	33.93	36.81	

Liquid Limit	**33**
Plastic Limit	**17**
Plasticity Index	**16**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 9.49

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



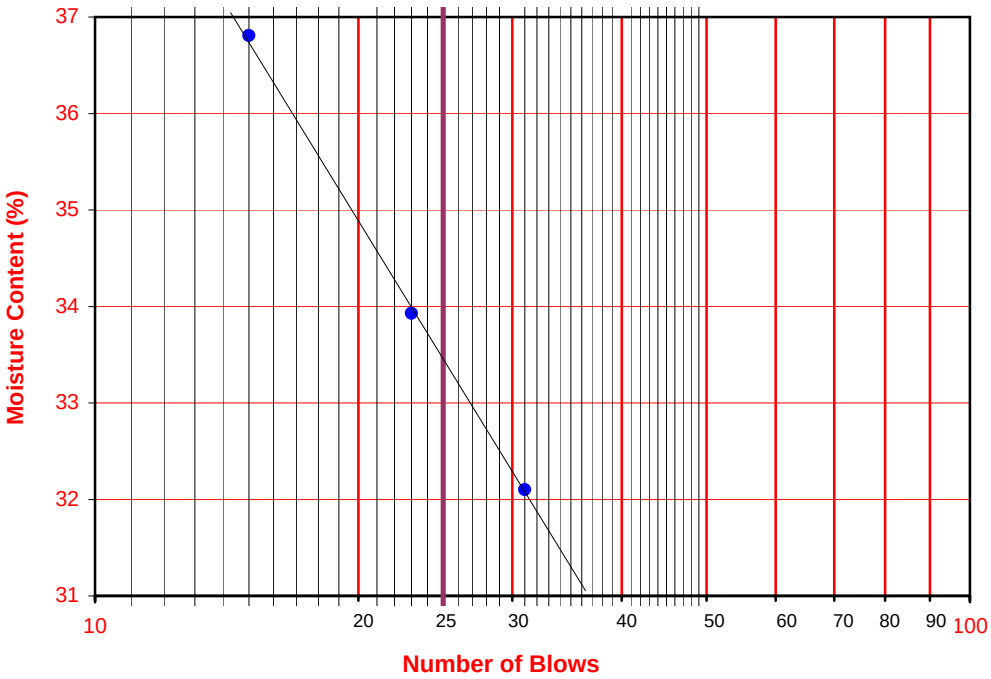
PROCEDURES USED

[ ] 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:	08/26/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/27/08
Boring No.:	A-08-011	Checked By:	LF		
Sample No.:	S-6	Depth (ft.)	30.0		
Soil Identification:	Brown lean clay (CL)				

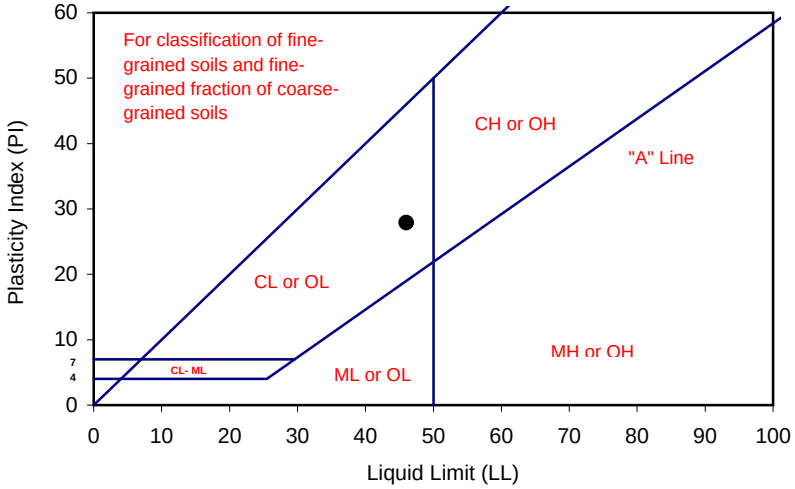
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			29	23	12	
Wet Wt. of Soil + Cont. (g)	9.96	9.85	22.10	19.81	20.58	
Dry Wt. of Soil + Cont. (g)	8.60	8.50	15.57	13.91	14.21	
Wt. of Container (g)	1.05	1.07	1.09	1.09	1.06	
Moisture Content (%) [Wn]	18.01	18.17	45.10	46.02	48.44	

Liquid Limit	**46**
Plastic Limit	**18**
Plasticity Index	**28**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 18.98

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



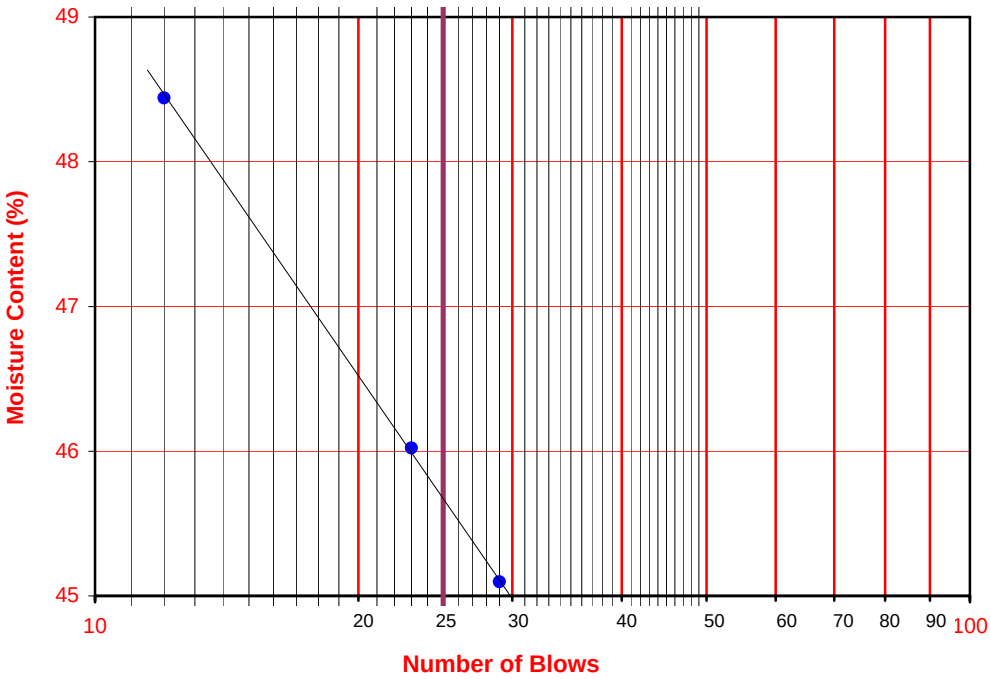
PROCEDURES USED

[ ] 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:	09/02/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/03/08
Boring No.:	A-08-012	Checked By:	LF		
Sample No.:	S-2	Depth (ft.)	10.0		
Soil Identification:	Olive fat clay (CH)				

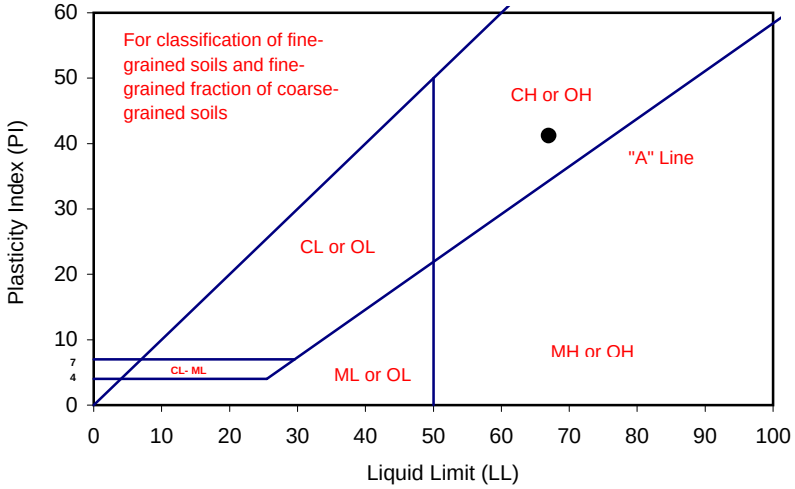
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			29	22	16	
Wet Wt. of Soil + Cont. (g)	10.02	10.06	19.15	19.48	19.65	
Dry Wt. of Soil + Cont. (g)	8.18	8.21	11.95	12.02	11.99	
Wt. of Container (g)	1.06	1.02	1.06	1.07	1.07	
Moisture Content (%) [Wn]	25.84	25.73	66.12	68.13	70.15	

Liquid Limit	**67**
Plastic Limit	**26**
Plasticity Index	**41**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 34.31

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



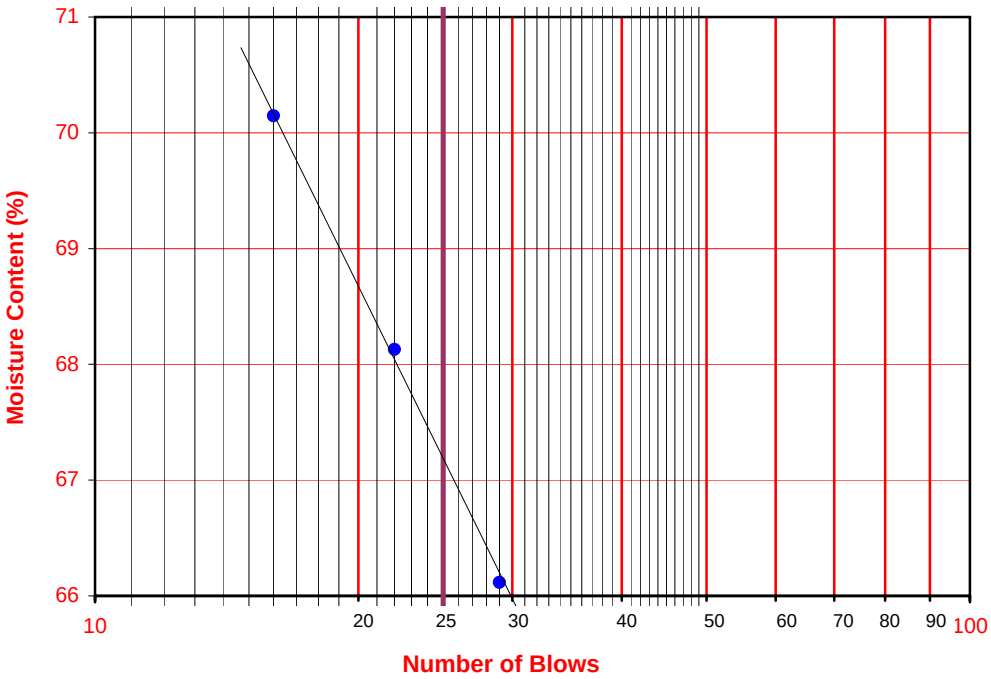
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/24/08
Project No. :	370900.02.GE.0S	Input By:	J. Ward	Date:	09/26/08
Boring No.:	A-08-012	Checked By:	J. Ward		
Sample No.:	D-3	Depth (ft.)	15.0		
Soil Identification:	Grayish brown lean clay (CL)				

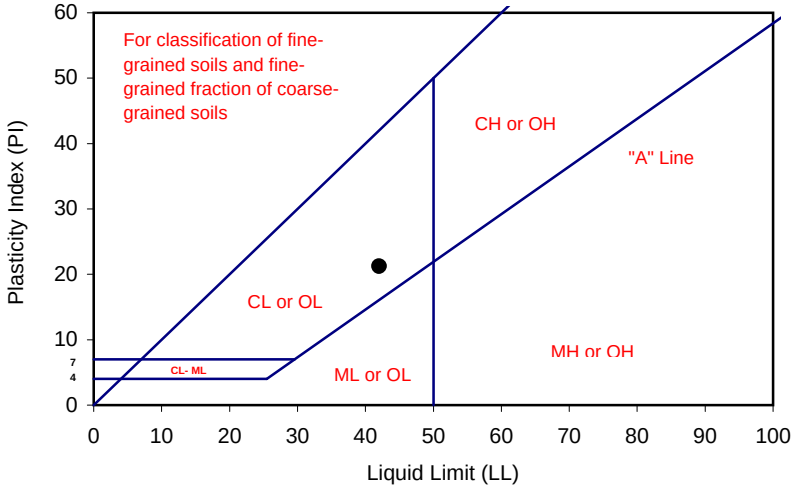
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	29	24	19
Wet Wt. of Soil + Cont. (g)	12.06	12.14	14.67	13.83	14.15	14.40
Dry Wt. of Soil + Cont. (g)	10.16	10.24	10.84	10.16	10.23	10.25
Wt. of Container (g)	1.04	1.07	1.06	1.08	1.07	1.04
Moisture Content (%) [Wn]	20.83	20.72	39.16	40.42	42.79	45.06

Liquid Limit	**42**
Plastic Limit	**21**
Plasticity Index	**21**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.06

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



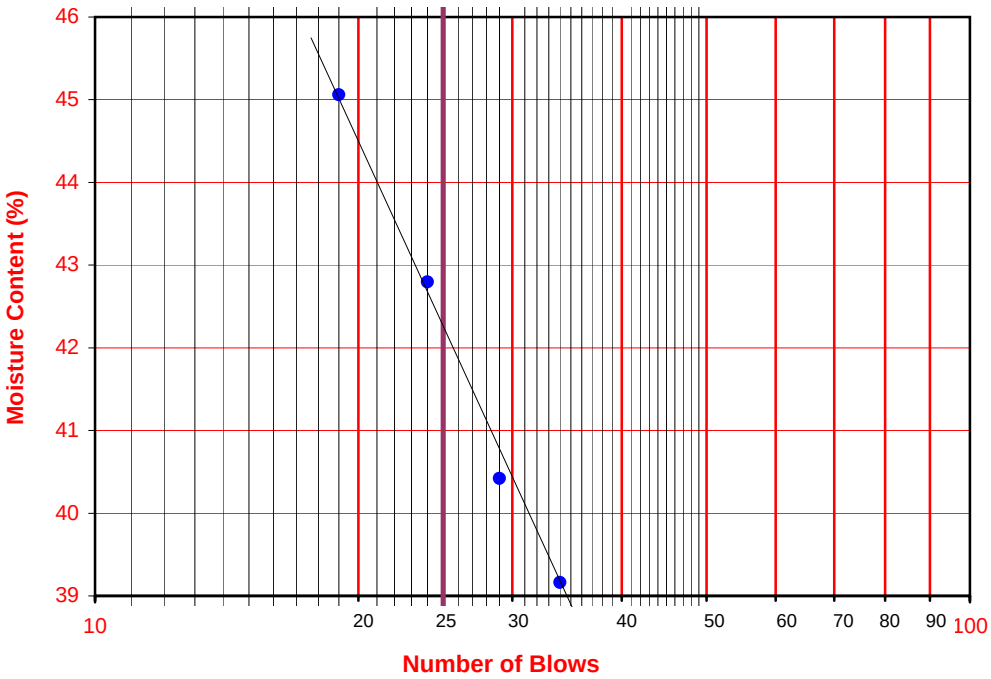
PROCEDURES USED

[ ] 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:	08/15/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/20/08
Boring No.:	A-08-012	Checked By:	LF		
Sample No.:	D-5	Depth (ft.)	25.0		
Soil Identification:	Olive fat clay (CH)				

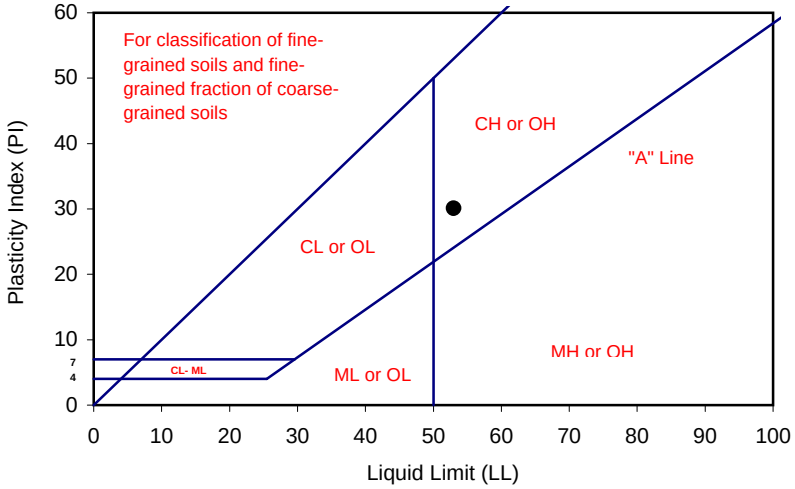
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			36	26	18	
Wet Wt. of Soil + Cont. (g)	9.04	9.06	19.33	20.34	21.39	
Dry Wt. of Soil + Cont. (g)	7.55	7.58	13.17	13.71	14.18	
Wt. of Container (g)	1.05	1.11	1.07	1.08	1.07	
Moisture Content (%) [Wn]	22.92	22.87	50.91	52.49	55.00	

Liquid Limit	**53**
Plastic Limit	**23**
Plasticity Index	**30**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 24.09

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



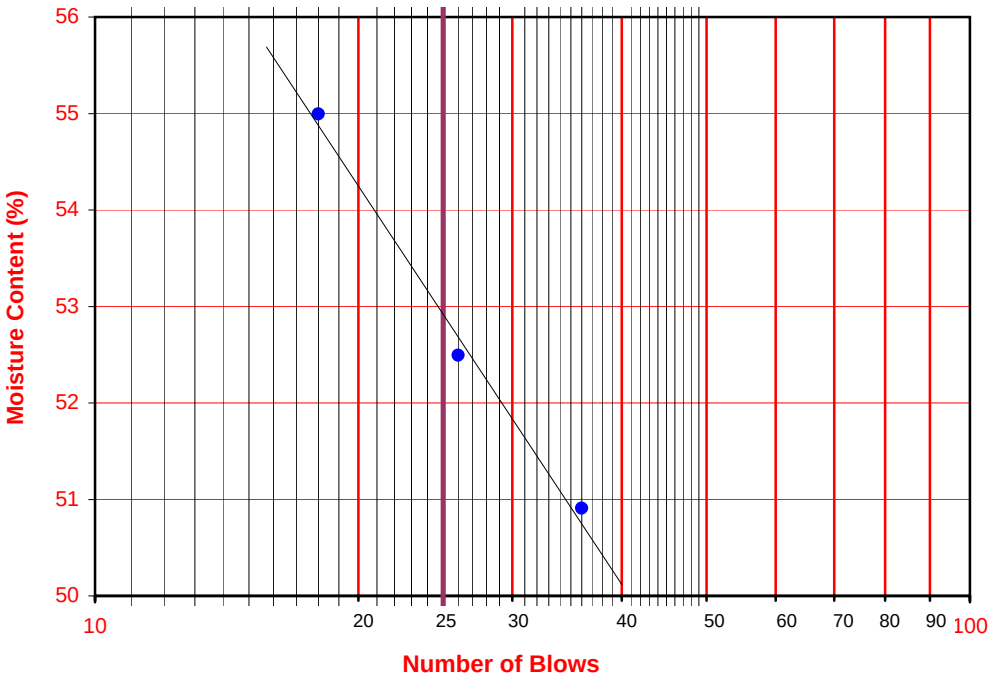
PROCEDURES USED

[ ] 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:	09/03/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/04/08
Boring No.:	A-08-012	Checked By:	LF		
Sample No.:	D-7	Depth (ft.)	35.0		
Soil Identification:	Yellowish brown lean clay (CL)				

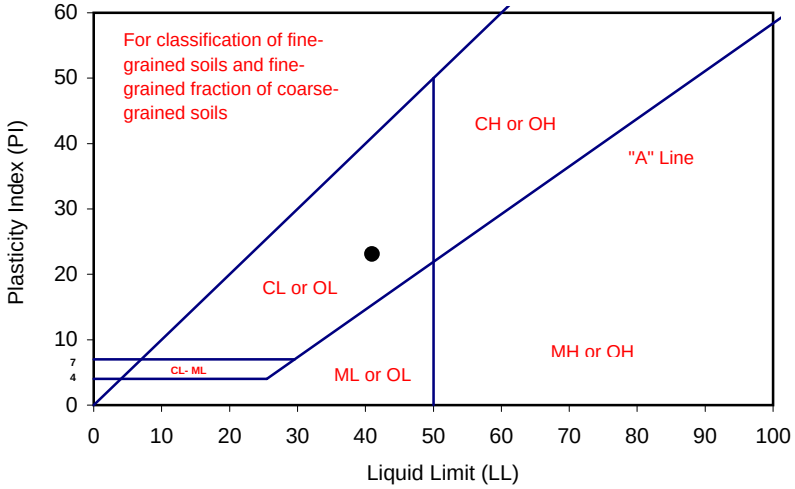
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	10.89	9.92	14.89	15.24	14.99	
Dry Wt. of Soil + Cont. (g)	9.39	8.58	11.03	11.16	10.91	
Wt. of Container (g)	1.03	1.07	1.03	1.04	1.08	
Moisture Content (%) [Wn]	17.94	17.84	38.60	40.32	41.51	

Liquid Limit	**41**
Plastic Limit	**18**
Plasticity Index	**23**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 15.33

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



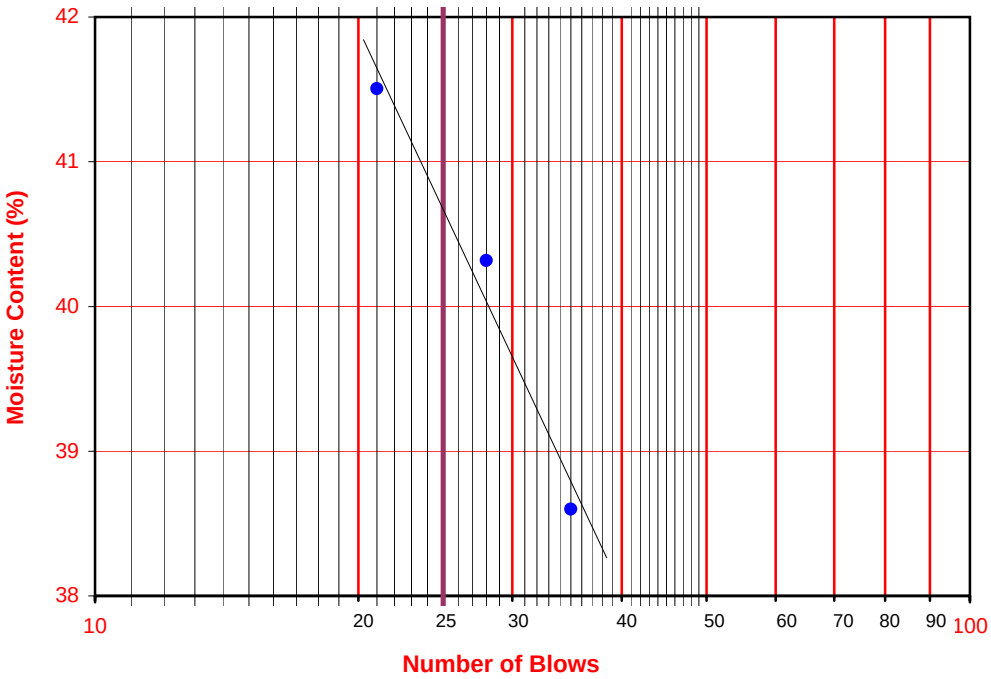
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/28/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/02/08
Boring No.:	A-08-012	Checked By:	LF		
Sample No.:	Bag-1	Depth (ft.)	35-40		
Soil Identification:	Olive lean clay with sand (CL)s				

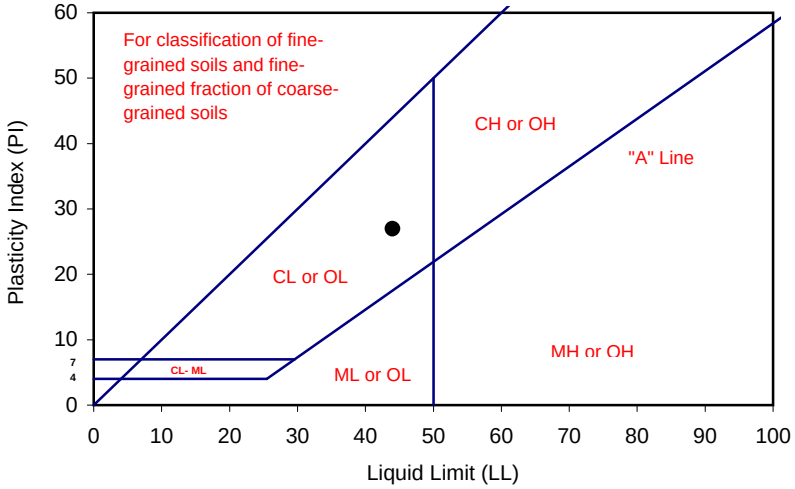
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	9.08	8.75	14.87	16.27	15.67	
Dry Wt. of Soil + Cont. (g)	7.91	7.62	10.80	11.65	11.09	
Wt. of Container (g)	1.02	1.01	1.04	1.03	1.07	
Moisture Content (%) [Wn]	16.98	17.10	41.70	43.50	45.71	

Liquid Limit	**44**
Plastic Limit	**17**
Plasticity Index	**27**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 17.52

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



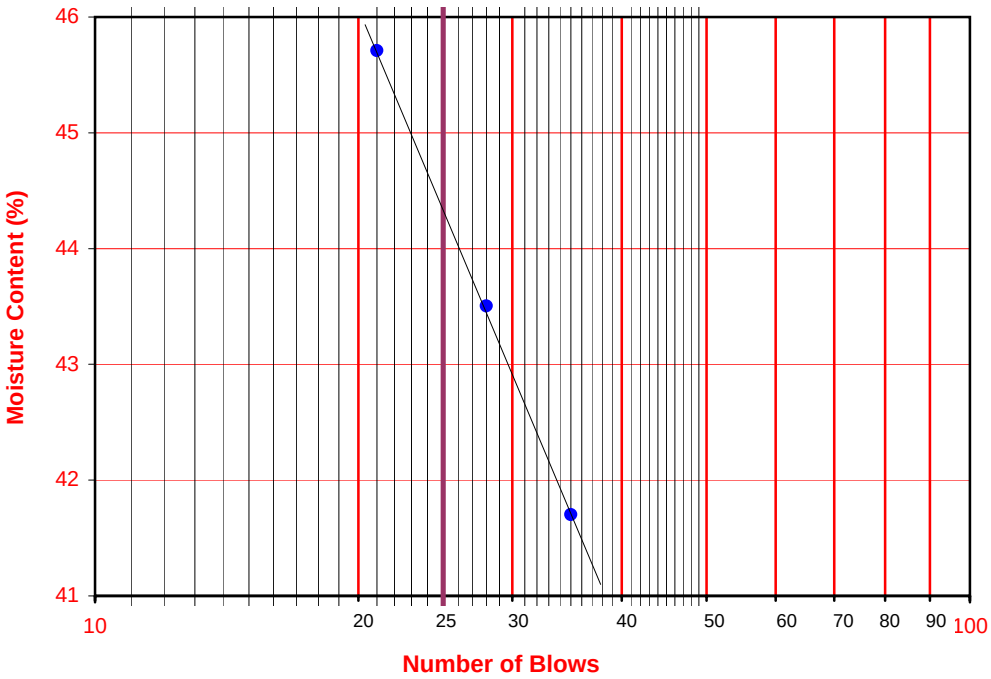
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/15/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/19/08
Boring No.:	A-08-012	Checked By:	LF		
Sample No.:	D-9	Depth (ft.)	45.0		
Soil Identification:	Olive brown lean clay (CL)				

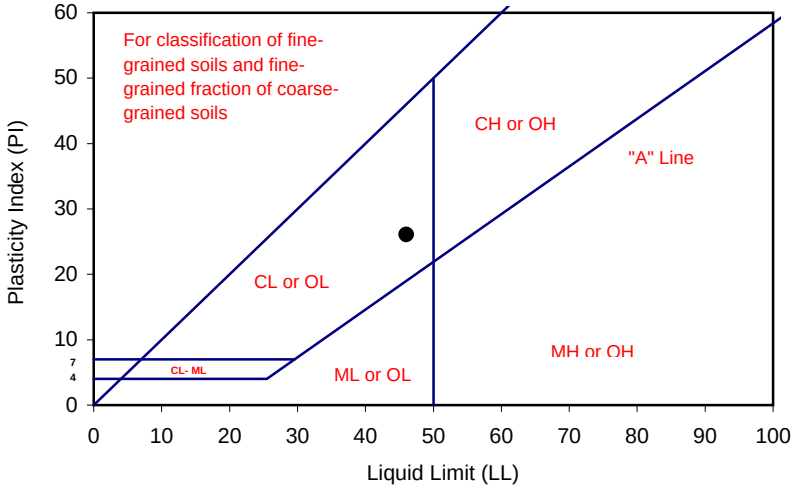
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	9.54	9.59	13.99	14.90	15.08	
Dry Wt. of Soil + Cont. (g)	8.14	8.17	10.07	10.57	10.57	
Wt. of Container (g)	1.08	1.07	1.10	1.07	1.10	
Moisture Content (%) [Wn]	19.83	20.00	43.70	45.58	47.62	

Liquid Limit	**46**
Plastic Limit	**20**
Plasticity Index	**26**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 18.98

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



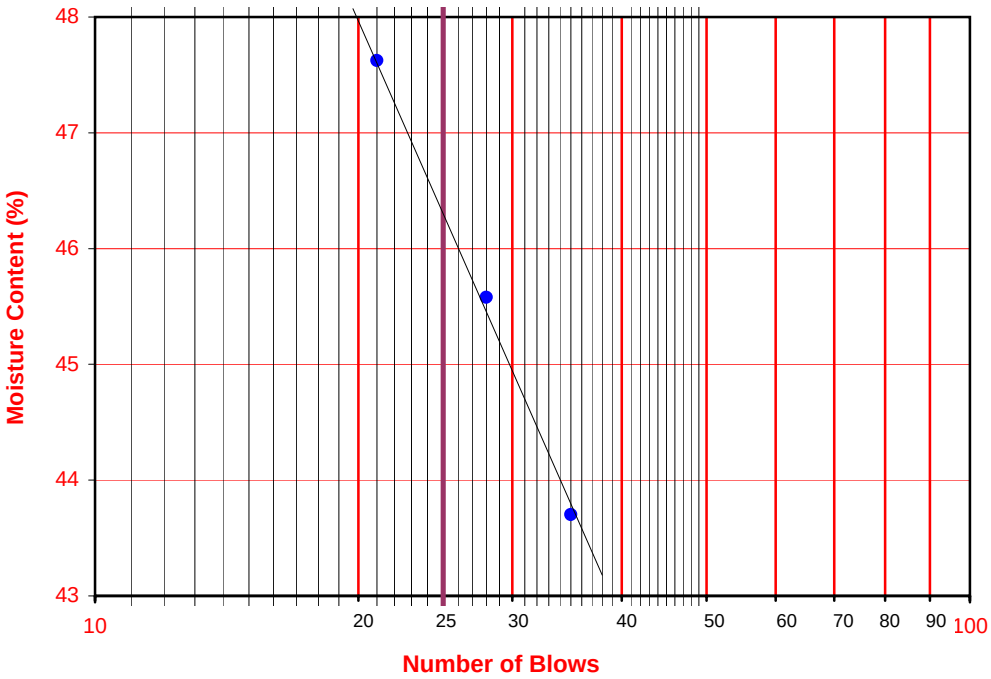
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/15/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/19/08
Boring No.:	A-08-012	Checked By:	LF		
Sample No.:	D-11	Depth (ft.)	55.0		
Soil Identification:	Yellow lean clay with sand (CL)s				

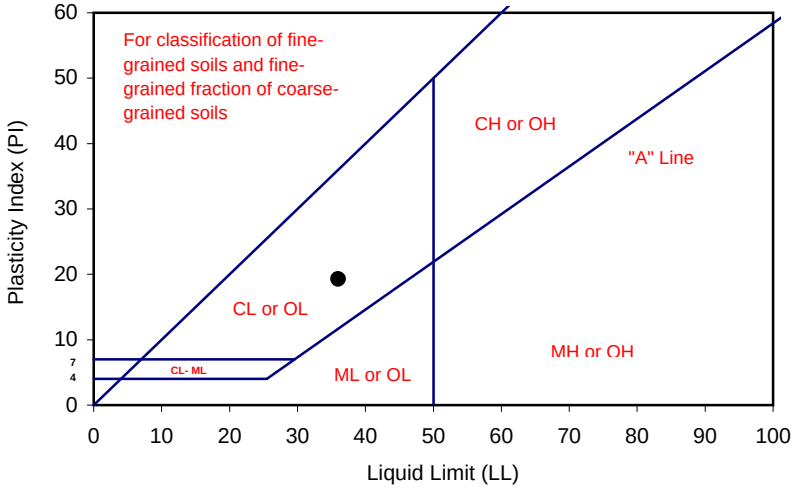
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	8.92	8.71	13.93	13.65	14.81	
Dry Wt. of Soil + Cont. (g)	7.78	7.63	10.65	10.34	11.08	
Wt. of Container (g)	1.04	1.08	1.08	1.13	1.10	
Moisture Content (%) [Wn]	16.91	16.49	34.27	35.94	37.37	

Liquid Limit	**36**
Plastic Limit	**17**
Plasticity Index	**19**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 11.68

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



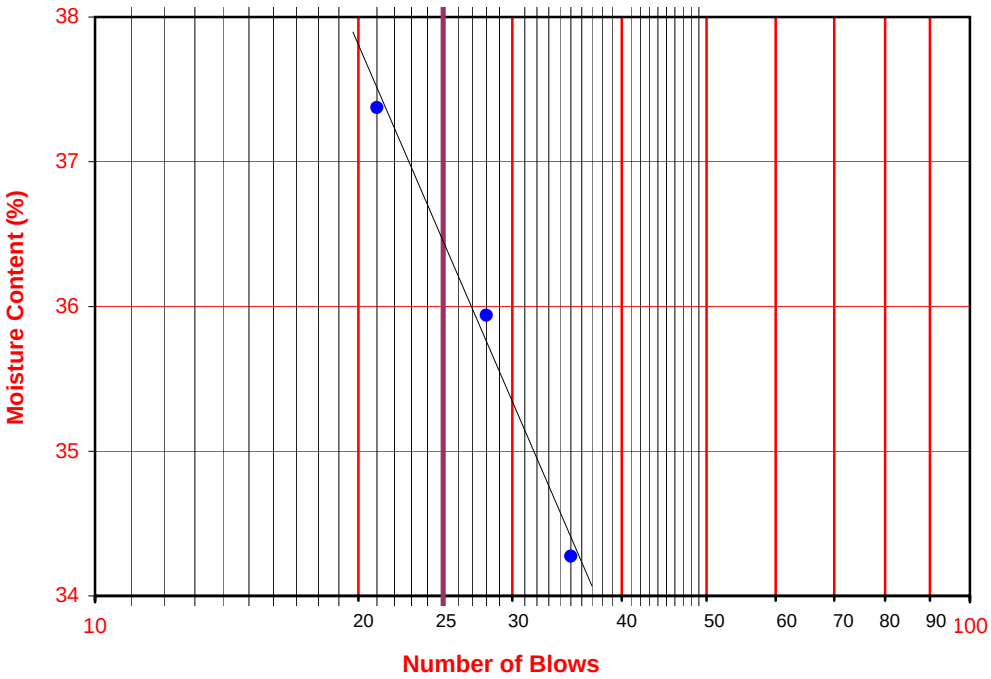
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	09/03/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/04/08
Boring No.:	A-08-012	Checked By:	LF		
Sample No.:	D-13	Depth (ft.)	65.0		
Soil Identification:	Olive brown fat clay (CH)				

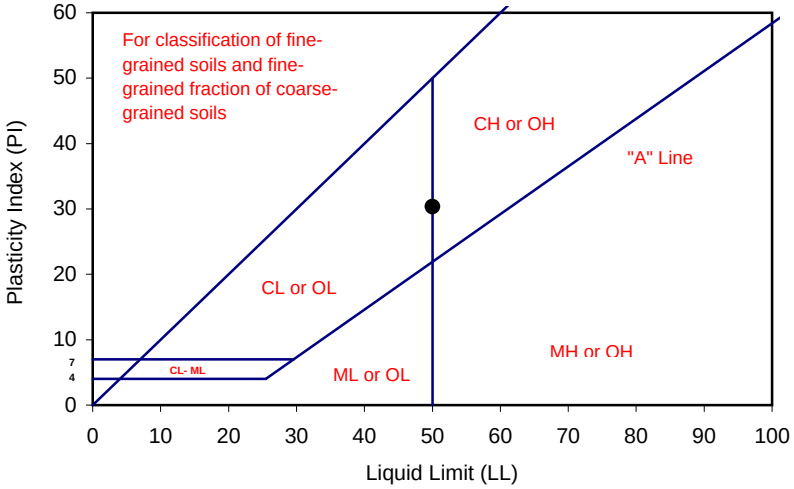
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			29	22	16	
Wet Wt. of Soil + Cont. (g)	10.13	10.24	18.27	15.99	16.20	
Dry Wt. of Soil + Cont. (g)	8.64	8.73	12.60	10.97	11.03	
Wt. of Container (g)	1.01	1.09	1.02	1.04	1.06	
Moisture Content (%) [Wn]	19.53	19.76	48.96	50.55	51.86	

Liquid Limit	**50**
Plastic Limit	**20**
Plasticity Index	**30**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 21.9

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



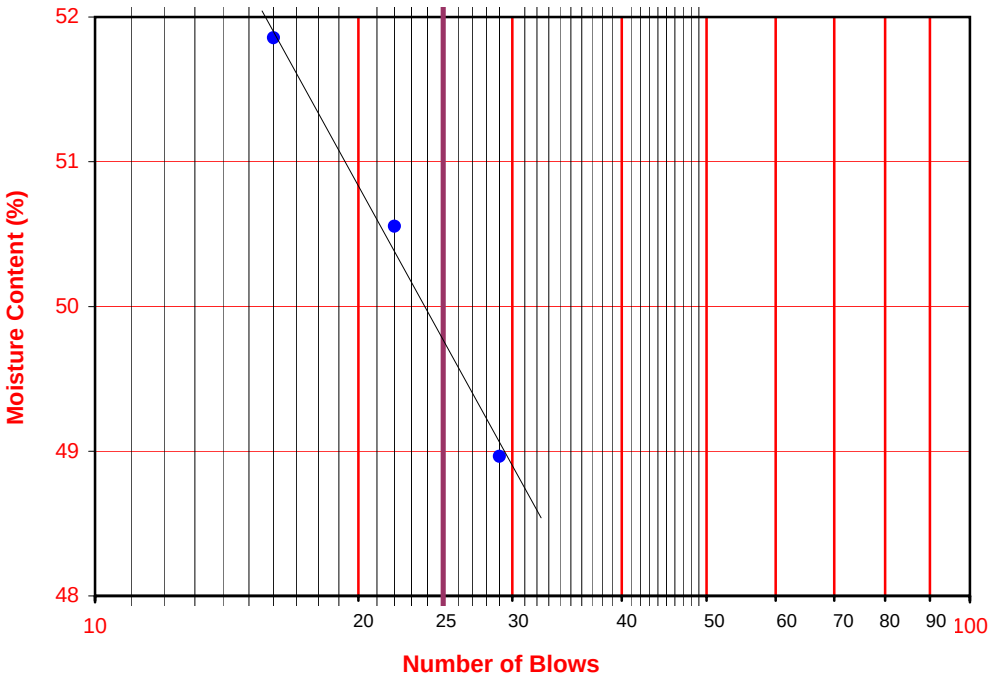
PROCEDURES USED

[ ] 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:	08/26/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/27/08
Boring No.:	A-08-013	Checked By:	LF		
Sample No.:	S-2	Depth (ft.)	10.0		
Soil Identification:	Gray lean clay (CL)				

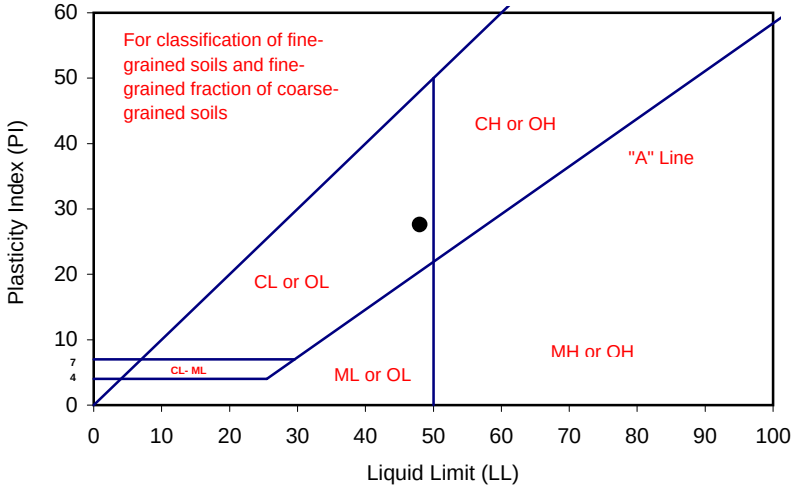
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	23	17	
Wet Wt. of Soil + Cont. (g)	9.89	8.78	19.47	19.98	20.10	
Dry Wt. of Soil + Cont. (g)	8.38	7.48	13.64	13.82	13.77	
Wt. of Container (g)	1.02	1.08	1.07	1.10	1.02	
Moisture Content (%) [Wn]	20.52	20.31	46.38	48.43	49.65	

Liquid Limit	**48**
Plastic Limit	**20**
Plasticity Index	**28**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 20.44

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



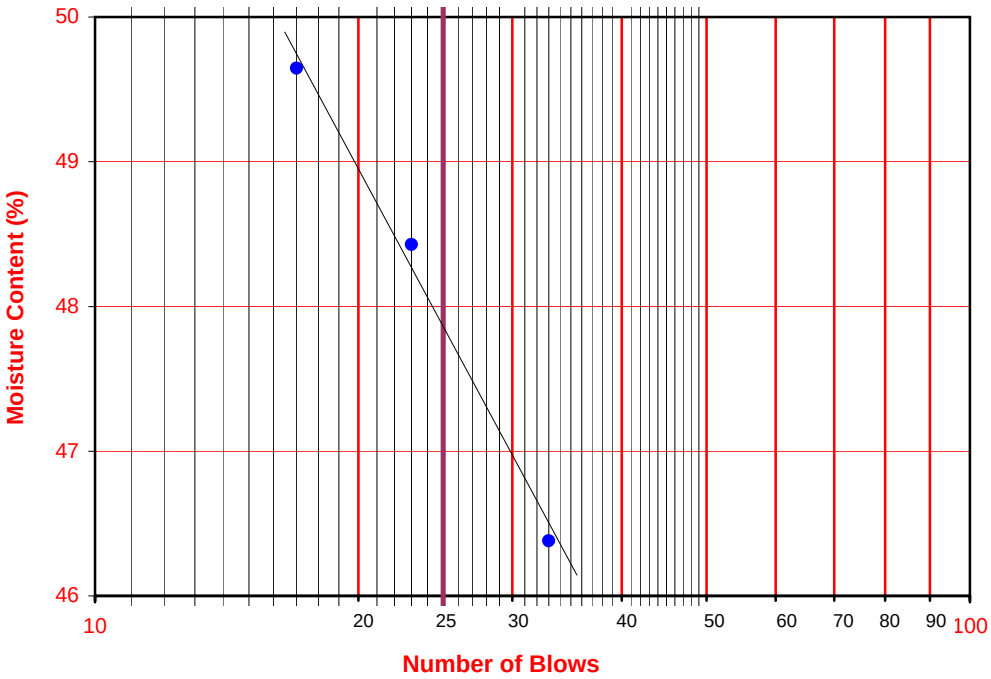
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/25/08
Project No. :	370900.02.GE.0S	Input By:	J. Ward	Date:	09/26/08
Boring No.:	A-08-013	Checked By:	J. Ward		
Sample No.:	D-3	Depth (ft.)	15.0		
Soil Identification:	Olive gray fat clay with sand (CH)s and caliche				

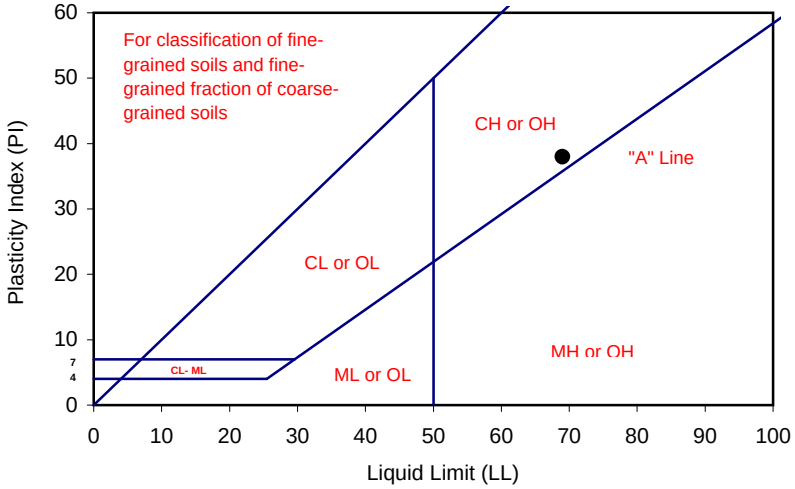
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	28	21	16
Wet Wt. of Soil + Cont. (g)	10.96	10.82	13.58	13.77	12.87	12.33
Dry Wt. of Soil + Cont. (g)	8.61	8.52	8.54	8.59	7.98	7.59
Wt. of Container (g)	1.04	1.10	1.04	1.04	1.04	1.04
Moisture Content (%) [Wn]	31.04	31.00	67.20	68.61	70.46	72.37

Liquid Limit	**69**
Plastic Limit	**31**
Plasticity Index	**38**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 35.77

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



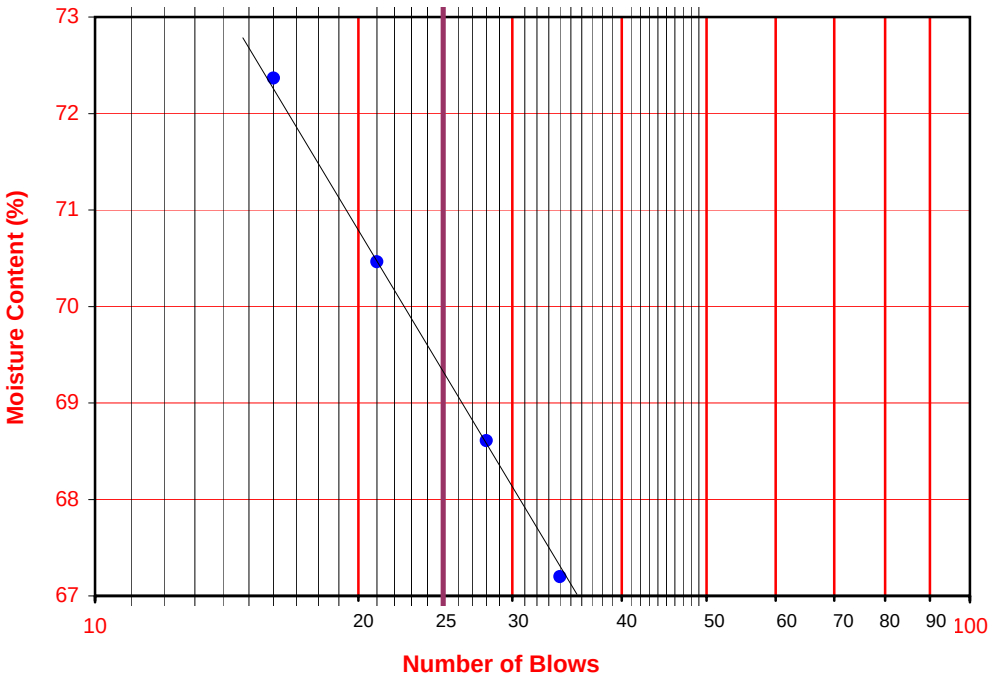
PROCEDURES USED

[ ] 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:	09/04/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/10/08
Boring No.:	A-08-013	Checked By:	LF		
Sample No.:	Bag-1	Depth (ft.)	15-20		
Soil Identification:	Olive fat clay with sand (CH)s				

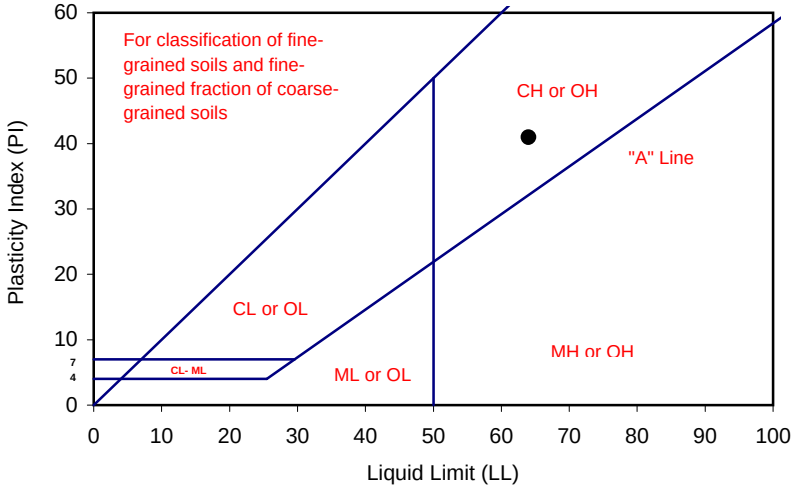
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			30	22	15	
Wet Wt. of Soil + Cont. (g)	8.61	8.84	20.52	20.91	22.92	
Dry Wt. of Soil + Cont. (g)	7.19	7.38	13.02	13.06	14.04	
Wt. of Container (g)	1.04	1.04	1.00	1.02	1.09	
Moisture Content (%) [Wn]	23.09	23.03	62.40	65.20	68.57	

Liquid Limit	**64**
Plastic Limit	**23**
Plasticity Index	**41**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 32.12

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



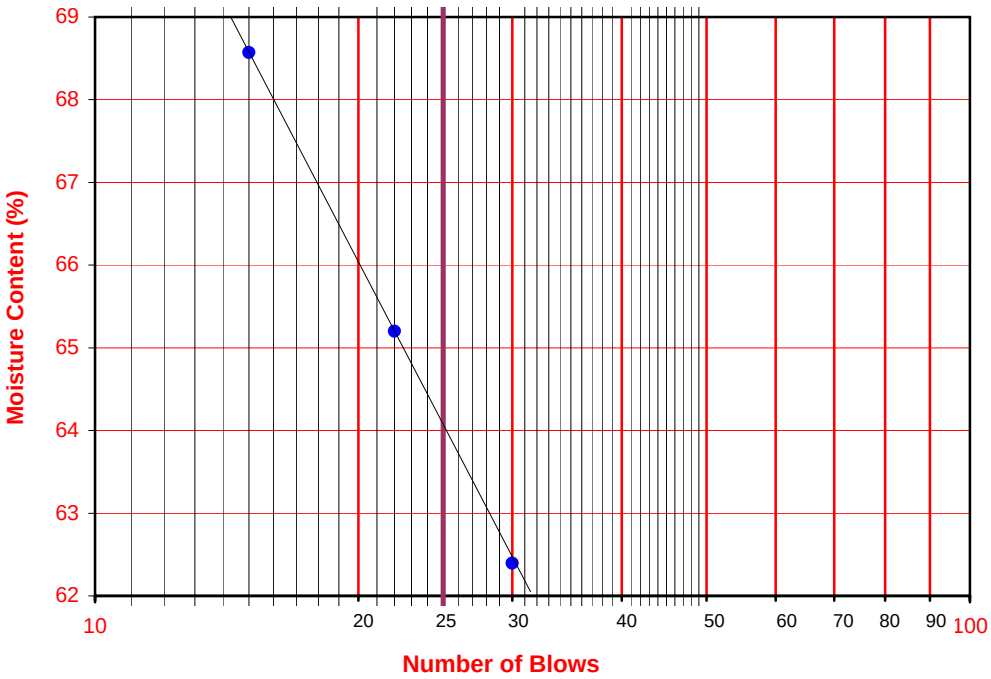
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/18/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/19/08
Boring No.:	A-08-013	Checked By:	LF		
Sample No.:	D-5	Depth (ft.)	25.0		
Soil Identification:	Olive lean clay (CL)				

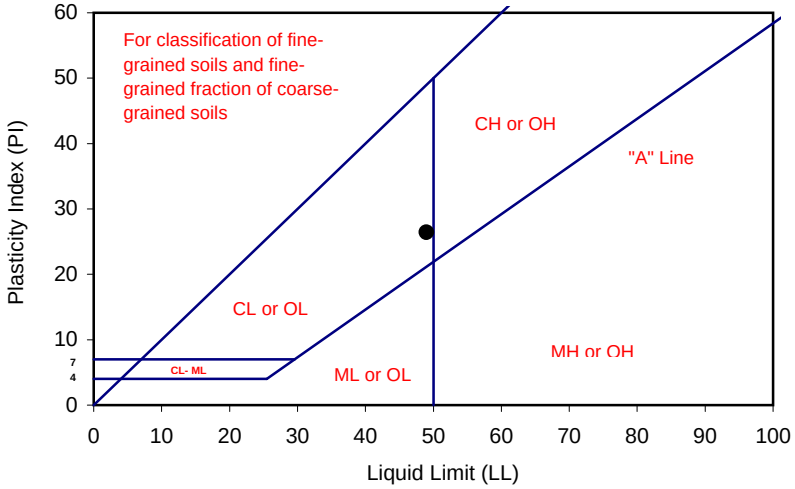
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			29	22	15	
Wet Wt. of Soil + Cont. (g)	11.34	10.83	13.67	15.51	14.24	
Dry Wt. of Soil + Cont. (g)	9.45	9.03	9.55	10.67	9.67	
Wt. of Container (g)	1.06	1.07	1.04	1.01	1.01	
Moisture Content (%) [Wn]	22.53	22.61	48.41	50.10	52.77	

Liquid Limit	**49**
Plastic Limit	**23**
Plasticity Index	**26**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 21.17

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



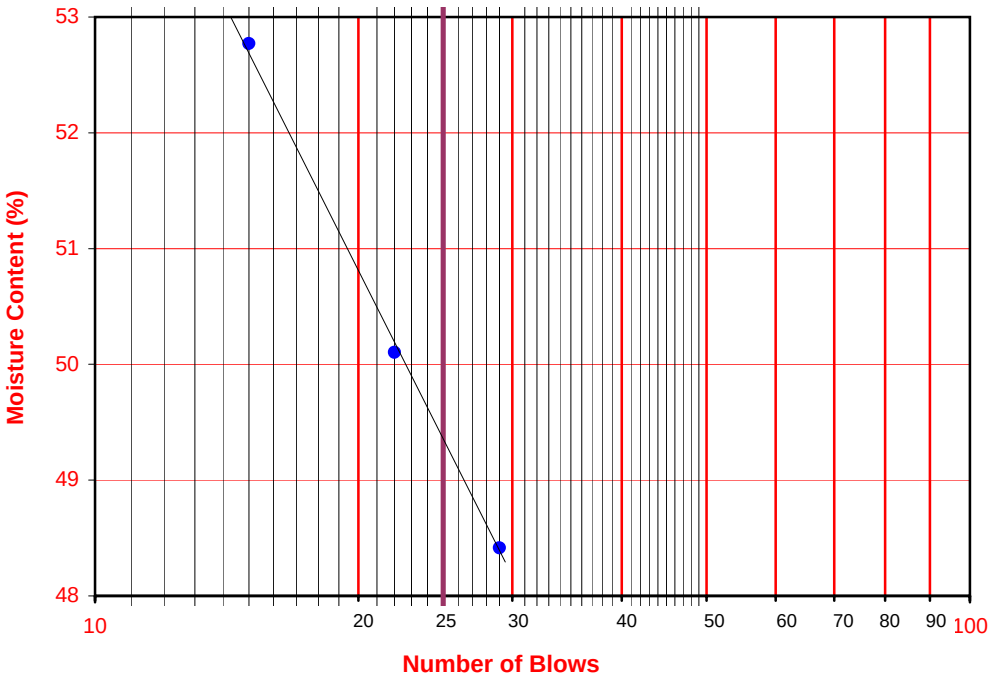
PROCEDURES USED

[ ] 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:	09/04/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/10/08
Boring No.:	A-08-013	Checked By:	LF		
Sample No.:	Bag-2	Depth (ft.)	25-30		
Soil Identification:	Olive fat clay (CH)				

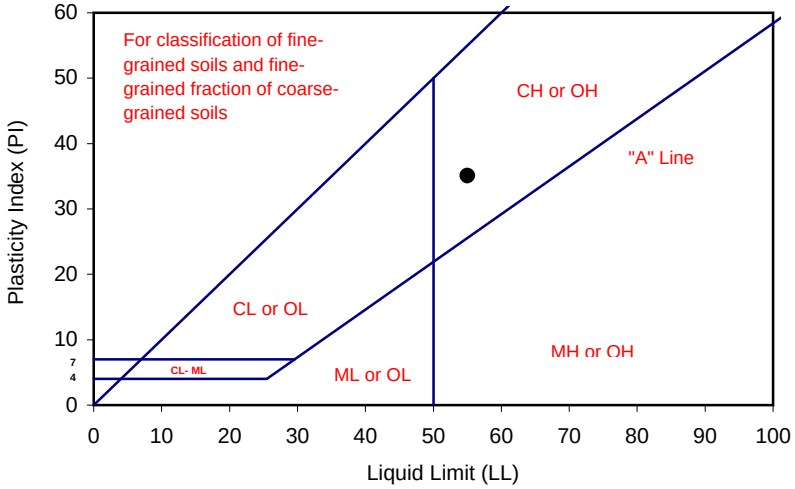
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			29	24	16	
Wet Wt. of Soil + Cont. (g)	9.58	10.03	21.25	20.47	20.75	
Dry Wt. of Soil + Cont. (g)	8.16	8.53	14.18	13.55	13.58	
Wt. of Container (g)	1.04	1.00	1.04	1.00	1.04	
Moisture Content (%) [Wn]	19.94	19.92	53.81	55.14	57.18	

Liquid Limit	**55**
Plastic Limit	**20**
Plasticity Index	**35**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 25.55

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



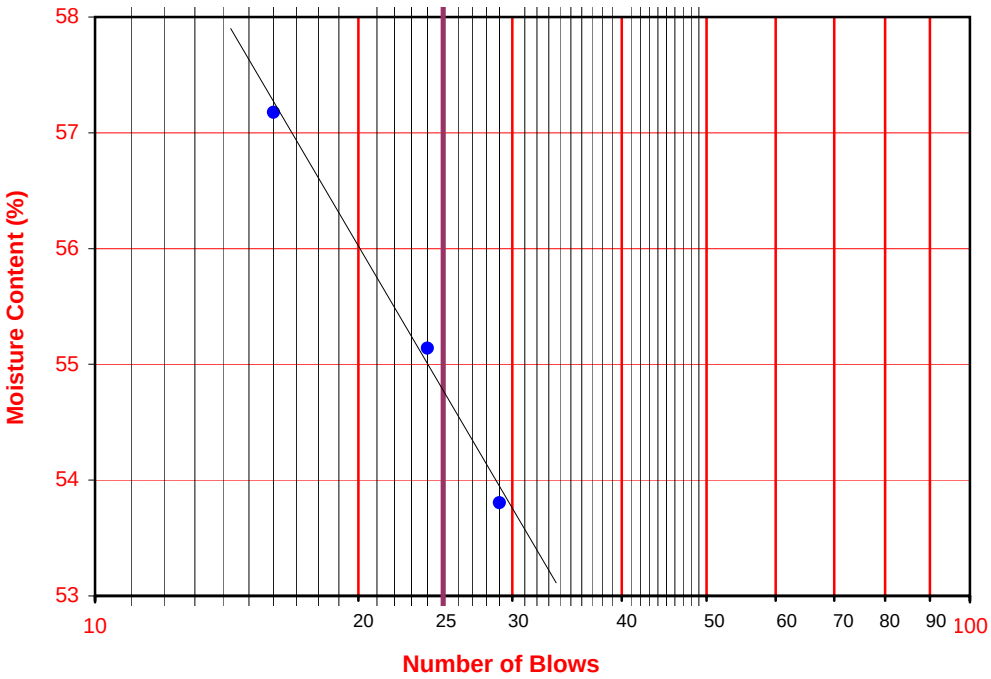
PROCEDURES USED

[ ] 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:	08/27/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/28/08
Boring No.:	A-08-013	Checked By:	LF		
Sample No.:	D-7	Depth (ft.)	35.0		
Soil Identification:	Olive brown fat clay (CH)				

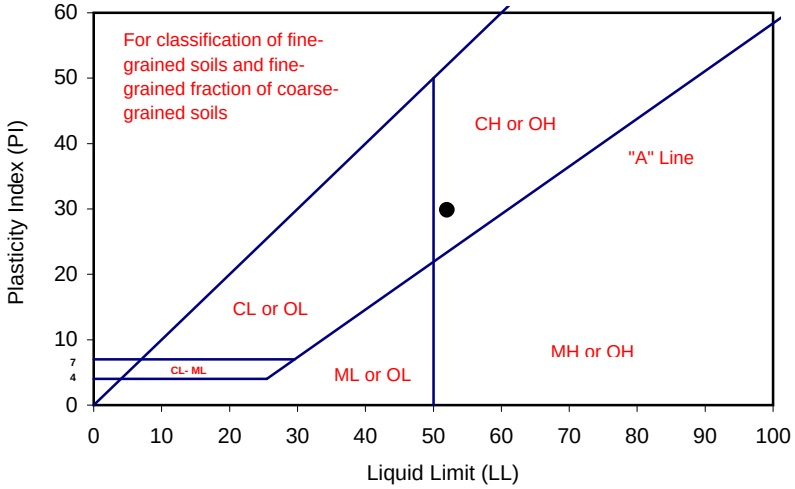
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	29	22	
Wet Wt. of Soil + Cont. (g)	10.32	10.08	19.60	18.89	19.47	
Dry Wt. of Soil + Cont. (g)	8.63	8.44	13.41	12.85	13.11	
Wt. of Container (g)	1.03	1.02	1.05	1.01	1.05	
Moisture Content (%) [Wn]	22.24	22.10	50.08	51.01	52.74	

Liquid Limit	**52**
Plastic Limit	**22**
Plasticity Index	**30**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 23.36

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



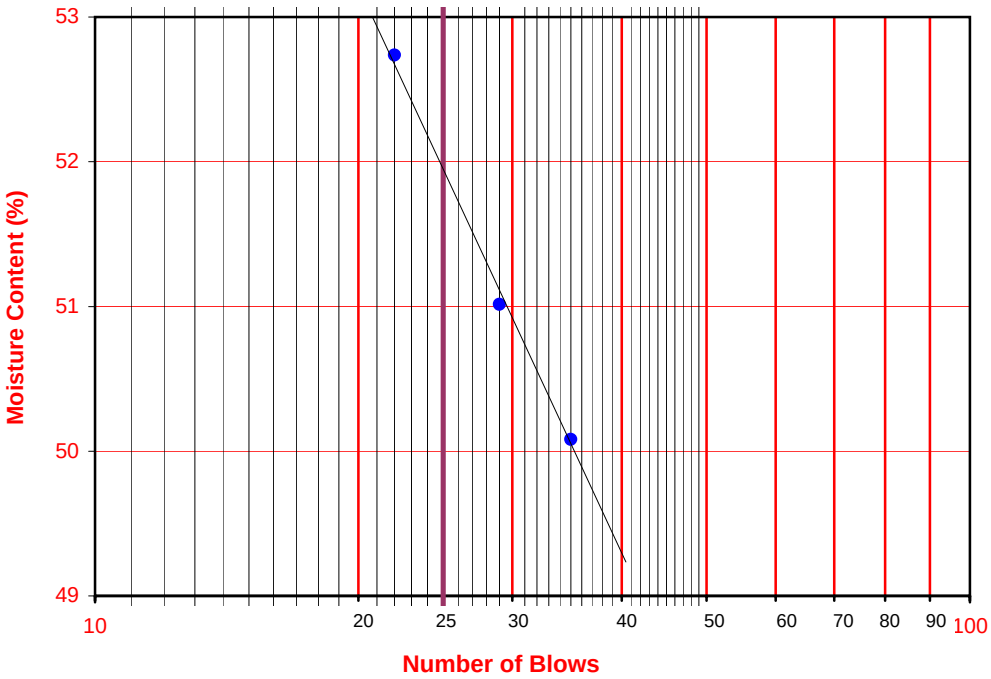
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/28/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/02/08
Boring No.:	A-08-013	Checked By:	LF		
Sample No.:	D-11	Depth (ft.)	55.0		
Soil Identification:	Yellowish brown sandy lean clay s(CL)				

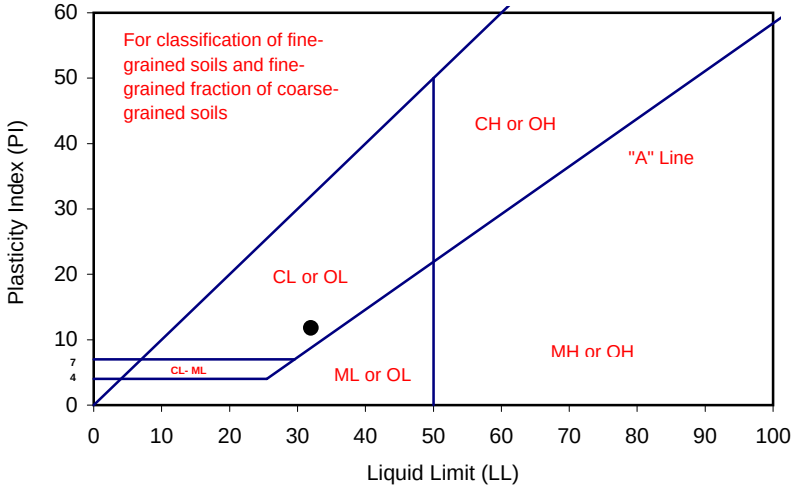
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			27	21	15	
Wet Wt. of Soil + Cont. (g)	10.79	10.76	16.50	16.68	15.26	
Dry Wt. of Soil + Cont. (g)	9.14	9.14	12.83	12.85	11.67	
Wt. of Container (g)	1.03	1.08	1.04	1.01	1.11	
Moisture Content (%) [Wn]	20.35	20.10	31.13	32.35	34.00	

Liquid Limit	**32**
Plastic Limit	**20**
Plasticity Index	**12**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.76

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



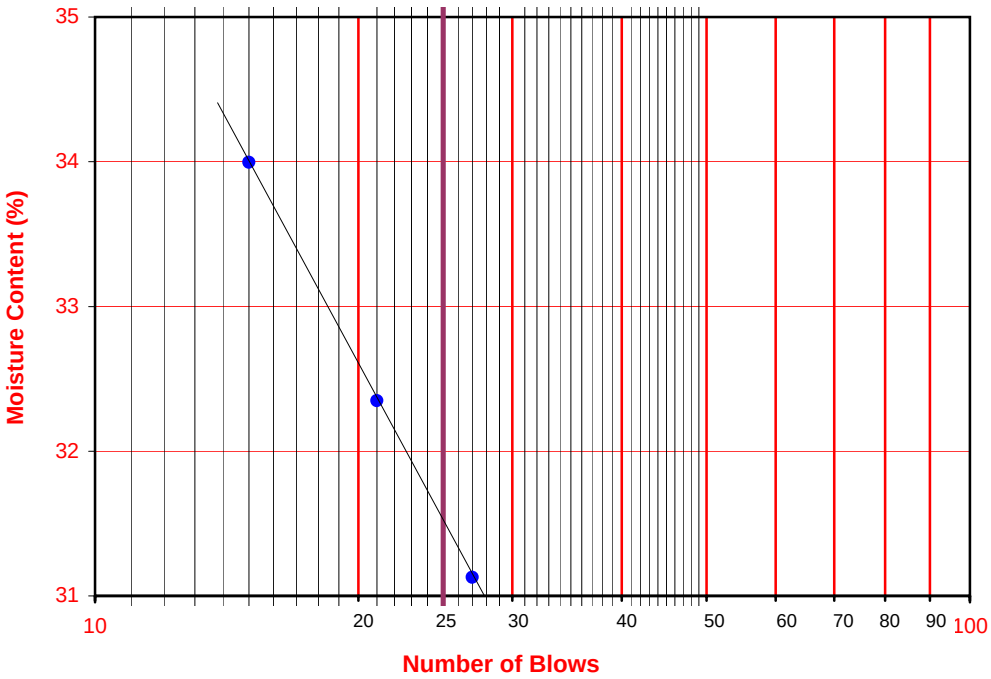
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/25/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/26/08
Boring No.:	A-08-013	Checked By:	LF		
Sample No.:	S-12	Depth (ft.)	60.0		
Soil Identification:	Light olive brown sandy lean clay s(CL)				

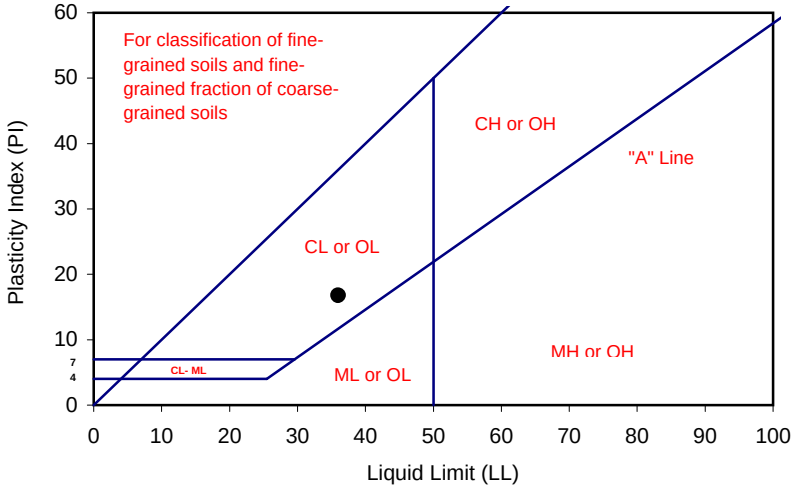
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	28	20	15
Wet Wt. of Soil + Cont. (g)	12.70	13.19	14.48	13.71	15.14	15.03
Dry Wt. of Soil + Cont. (g)	10.83	11.24	11.04	10.38	11.34	11.18
Wt. of Container (g)	1.07	1.10	1.02	1.07	1.04	1.07
Moisture Content (%) [Wn]	19.16	19.23	34.33	35.77	36.89	38.08

Liquid Limit	**36**
Plastic Limit	**19**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 11.68

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



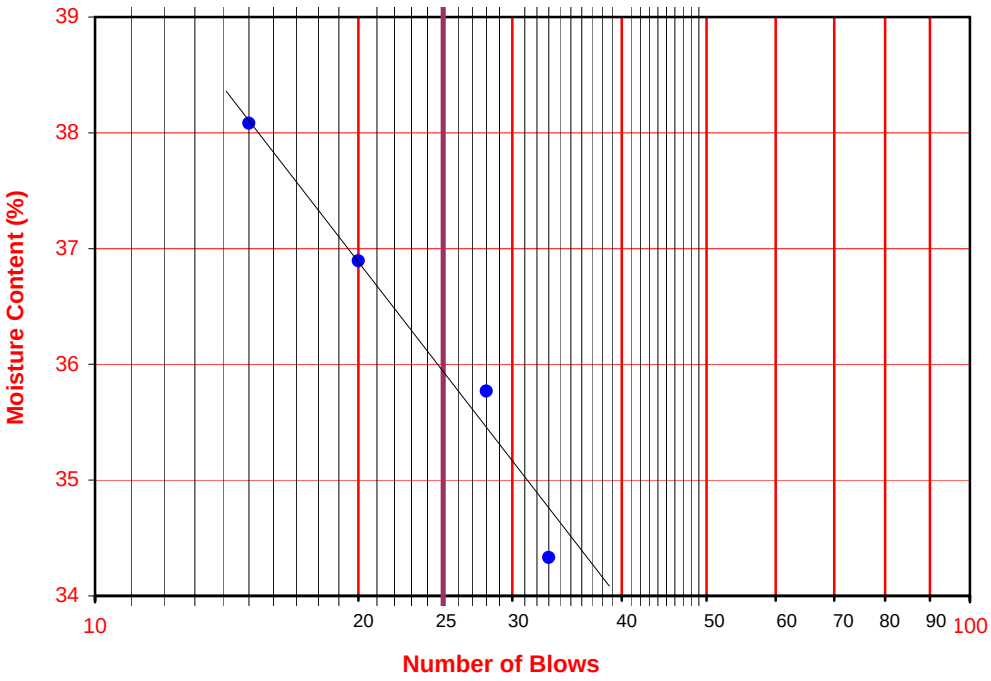
PROCEDURES USED

[ ] 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:	08/28/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/29/08
Boring No.:	A-08-013	Checked By:	LF		
Sample No.:	S-14	Depth (ft.)	70.0		
Soil Identification:	Olive brown lean clay (CL)				

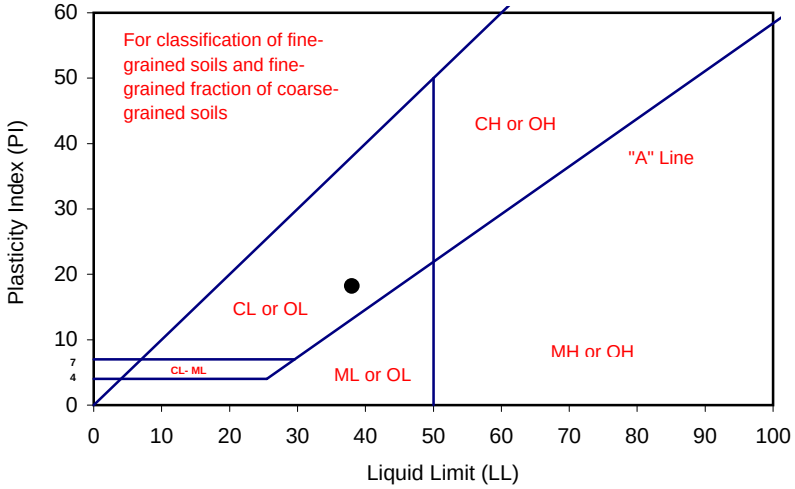
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	22	16	
Wet Wt. of Soil + Cont. (g)	8.92	9.19	20.48	22.29	21.52	
Dry Wt. of Soil + Cont. (g)	7.63	7.84	15.18	16.36	15.60	
Wt. of Container (g)	1.09	1.05	1.02	1.00	1.01	
Moisture Content (%) [Wn]	19.72	19.88	37.43	38.61	40.58	

Liquid Limit	**38**
Plastic Limit	**20**
Plasticity Index	**18**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 13.14

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



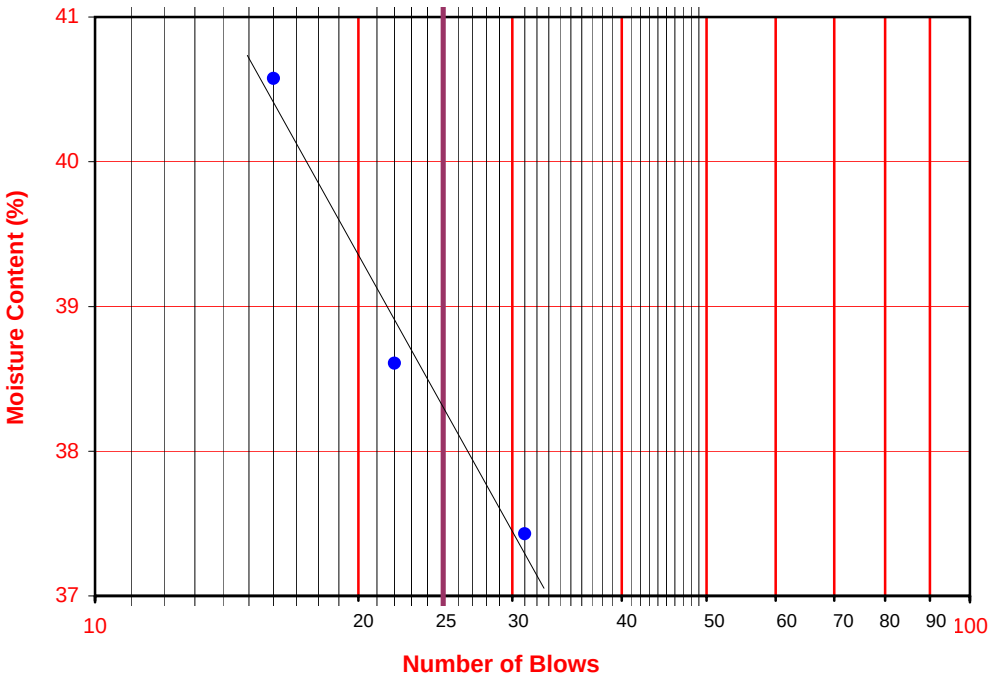
PROCEDURES USED

[ ] 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:	09/03/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/04/08
Boring No.:	A-08-014	Checked By:	LF		
Sample No.:	S-6	Depth (ft.)	30.0		
Soil Identification:	Olive fat clay (CH)				

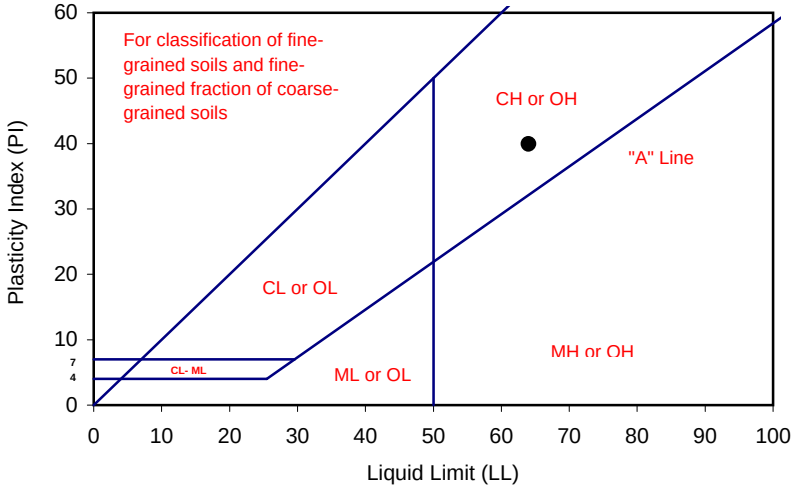
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	29	21	18
Wet Wt. of Soil + Cont. (g)	9.39	9.33	20.92	19.10	20.24	19.49
Dry Wt. of Soil + Cont. (g)	7.78	7.72	13.33	12.09	12.65	12.09
Wt. of Container (g)	1.06	1.05	1.04	1.01	1.06	1.04
Moisture Content (%) [Wn]	23.96	24.14	61.76	63.27	65.49	66.97

Liquid Limit	**64**
Plastic Limit	**24**
Plasticity Index	**40**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 32.12

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



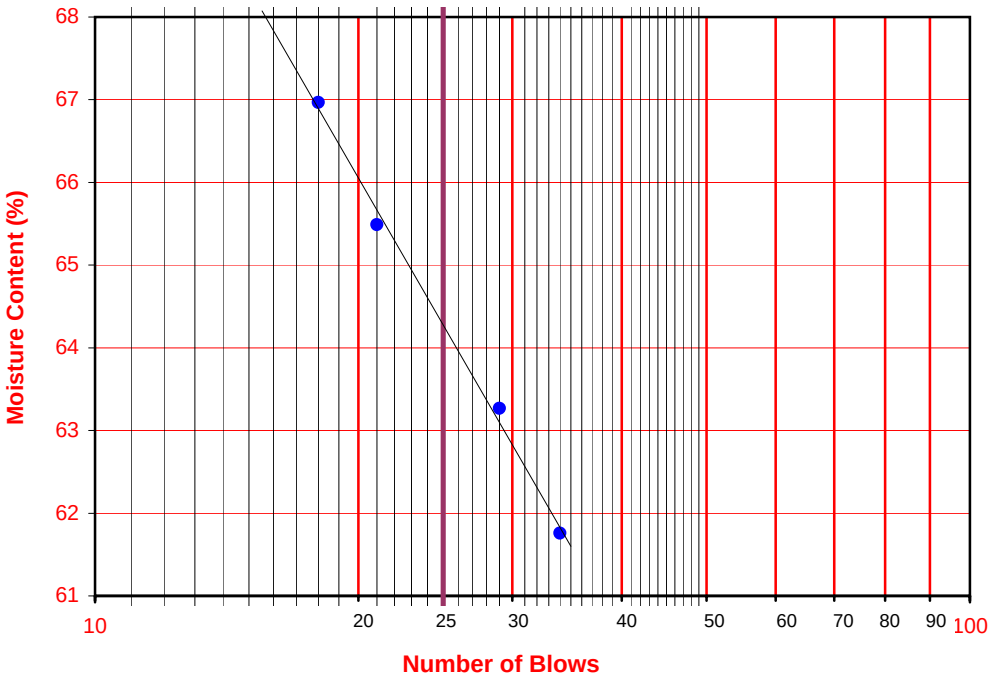
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/09/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/10/08
Boring No.:	A-08-015	Checked By:	LF		
Sample No.:	Bag-1	Depth (ft.)	0-7		
Soil Identification:	Dark brown lean clay with sand (CL)s				

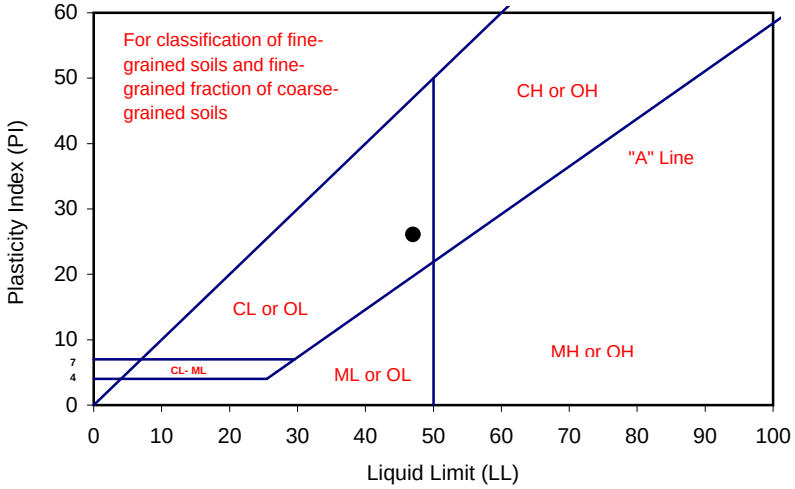
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	22	16	
Wet Wt. of Soil + Cont. (g)	11.88	12.15	15.71	13.50	15.13	
Dry Wt. of Soil + Cont. (g)	10.01	10.23	11.09	9.48	10.47	
Wt. of Container (g)	1.07	1.06	1.06	1.04	1.06	
Moisture Content (%) [Wn]	20.92	20.94	46.06	47.63	49.52	

Liquid Limit	**47**
Plastic Limit	**21**
Plasticity Index	**26**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 19.71

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



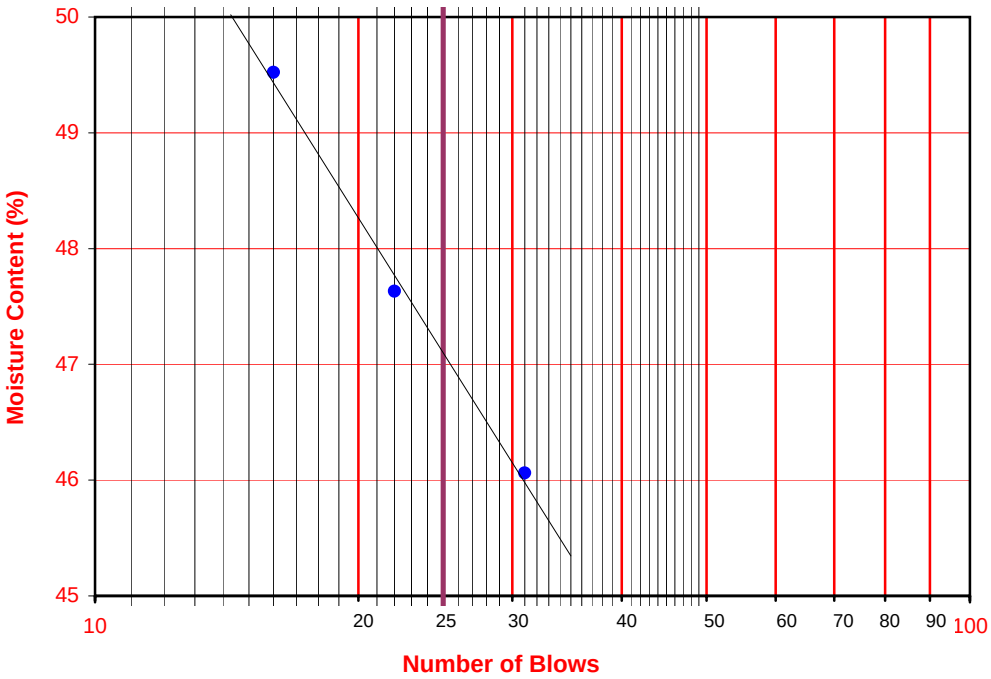
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/25/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/26/08
Boring No.:	A-08-015	Checked By:	LF		
Sample No.:	D-1	Depth (ft.)	5.0		
Soil Identification:	Pale olive fat clay (CH)				

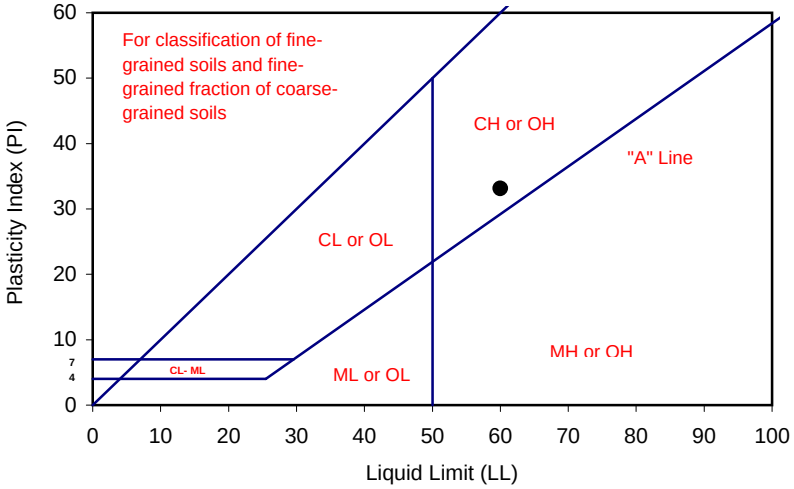
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	27	20	
Wet Wt. of Soil + Cont. (g)	12.06	11.43	14.41	14.00	15.28	
Dry Wt. of Soil + Cont. (g)	9.73	9.23	9.56	9.20	9.83	
Wt. of Container (g)	1.05	1.05	1.07	1.08	1.04	
Moisture Content (%) [Wn]	26.84	26.89	57.13	59.11	62.00	

Liquid Limit	**60**
Plastic Limit	**27**
Plasticity Index	**33**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 29.2

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



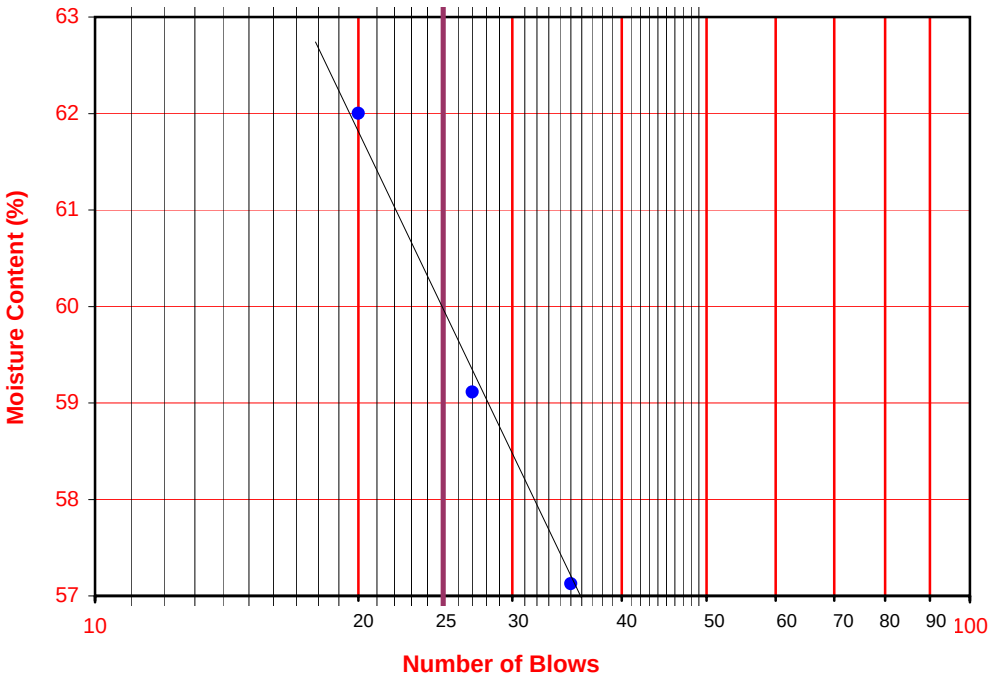
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/29/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/02/08
Boring No.:	A-08-015	Checked By:	LF		
Sample No.:	D-3	Depth (ft.)	15.0		
Soil Identification:	Yellowish brown lean clay (CL) with caliche				

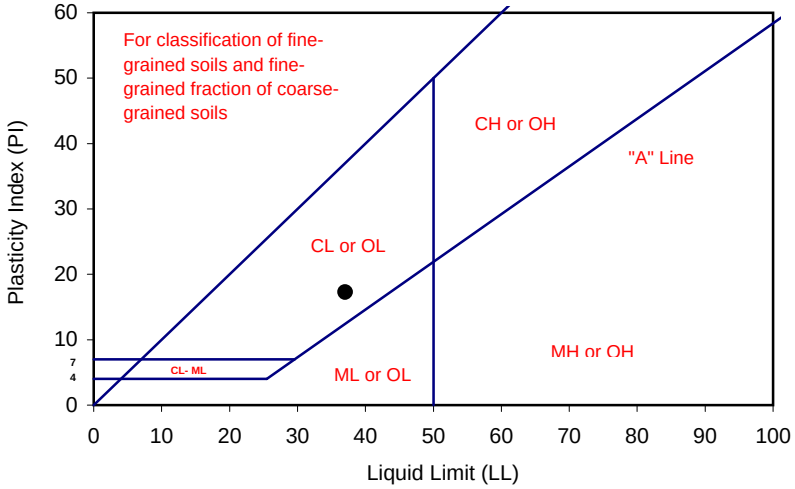
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	9.45	10.03	14.84	17.55	16.25	
Dry Wt. of Soil + Cont. (g)	8.05	8.56	11.24	13.12	12.08	
Wt. of Container (g)	1.01	1.05	1.06	1.02	1.02	
Moisture Content (%) [Wn]	19.89	19.57	35.36	36.61	37.70	

Liquid Limit	**37**
Plastic Limit	**20**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 12.41

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



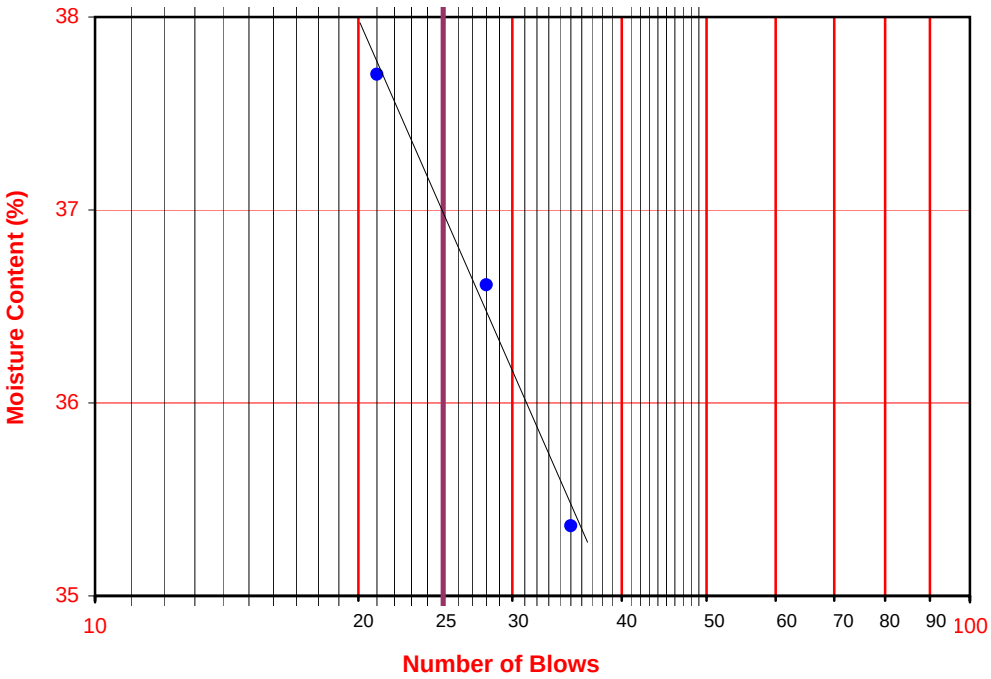
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/29/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/02/08
Boring No.:	A-08-015	Checked By:	LF		
Sample No.:	S-4	Depth (ft.)	20.0		

Soil Identification: Light olive sandy lean clay s(CL) with caliche

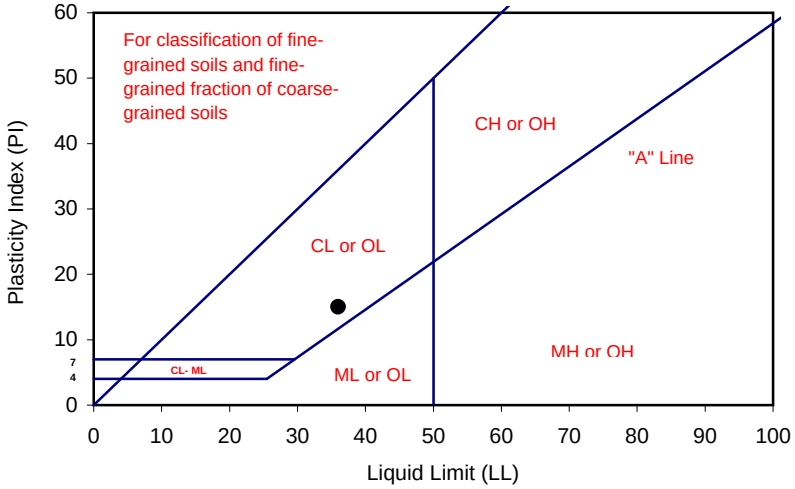
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	9.93	10.12	14.23	15.12	14.56	
Dry Wt. of Soil + Cont. (g)	8.40	8.54	10.89	11.45	10.89	
Wt. of Container (g)	1.08	1.03	1.04	1.11	1.00	
Moisture Content (%) [Wn]	20.90	21.04	33.91	35.49	37.11	

Liquid Limit	**36**
Plastic Limit	**21**
Plasticity Index	**15**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 11.68

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



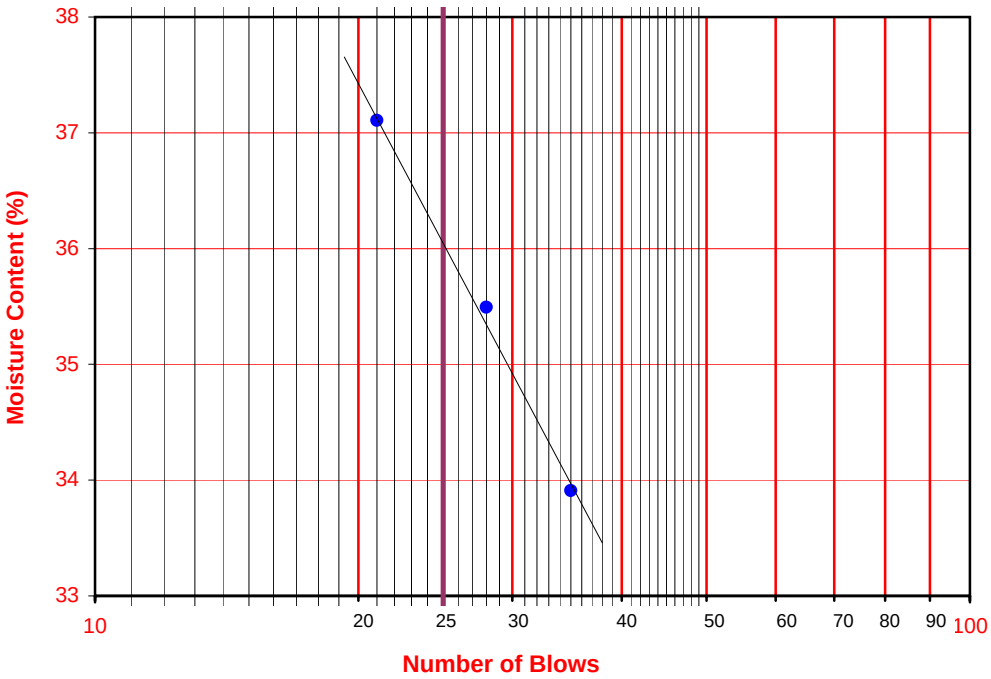
PROCEDURES USED

[ ] 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:	08/27/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/28/08
Boring No.:	A-08-015	Checked By:	LF		
Sample No.:	D-5	Depth (ft.)	25.0		
Soil Identification:	Brown fat clay (CH)				

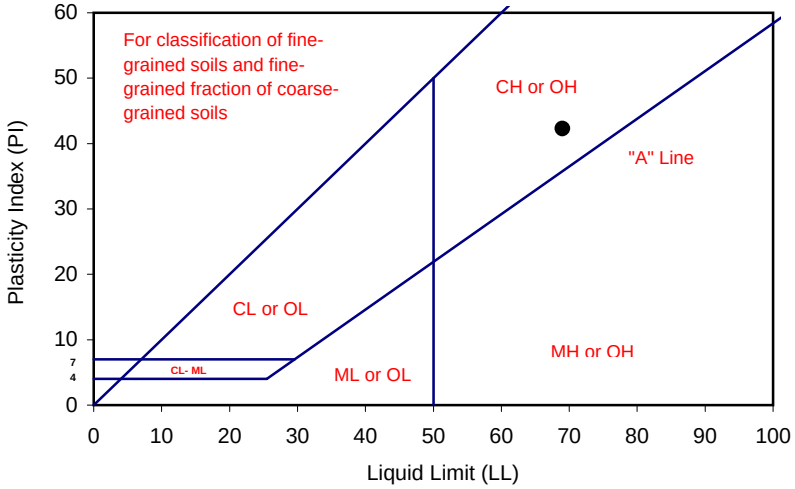
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			36	27	22	
Wet Wt. of Soil + Cont. (g)	9.53	9.39	19.73	22.45	19.93	
Dry Wt. of Soil + Cont. (g)	7.74	7.64	12.28	13.75	12.17	
Wt. of Container (g)	1.06	1.06	1.04	1.04	1.05	
Moisture Content (%) [Wn]	26.80	26.60	66.28	68.45	69.78	

Liquid Limit	**69**
Plastic Limit	**27**
Plasticity Index	**42**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 35.77

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



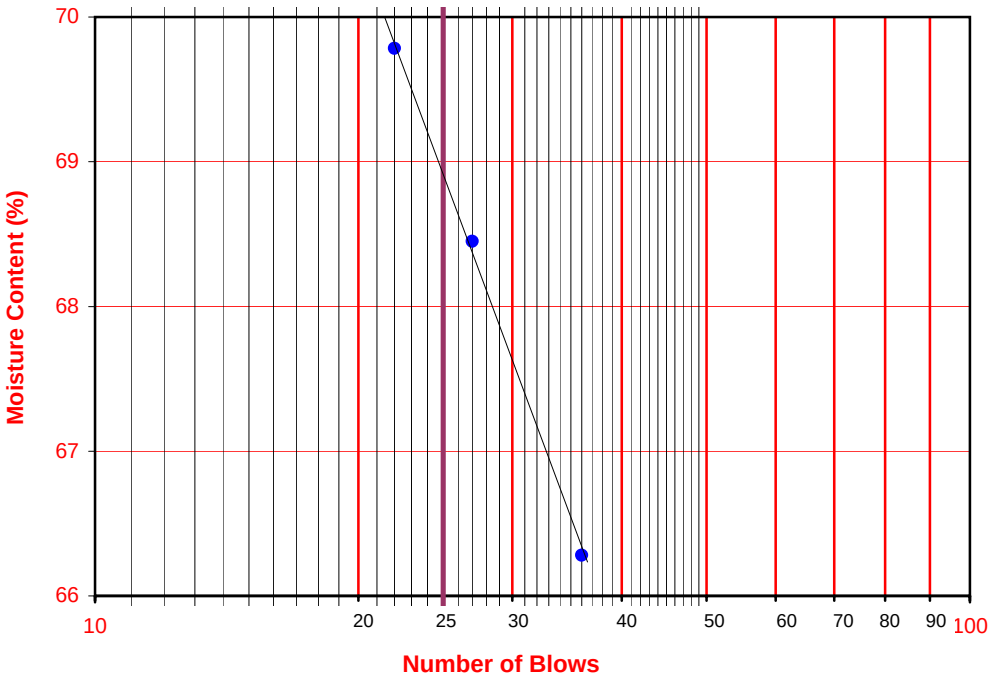
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/28/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/29/08
Boring No.:	A-08-016	Checked By:	LF		
Sample No.:	S-2	Depth (ft.)	10.0		
Soil Identification:	Brown sandy lean clay s(CL)				

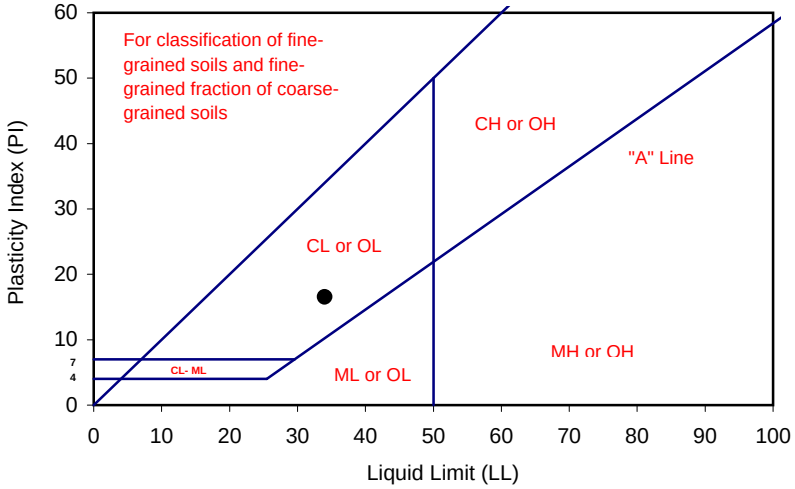
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			28	22	16	
Wet Wt. of Soil + Cont. (g)	10.19	9.83	11.88	15.38	13.66	
Dry Wt. of Soil + Cont. (g)	8.84	8.51	9.19	11.73	10.36	
Wt. of Container (g)	1.04	1.02	1.06	1.07	1.02	
Moisture Content (%) [Wn]	17.31	17.62	33.09	34.24	35.33	

Liquid Limit	**34**
Plastic Limit	**17**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 10.22

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



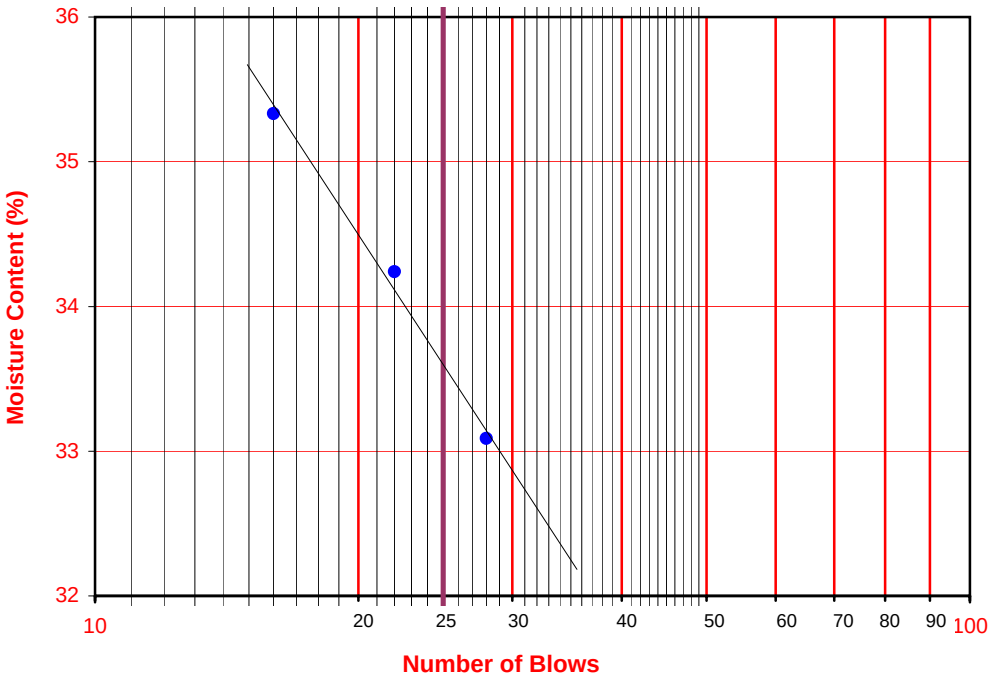
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	V. Juliano	Date:	09/04/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/10/08
Boring No.:	A-08-016	Checked By:	LF		
Sample No.:	D-3	Depth (ft.)	15.0		
Soil Identification:	Yellowish brown lean clay with sand (CL)s				

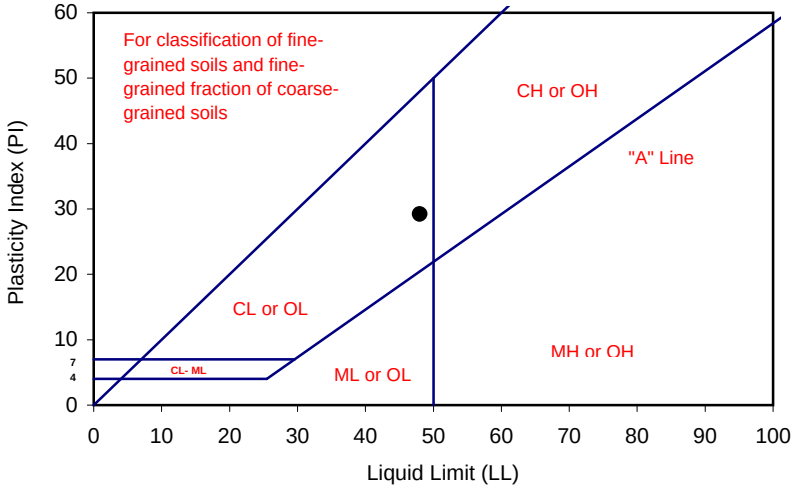
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	10.62	10.00	15.18	12.59	14.42	
Dry Wt. of Soil + Cont. (g)	9.14	8.56	10.81	8.90	10.02	
Wt. of Container (g)	1.12	1.02	1.05	1.03	1.03	
Moisture Content (%) [Wn]	18.45	19.10	44.77	46.89	48.94	

Liquid Limit	**48**
Plastic Limit	**19**
Plasticity Index	**29**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 20.44

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



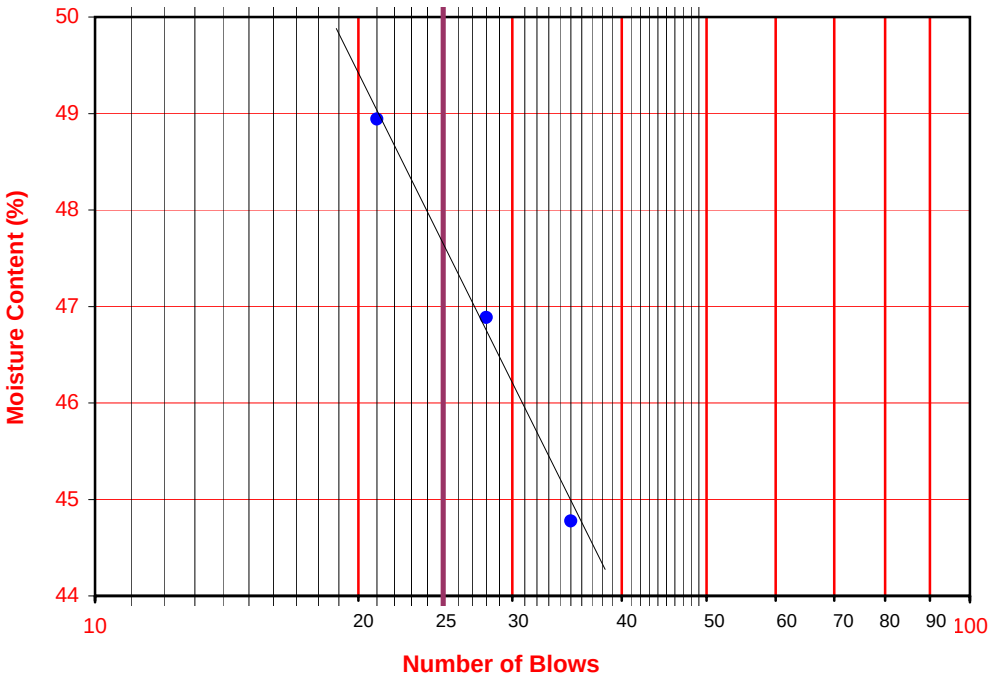
PROCEDURES USED

[ ] 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:	09/02/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/03/08
Boring No.:	A-08-016	Checked By:	LF		
Sample No.:	D-5	Depth (ft.)	25.0		

Soil Identification: Yellowish brown lean clay with sand (CL)s and caliche

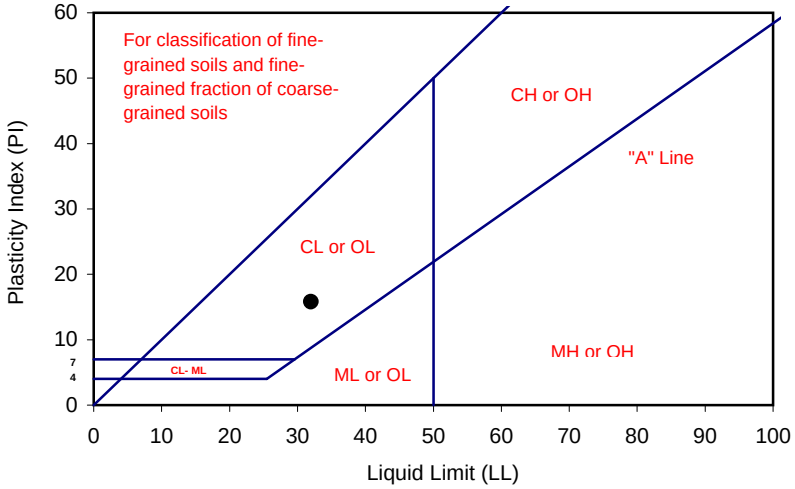
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			32	23	15	
Wet Wt. of Soil + Cont. (g)	9.04	9.28	22.55	22.42	23.21	
Dry Wt. of Soil + Cont. (g)	7.92	8.14	17.51	17.26	17.69	
Wt. of Container (g)	1.05	1.06	1.05	1.07	1.06	
Moisture Content (%) [Wn]	16.30	16.10	30.62	31.87	33.19	

Liquid Limit	**32**
Plastic Limit	**16**
Plasticity Index	**16**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.76

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



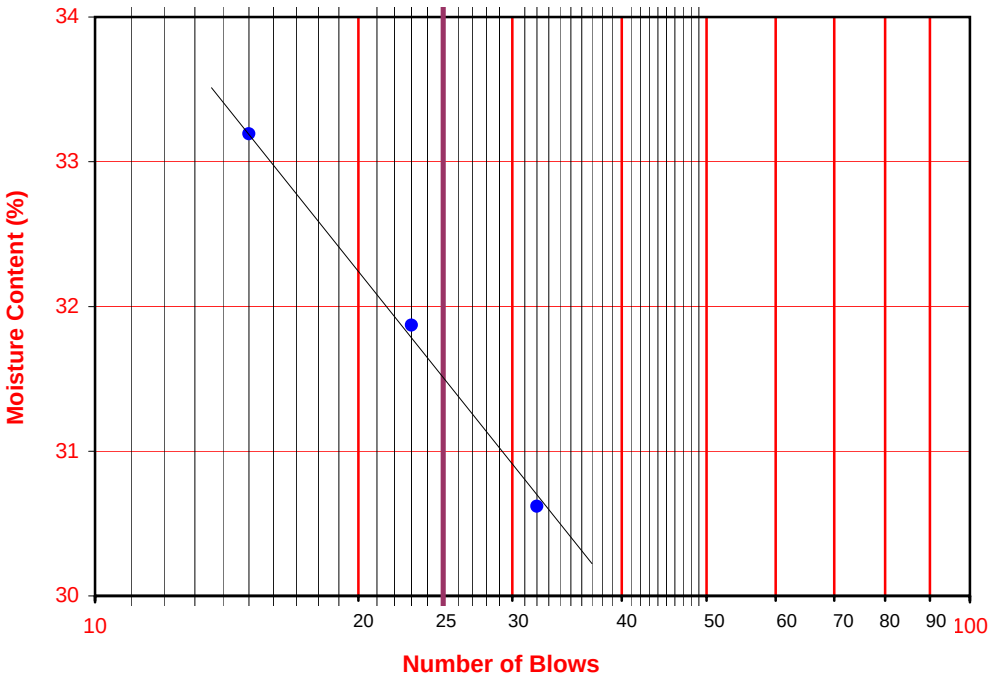
PROCEDURES USED

[ ] 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:	08/26/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/27/08
Boring No.:	A-08-016	Checked By:	LF		
Sample No.:	D-9	Depth (ft.)	45.0		
Soil Identification:	Brown lean clay (CL)				

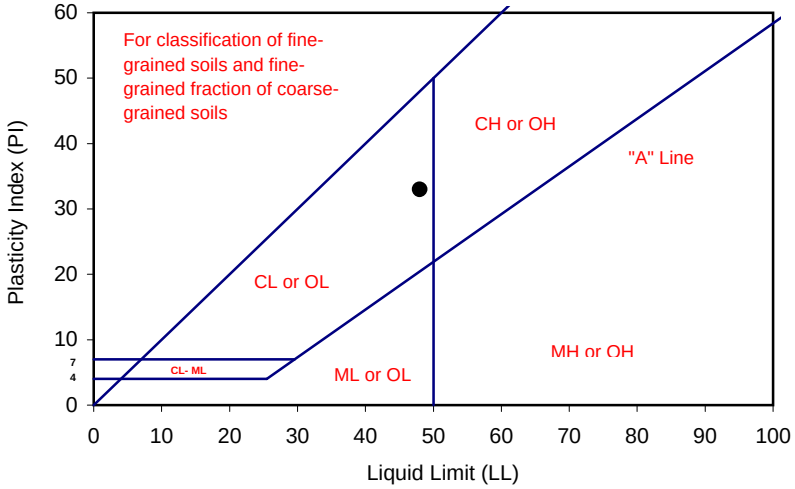
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			30	25	18	
Wet Wt. of Soil + Cont. (g)	8.66	8.30	20.62	22.28	21.60	
Dry Wt. of Soil + Cont. (g)	7.66	7.37	14.45	15.41	14.74	
Wt. of Container (g)	1.06	1.10	1.06	1.05	1.05	
Moisture Content (%) [Wn]	15.15	14.83	46.08	47.84	50.11	

Liquid Limit	**48**
Plastic Limit	**15**
Plasticity Index	**33**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 20.44

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



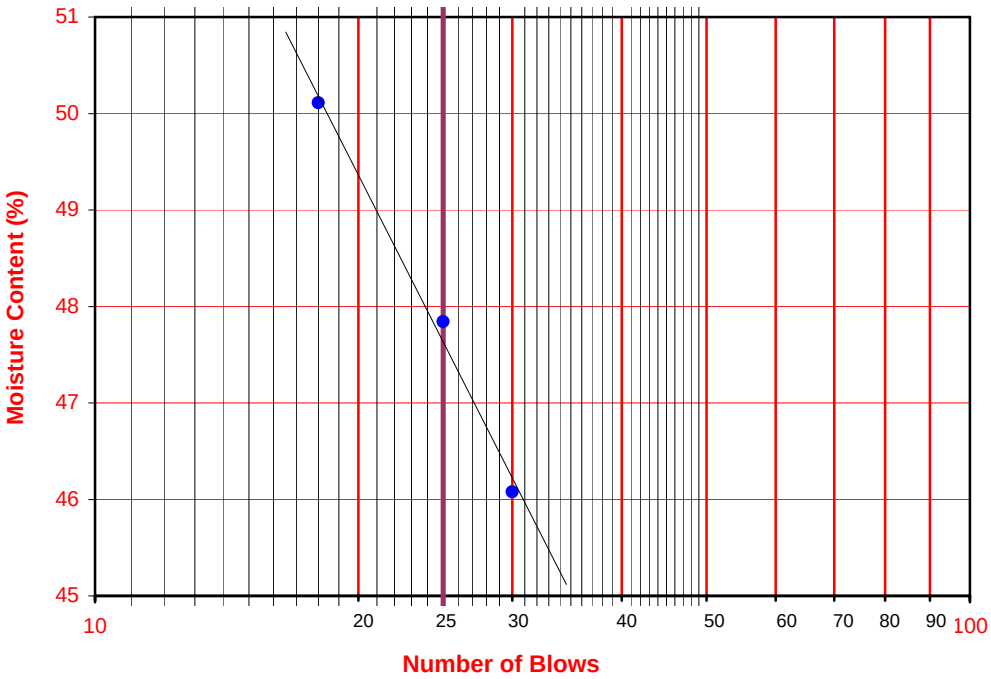
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/26/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/27/08
Boring No.:	A-08-016	Checked By:	LF		
Sample No.:	D-11	Depth (ft.)	55.0		
Soil Identification:	Pale olive lean clay with sand (CL)s				

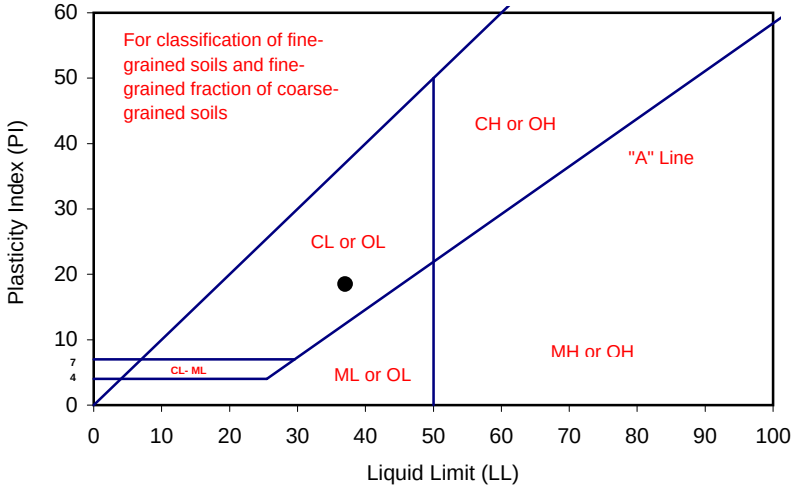
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	27	19	
Wet Wt. of Soil + Cont. (g)	12.71	13.25	13.51	16.70	14.67	
Dry Wt. of Soil + Cont. (g)	10.90	11.34	10.30	12.56	10.88	
Wt. of Container (g)	1.07	1.05	1.09	1.09	1.05	
Moisture Content (%) [Wn]	18.41	18.56	34.85	36.09	38.56	

Liquid Limit	**37**
Plastic Limit	**18**
Plasticity Index	**19**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 12.41

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



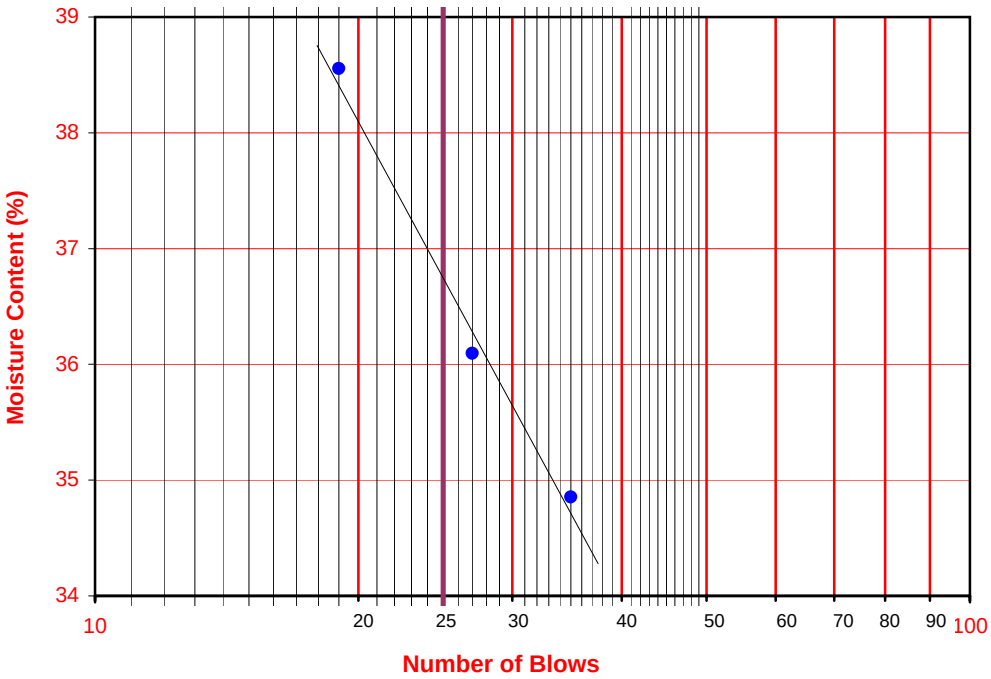
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/28/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/29/08
Boring No.:	A-08-016	Checked By:	LF		
Sample No.:	S-12	Depth (ft.)	60.0		
Soil Identification:	Olive sandy lean clay s(CL)				

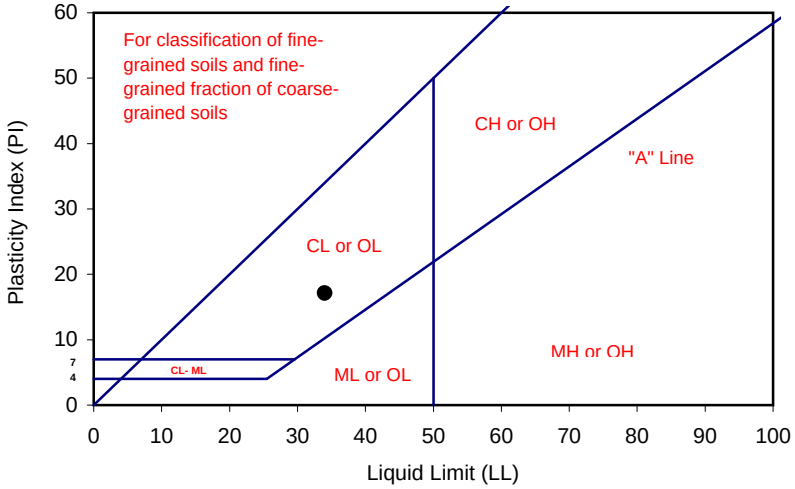
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	29	23	17
Wet Wt. of Soil + Cont. (g)	13.39	13.42	13.67	13.19	15.78	15.00
Dry Wt. of Soil + Cont. (g)	11.61	11.63	10.60	10.14	12.00	11.29
Wt. of Container (g)	1.06	1.03	1.04	1.04	1.05	1.10
Moisture Content (%) [Wn]	16.87	16.89	32.11	33.52	34.52	36.41

Liquid Limit	**34**
Plastic Limit	**17**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 10.22

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



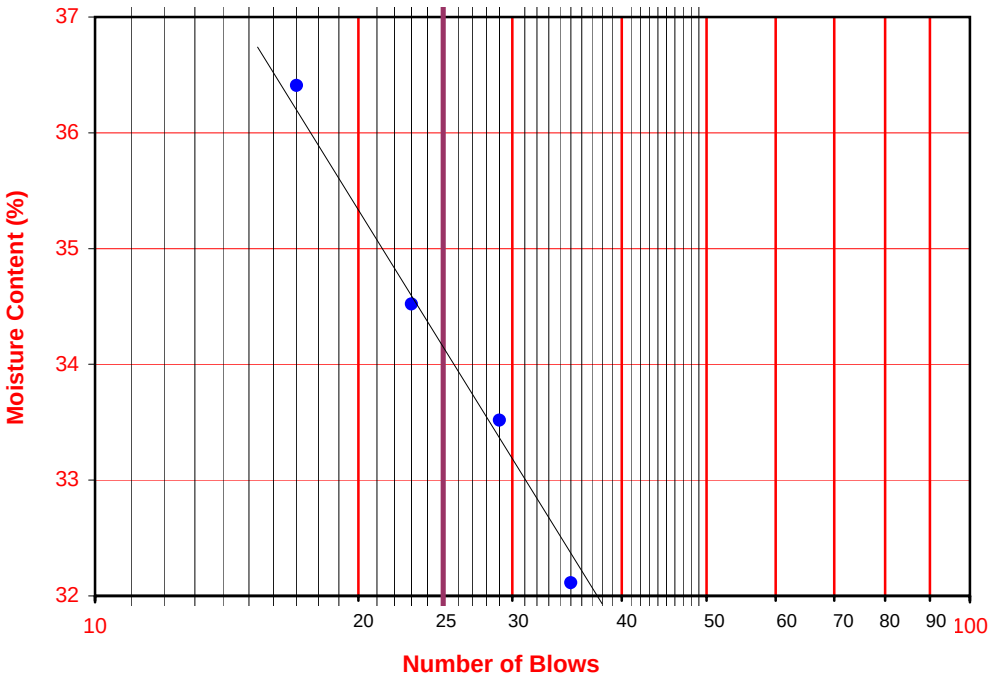
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	08/27/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/28/08
Boring No.:	A-08-016	Checked By:	LF		
Sample No.:	D-13	Depth (ft.)	65.0		
Soil Identification:	Olive brown clayey sand (SC)				

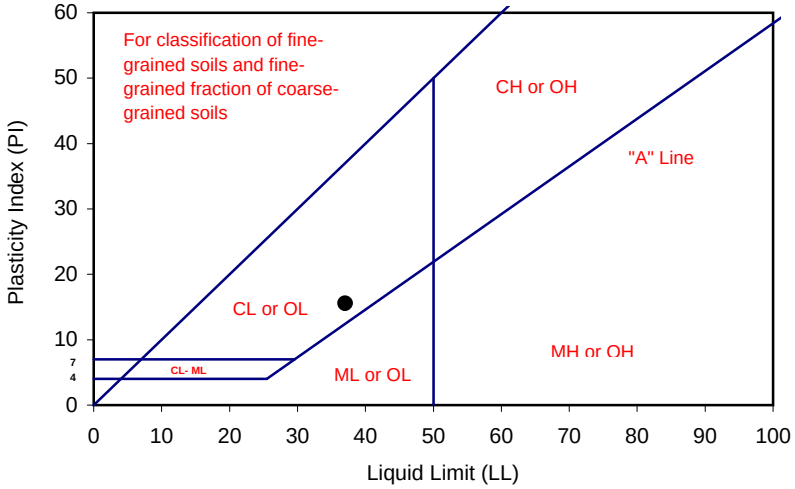
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	27	15	
Wet Wt. of Soil + Cont. (g)	9.39	10.42	20.85	19.17	20.59	
Dry Wt. of Soil + Cont. (g)	7.91	8.77	15.65	14.33	15.19	
Wt. of Container (g)	1.04	1.04	1.06	1.08	1.05	
Moisture Content (%) [Wn]	21.54	21.35	35.64	36.53	38.19	

Liquid Limit	**37**
Plastic Limit	**21**
Plasticity Index	**16**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 12.41

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



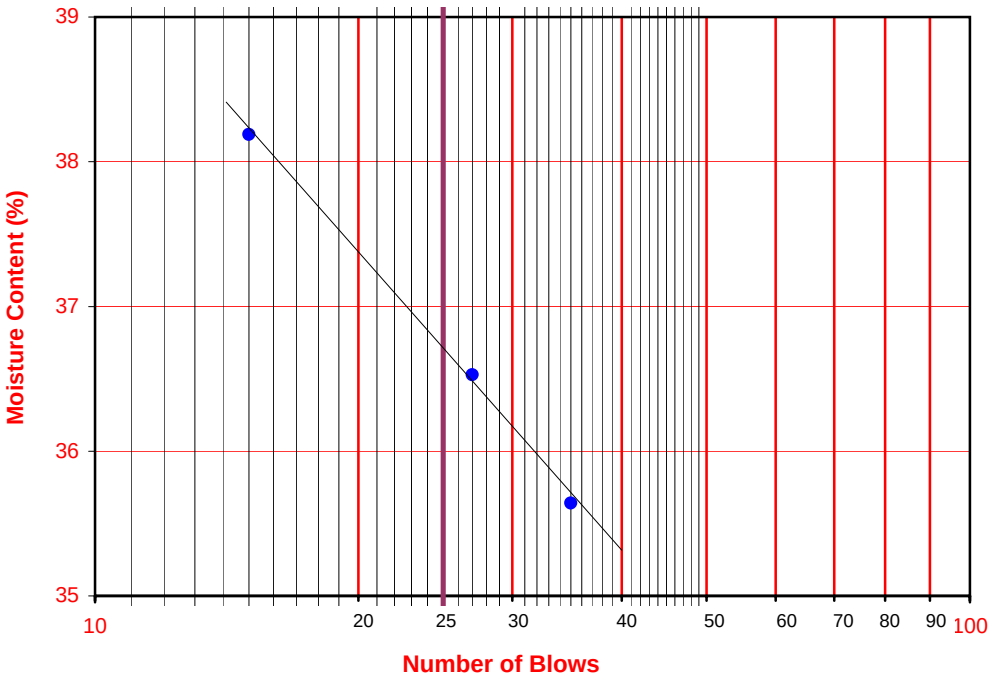
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/28/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/29/08
Boring No.:	A-08-016	Checked By:	LF		
Sample No.:	S-14	Depth (ft.)	70.0		
Soil Identification:	Olive sandy lean clay s(CL)				

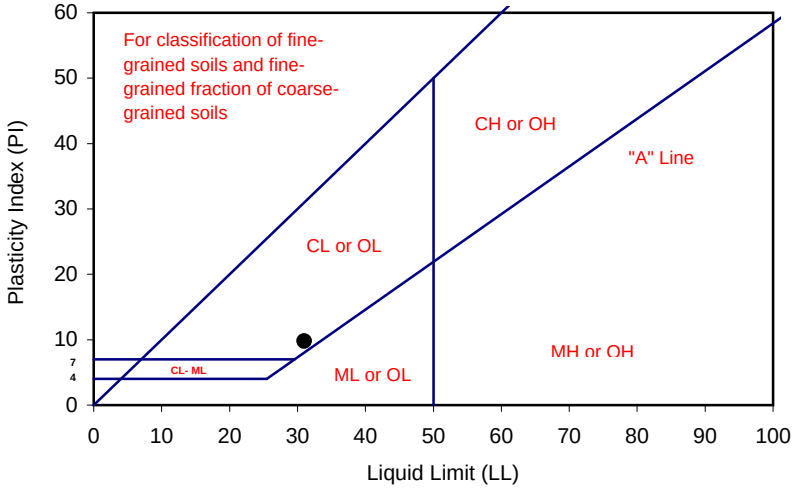
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	27	18	
Wet Wt. of Soil + Cont. (g)	13.33	13.80	13.47	15.16	17.79	
Dry Wt. of Soil + Cont. (g)	11.19	11.57	10.62	11.80	13.66	
Wt. of Container (g)	1.10	1.04	1.08	1.04	1.09	
Moisture Content (%) [Wn]	21.21	21.18	29.87	31.23	32.86	

Liquid Limit	**31**
Plastic Limit	**21**
Plasticity Index	**10**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.03

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



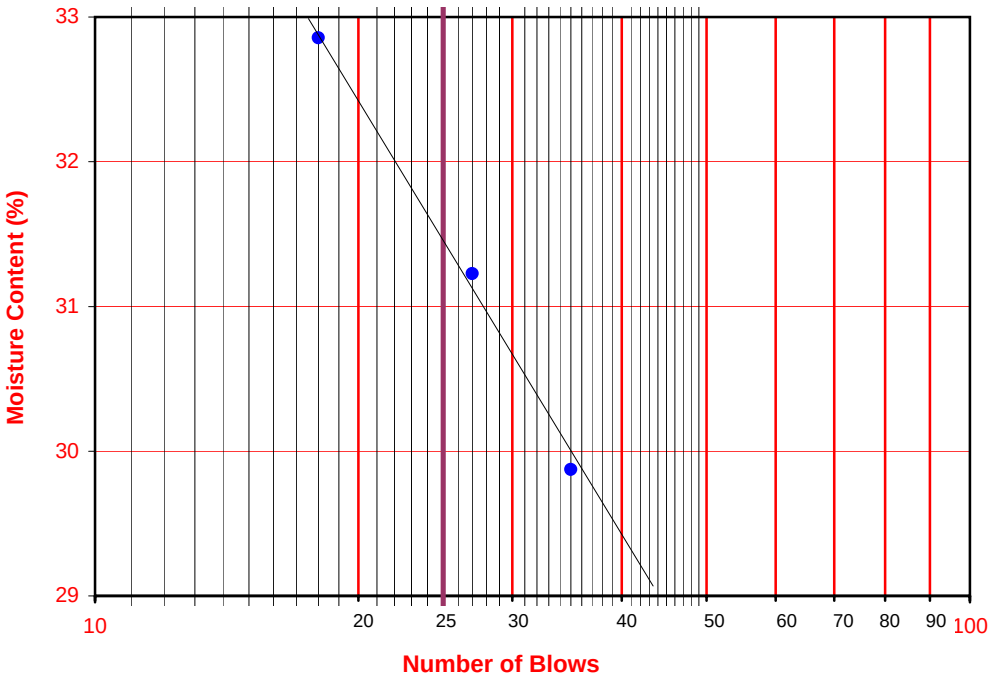
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/29/08
Project No. :	370900.02.GE.0S	Input By:	J. Ward	Date:	09/30/08
Boring No.:	A-08-017	Checked By:	J. Ward		
Sample No.:	D-2	Depth (ft.)	10.0		
Soil Identification:	Olive brown lean clay with sand (CL)s and caliche				

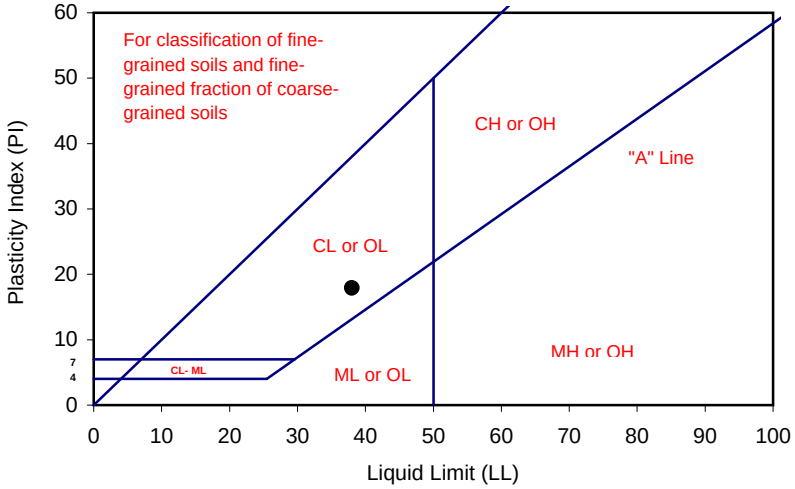
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	25	19	
Wet Wt. of Soil + Cont. (g)	13.96	12.79	13.49	14.62	15.18	
Dry Wt. of Soil + Cont. (g)	11.80	10.83	10.16	10.91	11.25	
Wt. of Container (g)	1.04	1.07	1.05	1.08	1.09	
Moisture Content (%) [Wn]	20.07	20.08	36.55	37.74	38.68	

Liquid Limit	**38**
Plastic Limit	**20**
Plasticity Index	**18**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 13.14

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



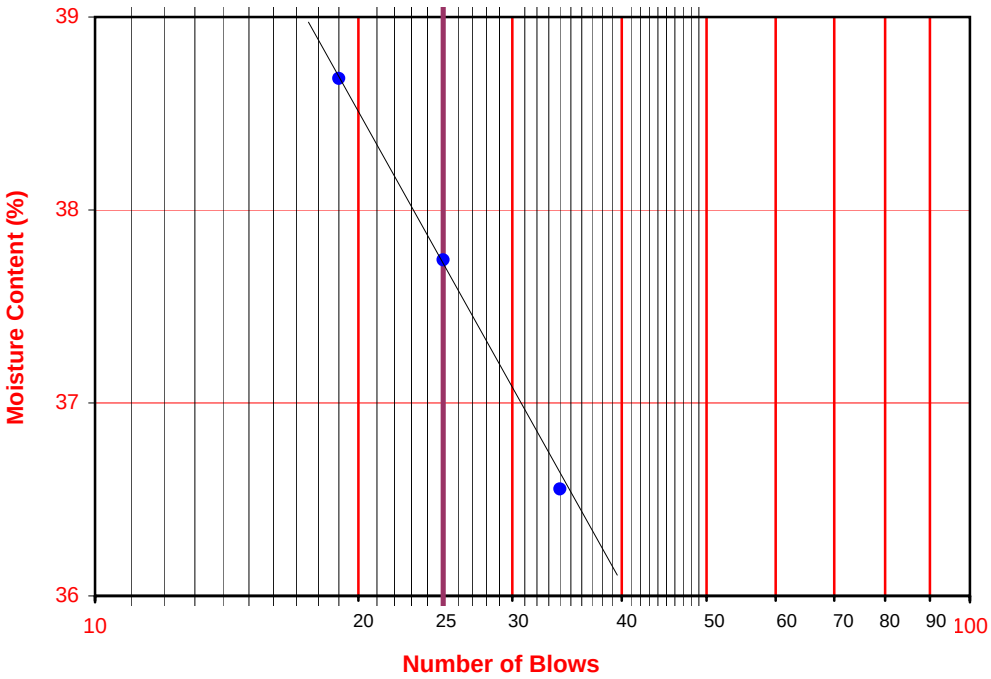
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/26/08
Project No. :	370900.02.GE.0S	Input By:	J. Ward	Date:	09/30/08
Boring No.:	A-08-017	Checked By:	J. Ward		
Sample No.:	D-4	Depth (ft.)	20.0		
Soil Identification:	Olive lean clay with sand (CL)s				

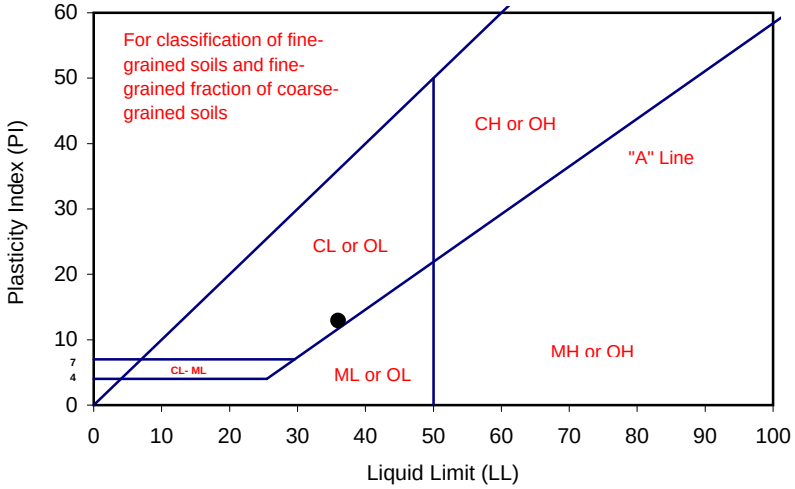
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	29	22	15
Wet Wt. of Soil + Cont. (g)	11.36	12.48	13.68	12.47	11.61	13.09
Dry Wt. of Soil + Cont. (g)	9.42	10.35	10.45	9.43	8.72	9.76
Wt. of Container (g)	1.04	1.08	1.08	1.05	1.01	1.07
Moisture Content (%) [Wn]	23.15	22.98	34.47	36.28	37.48	38.32

Liquid Limit	**36**
Plastic Limit	**23**
Plasticity Index	**13**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 11.68

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



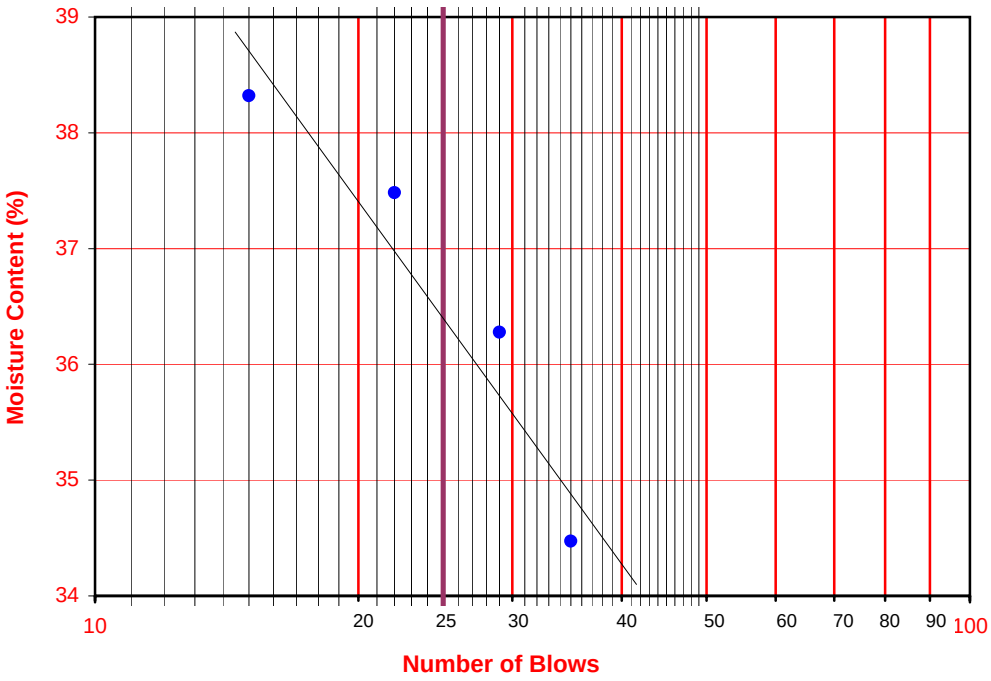
PROCEDURES USED

[ ] 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:	09/29/08
Project No. :	370900.02.GE.0S	Input By:	J. Ward	Date:	09/30/08
Boring No.:	A-08-017	Checked By:	J. Ward		
Sample No.:	D-6	Depth (ft.)	30.0		
Soil Identification:	Olive gray fat clay (CH)				

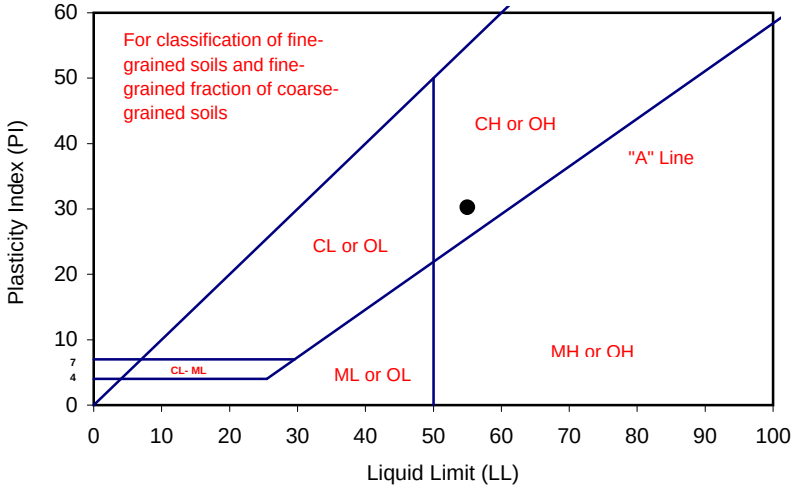
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			38	29	20	17
Wet Wt. of Soil + Cont. (g)	10.13	9.48	20.02	18.95	20.62	21.06
Dry Wt. of Soil + Cont. (g)	8.32	7.81	13.50	12.65	13.52	13.69
Wt. of Container (g)	1.02	1.06	1.02	1.07	1.05	1.10
Moisture Content (%) [Wn]	24.79	24.74	52.24	54.40	56.94	58.54

Liquid Limit	**55**
Plastic Limit	**25**
Plasticity Index	**30**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 25.55

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



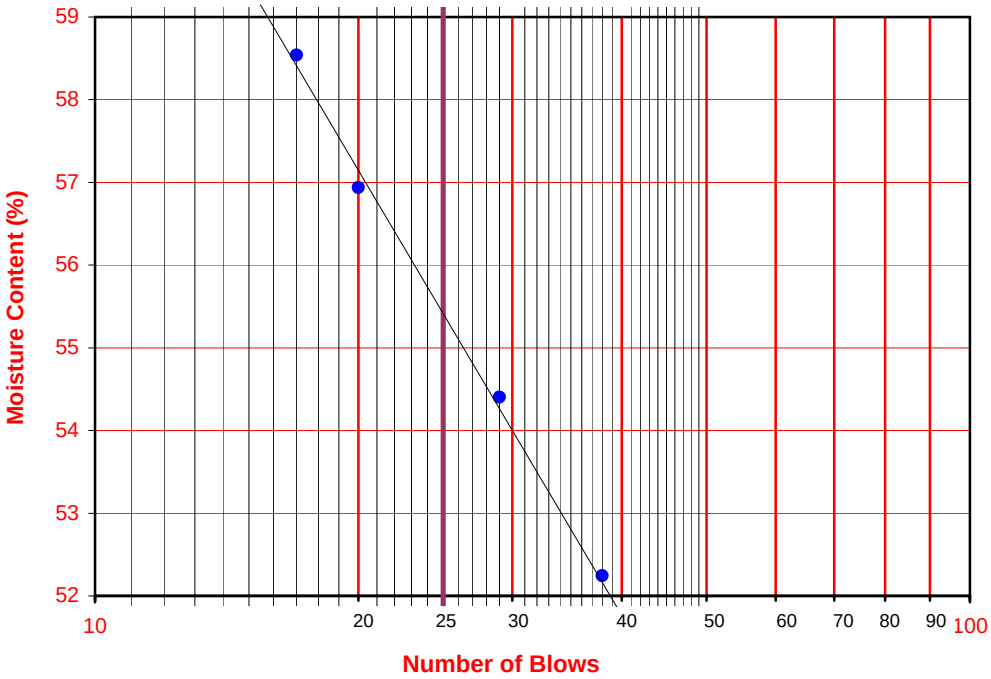
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/29/08
Project No. :	370900.02.GE.0S	Input By:	J. Ward	Date:	09/30/08
Boring No.:	A-08-017	Checked By:	J. Ward		
Sample No.:	D-8	Depth (ft.)	40.0		
Soil Identification:	Olive lean clay (CL)				

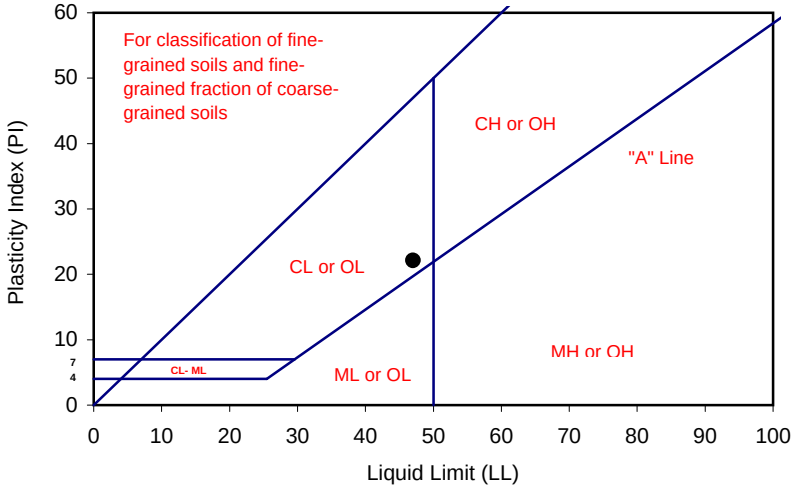
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	23	17
Wet Wt. of Soil + Cont. (g)	14.29	14.68	14.37	14.08	14.94	13.69
Dry Wt. of Soil + Cont. (g)	11.64	11.98	10.22	9.96	10.44	9.48
Wt. of Container (g)	1.03	1.07	1.04	1.04	1.06	1.00
Moisture Content (%) [Wn]	24.98	24.75	45.21	46.19	47.97	49.65

Liquid Limit	**47**
Plastic Limit	**25**
Plasticity Index	**22**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 19.71

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



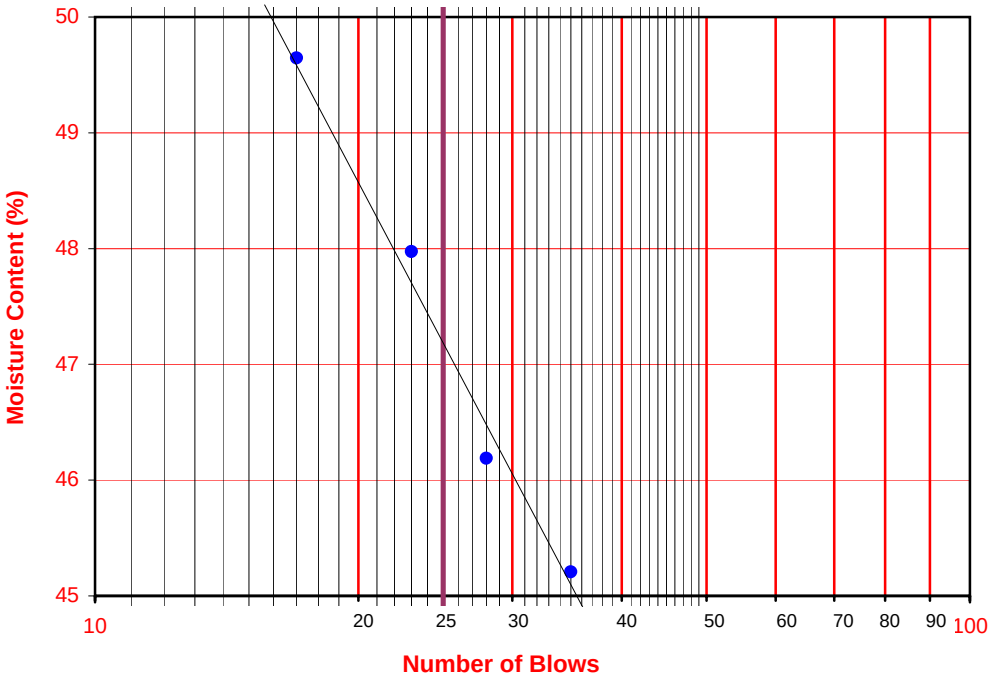
PROCEDURES USED

[ ] 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:	09/29/08
Project No. :	370900.02.GE.0S	Input By:	J. Ward	Date:	09/30/08
Boring No.:	A-08-017	Checked By:	J. Ward		
Sample No.:	D-10	Depth (ft.)	50.0		
Soil Identification:	Dark olive fat clay (CH)				

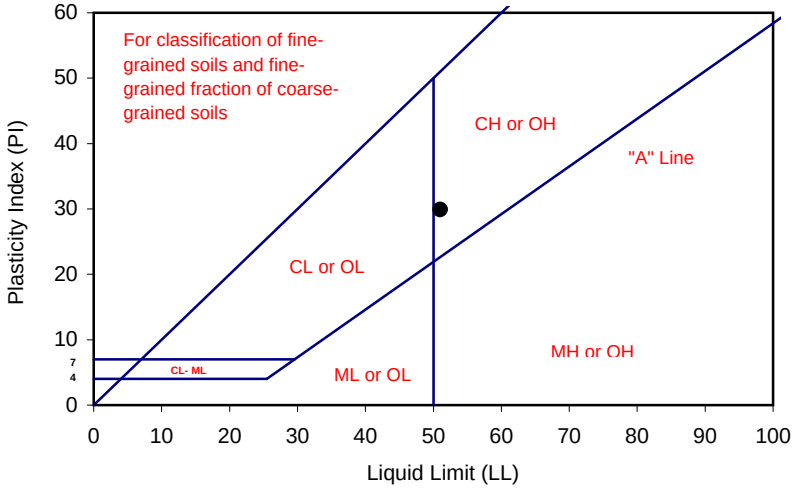
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			38	23	15	
Wet Wt. of Soil + Cont. (g)	9.64	9.26	20.75	21.84	21.29	
Dry Wt. of Soil + Cont. (g)	8.14	7.83	14.29	14.79	14.30	
Wt. of Container (g)	1.06	1.03	1.03	1.05	1.04	
Moisture Content (%) [Wn]	21.19	21.03	48.72	51.31	52.71	

Liquid Limit	**51**
Plastic Limit	**21**
Plasticity Index	**30**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 22.63

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



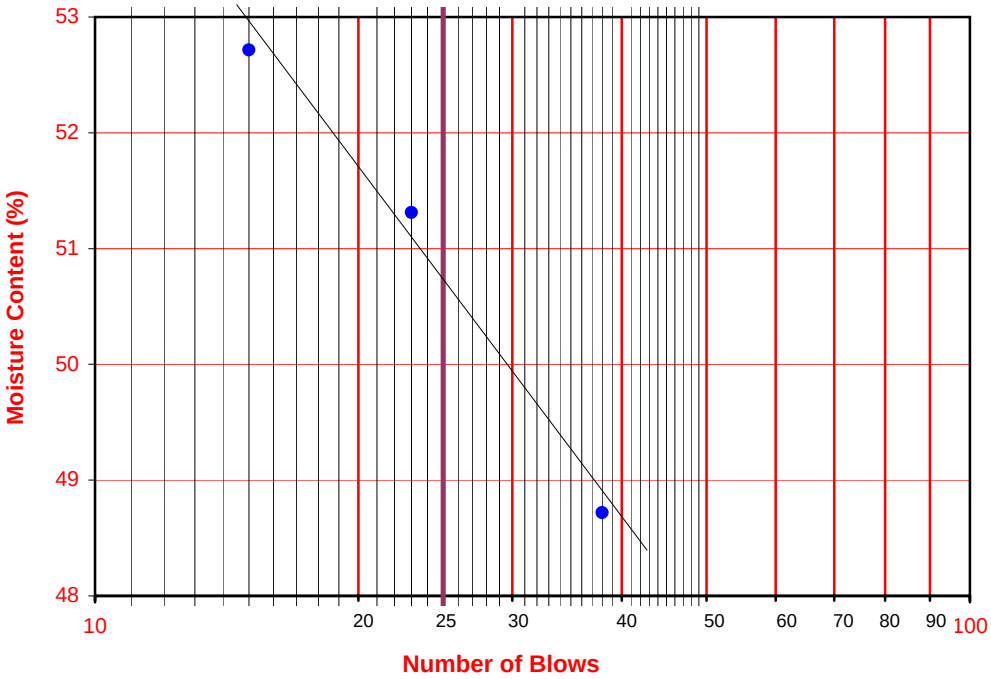
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/18/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/25/08
Boring No.:	A-08-017	Checked By:	LF		
Sample No.:	S-15	Depth (ft.)	75.0		
Soil Identification:	Yellowish brown fat clay (CH)				

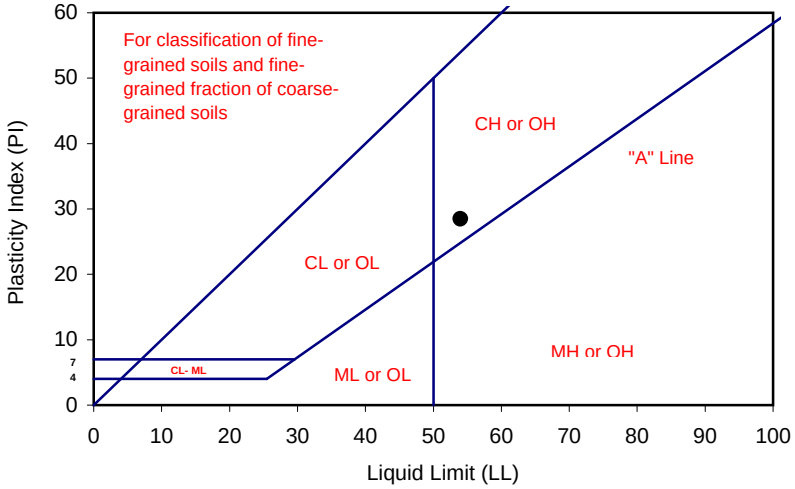
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	28	22	16
Wet Wt. of Soil + Cont. (g)	13.49	11.47	13.01	12.59	13.64	14.91
Dry Wt. of Soil + Cont. (g)	10.96	9.36	8.91	8.55	9.16	9.86
Wt. of Container (g)	1.05	1.09	1.03	1.04	1.05	1.06
Moisture Content (%) [Wn]	25.53	25.51	52.03	53.79	55.24	57.39

Liquid Limit	**54**
Plastic Limit	**26**
Plasticity Index	**28**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 24.82

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



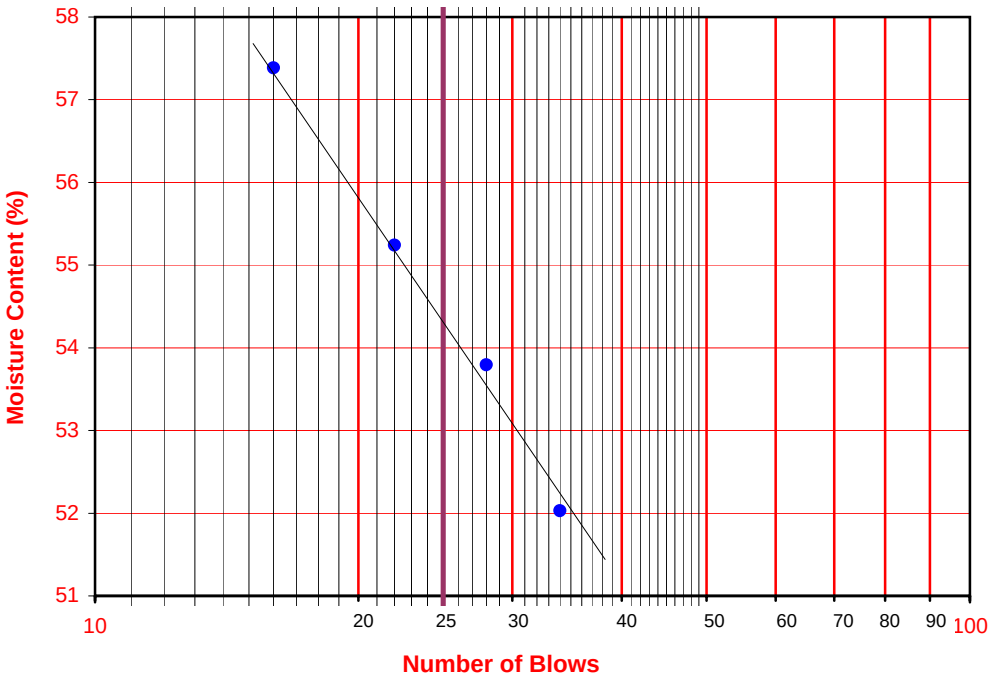
PROCEDURES USED

[ ] 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:	F. Tabibkhoei	Date:	05/21/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/22/09
Boring No.:	A-08-018	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	0-7		
Soil Identification:	Dark brown sandy lean clay s(CL)				

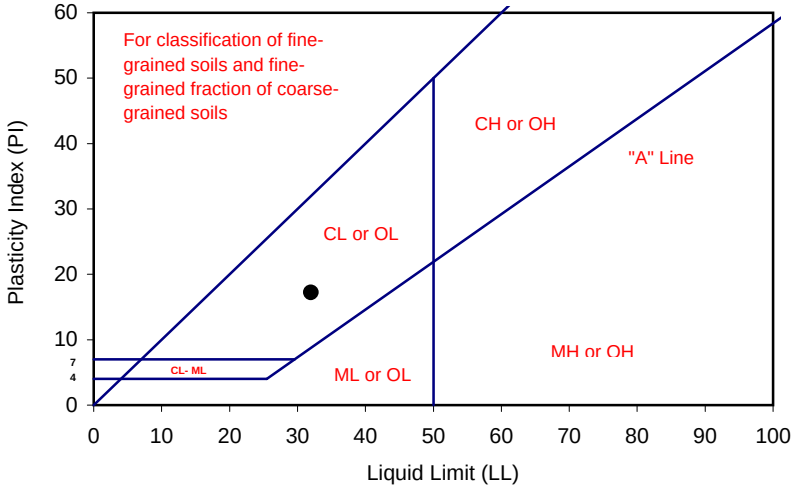
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	23	20
Wet Wt. of Soil + Cont. (g)	49.14	48.72	47.08	43.95	42.14	51.06
Dry Wt. of Soil + Cont. (g)	46.85	46.47	43.53	39.37	37.99	44.67
Wt. of Container (g)	31.41	31.14	31.70	24.64	25.04	25.03
Moisture Content (%) [Wn]	14.83	14.68	30.01	31.09	32.05	32.54

Liquid Limit	**32**
Plastic Limit	**15**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.76

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



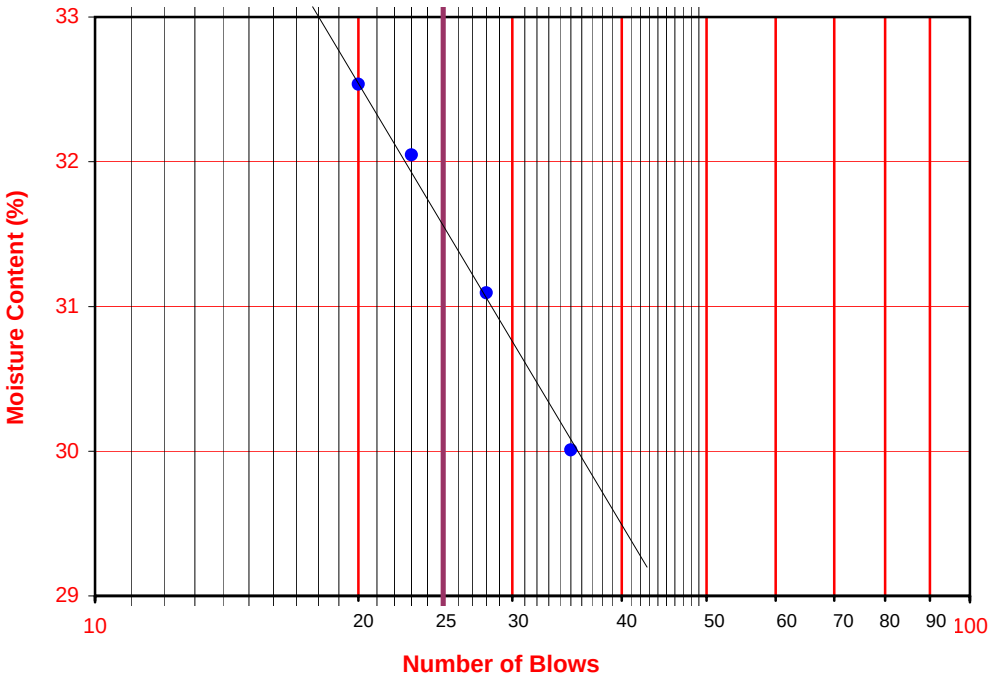
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/21/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/22/08
Boring No.:	A-08-018	Checked By:	LF		
Sample No.:	S-2	Depth (ft.)	10.0		
Soil Identification:	Yellowish brown sandy lean clay s(CL)				

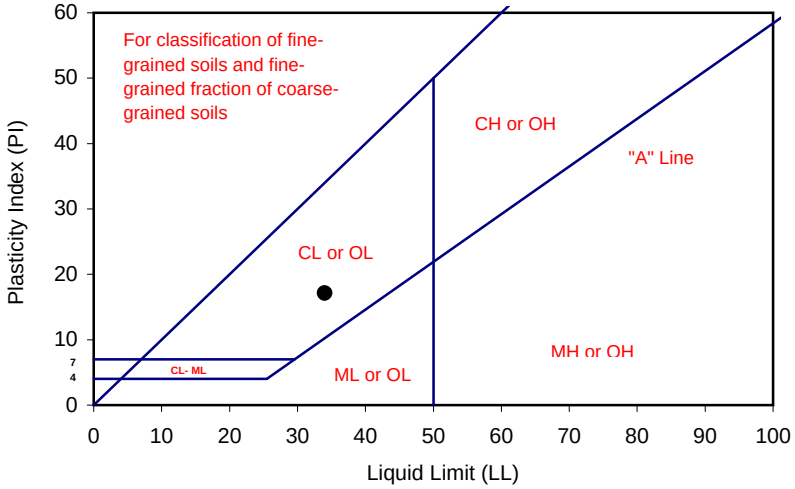
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	26	20	
Wet Wt. of Soil + Cont. (g)	12.27	10.13	14.14	14.33	14.57	
Dry Wt. of Soil + Cont. (g)	10.65	8.82	10.88	10.95	11.06	
Wt. of Container (g)	1.05	1.04	1.06	1.06	1.07	
Moisture Content (%) [Wn]	16.88	16.84	33.20	34.18	35.14	

Liquid Limit	**34**
Plastic Limit	**17**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 10.22

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



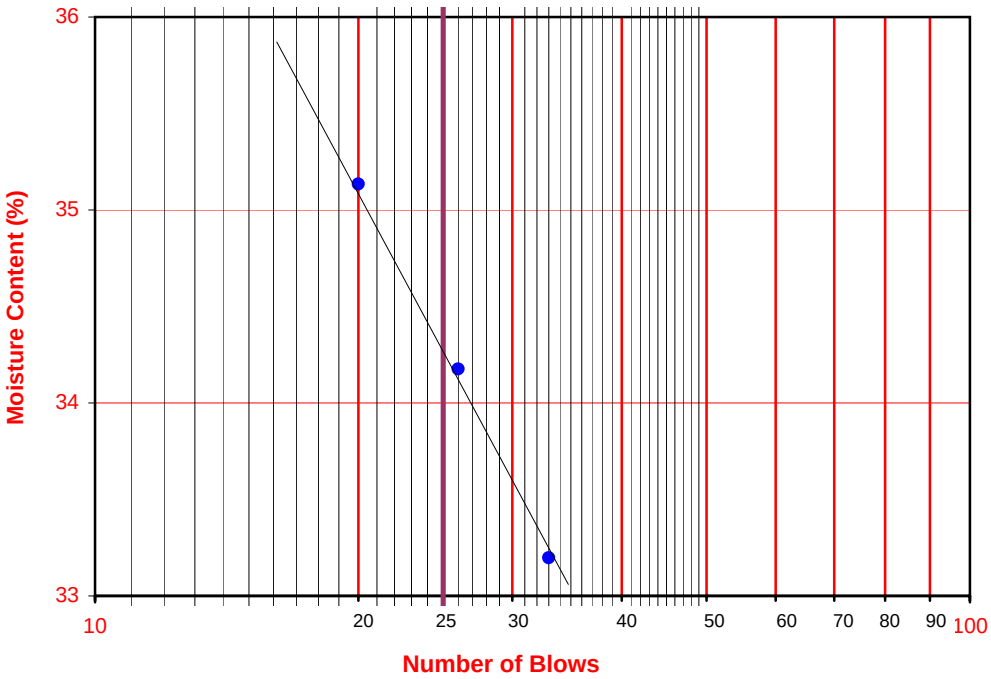
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	G. Bathala	Date:	05/21/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/22/09
Boring No.:	A-08-021	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	0-7		
Soil Identification:	Yellowish brown sandy lean clay s(CL) with caliche				

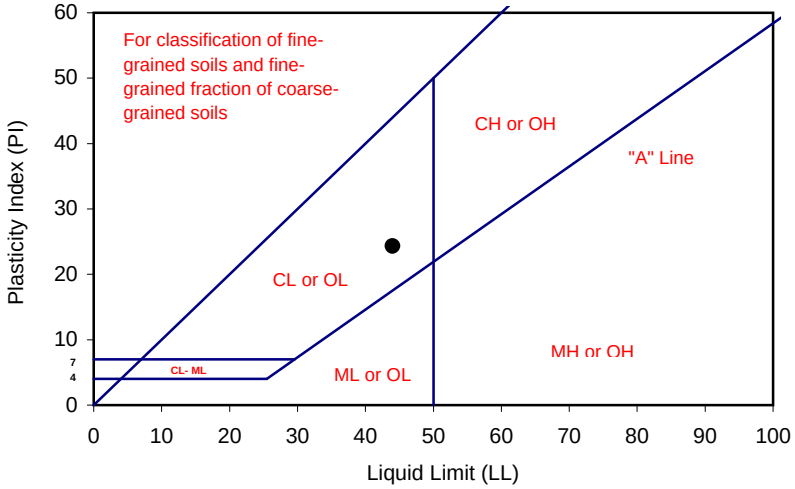
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	23	18
Wet Wt. of Soil + Cont. (g)	12.40	11.72	15.02	15.35	14.84	14.87
Dry Wt. of Soil + Cont. (g)	10.53	9.97	10.89	11.06	10.61	10.52
Wt. of Container (g)	1.04	1.07	1.02	1.01	1.05	1.07
Moisture Content (%) [Wn]	19.70	19.66	41.84	42.69	44.25	46.03

Liquid Limit	**44**
Plastic Limit	**20**
Plasticity Index	**24**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 17.52

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



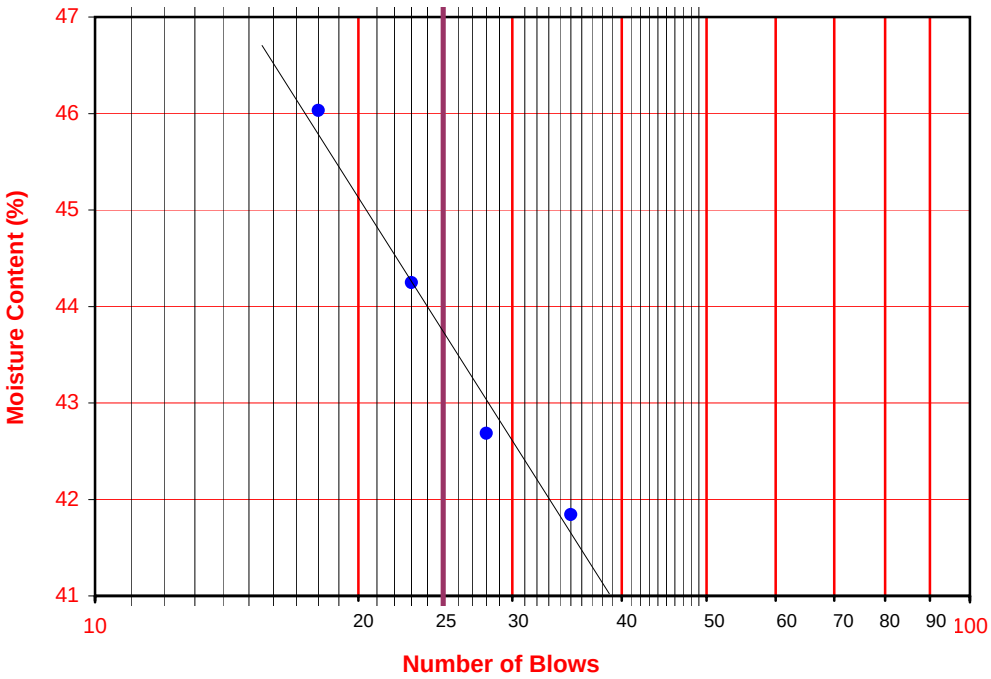
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/03/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/04/08
Boring No.:	A-08-021	Checked By:	LF		
Sample No.:	D-5	Depth (ft.)	25.0		
Soil Identification:	Yellowish brown clayey sand (SC)				

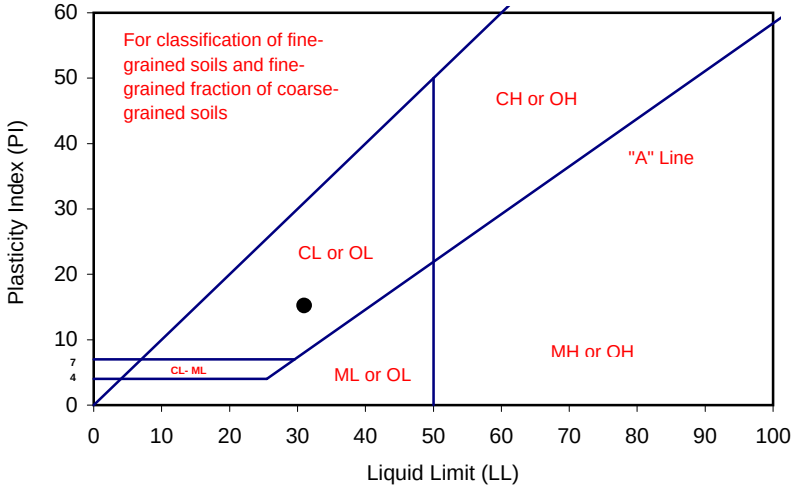
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			32	25	20	15
Wet Wt. of Soil + Cont. (g)	12.17	10.24	13.10	13.44	14.58	14.90
Dry Wt. of Soil + Cont. (g)	10.66	8.98	10.29	10.49	11.26	11.42
Wt. of Container (g)	1.06	1.04	1.04	1.05	1.05	1.04
Moisture Content (%) [Wn]	15.73	15.87	30.38	31.25	32.52	33.53

Liquid Limit	**31**
Plastic Limit	**16**
Plasticity Index	**15**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.03

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



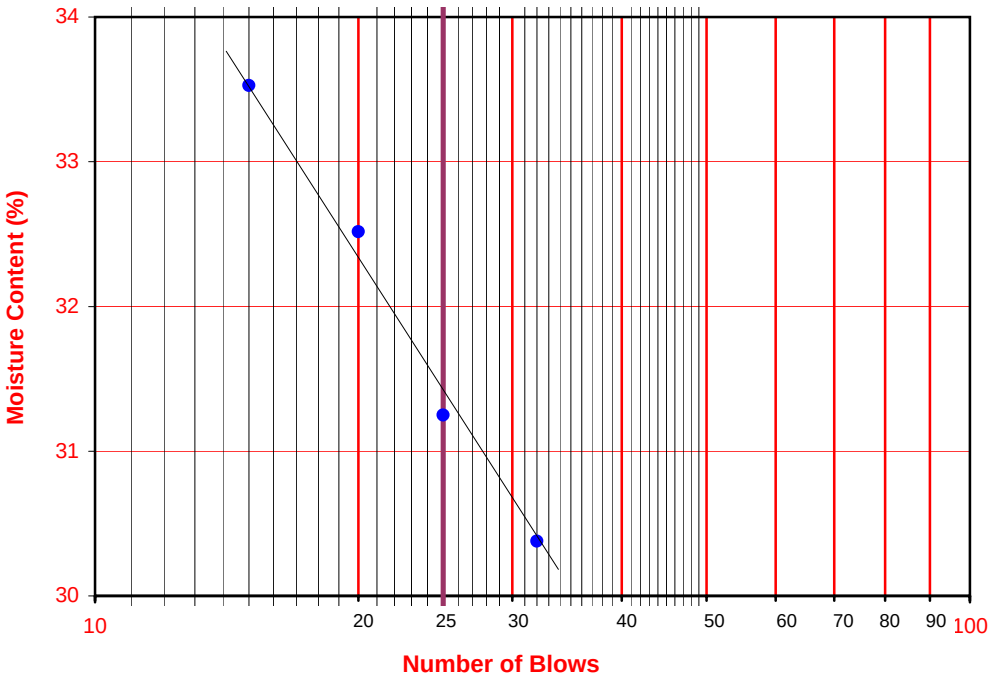
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	05/09/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/13/09
Boring No.:	A-08-022	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	0-5		
Soil Identification:	Brown clayey sand (SC)				

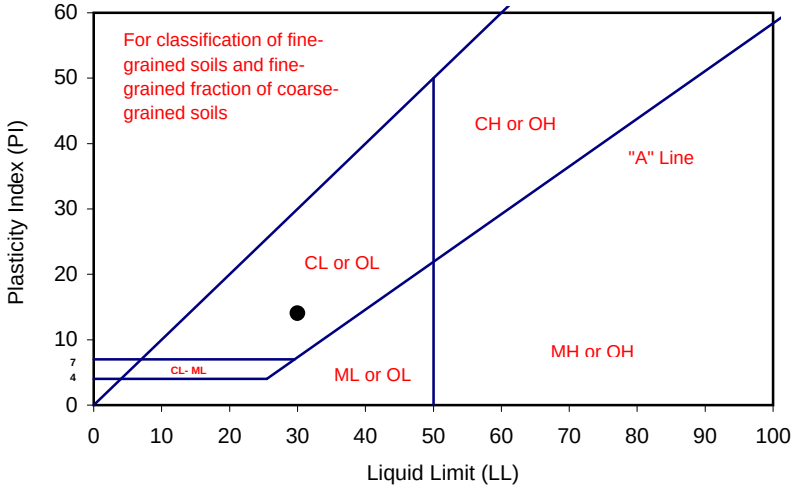
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	27	18	
Wet Wt. of Soil + Cont. (g)	13.68	11.83	13.71	15.38	16.98	
Dry Wt. of Soil + Cont. (g)	11.94	10.36	10.83	12.06	13.18	
Wt. of Container (g)	1.10	1.07	1.05	1.08	1.01	
Moisture Content (%) [Wn]	16.05	15.82	29.45	30.24	31.22	

Liquid Limit	**30**
Plastic Limit	**16**
Plasticity Index	**14**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 7.3

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



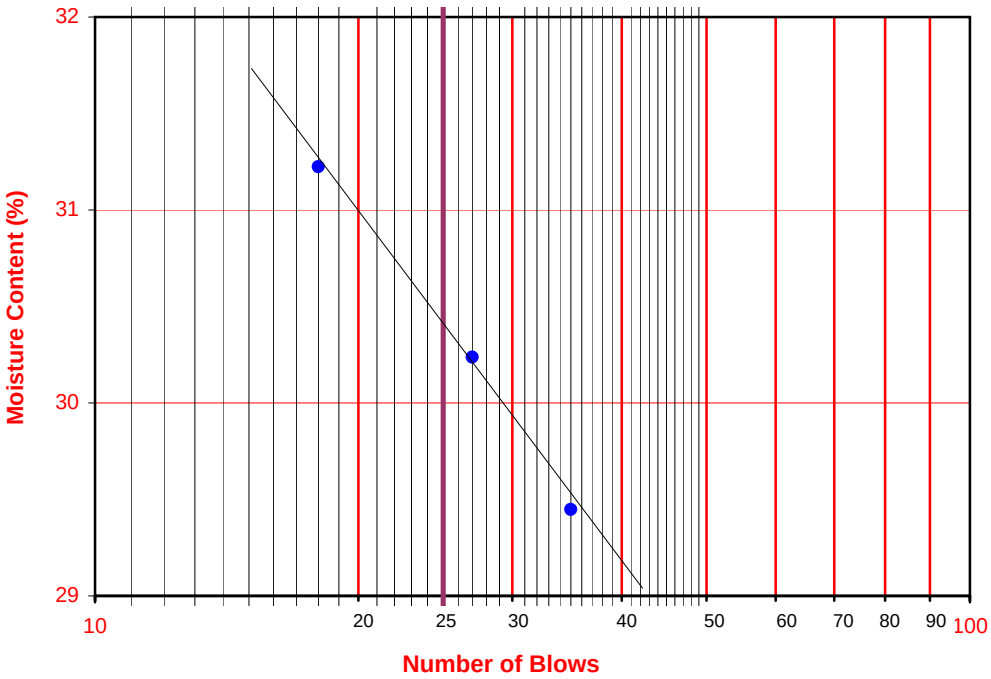
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/27/08
Boring No.:	A-08-022	Checked By:	LF		
Sample No.:	S-4	Depth (ft.)	20.0		
Soil Identification:	Brown sandy lean clay s(CL)				

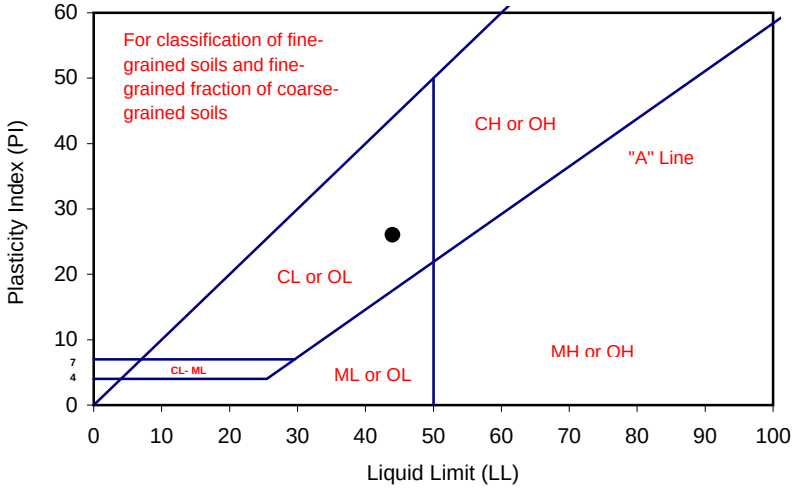
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	8.33	9.67	13.94	14.78	13.87	
Dry Wt. of Soil + Cont. (g)	7.22	8.36	10.14	10.62	9.95	
Wt. of Container (g)	1.08	1.04	1.11	1.04	1.10	
Moisture Content (%) [Wn]	18.08	17.90	42.08	43.42	44.29	

Liquid Limit	**44**
Plastic Limit	**18**
Plasticity Index	**26**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 17.52

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



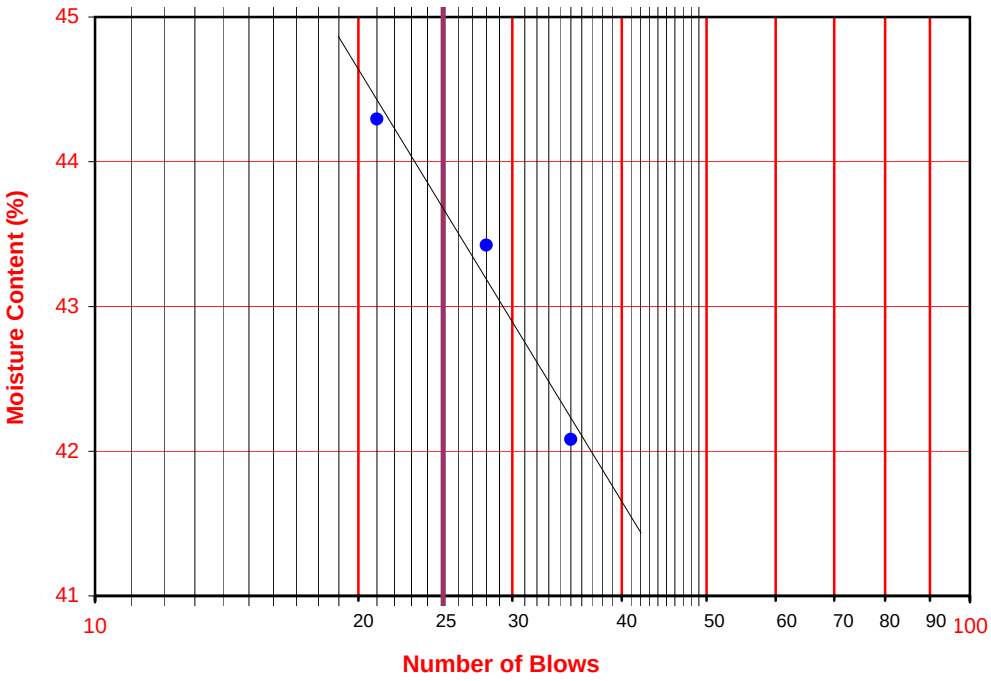
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	05/21/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/22/09
Boring No.:	A-08-023	Checked By:	J. Ward		
Sample No.:	D-1	Depth (ft.)	5.0		
Soil Identification:	Olive sandy lean clay s(CL)				

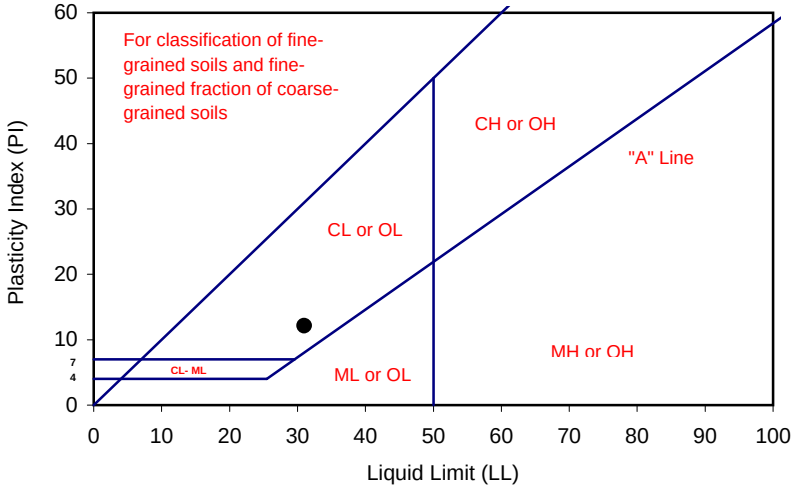
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	27	18	
Wet Wt. of Soil + Cont. (g)	12.92	12.25	14.61	14.08	12.34	
Dry Wt. of Soil + Cont. (g)	11.03	10.48	11.54	10.99	9.59	
Wt. of Container (g)	1.06	1.03	1.06	1.00	1.04	
Moisture Content (%) [Wn]	18.96	18.73	29.29	30.93	32.16	

Liquid Limit	**31**
Plastic Limit	**19**
Plasticity Index	**12**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.03

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



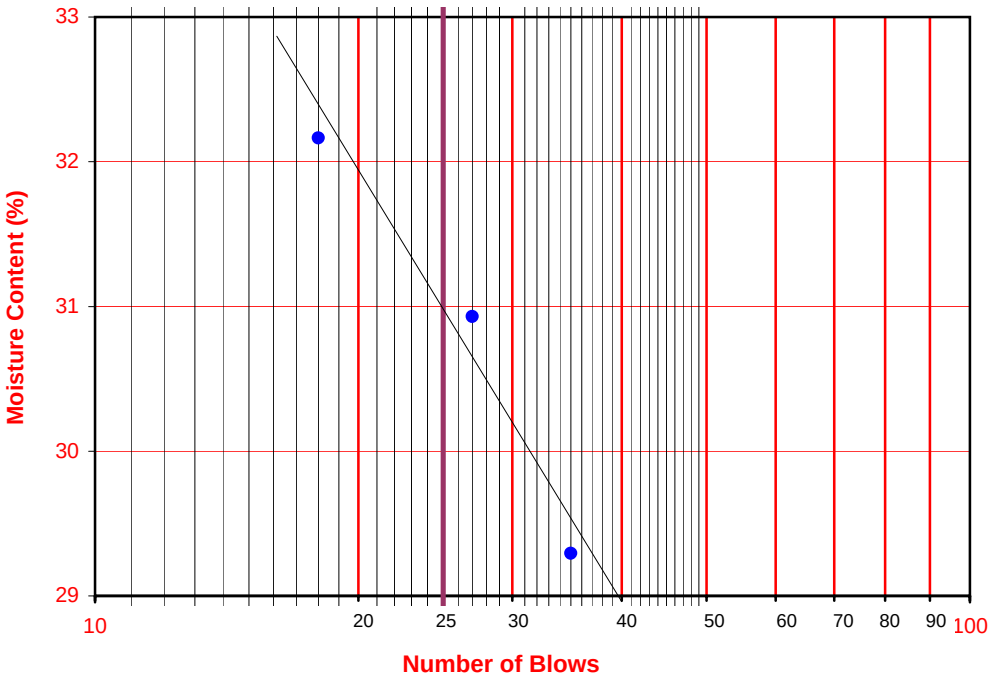
PROCEDURES USED

[ ] 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:	09/05/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/10/08
Boring No.:	A-08-023	Checked By:	LF		
Sample No.:	Bag-1	Depth (ft.)	20-25		
Soil Identification:	Olive clayey sand (SC)				

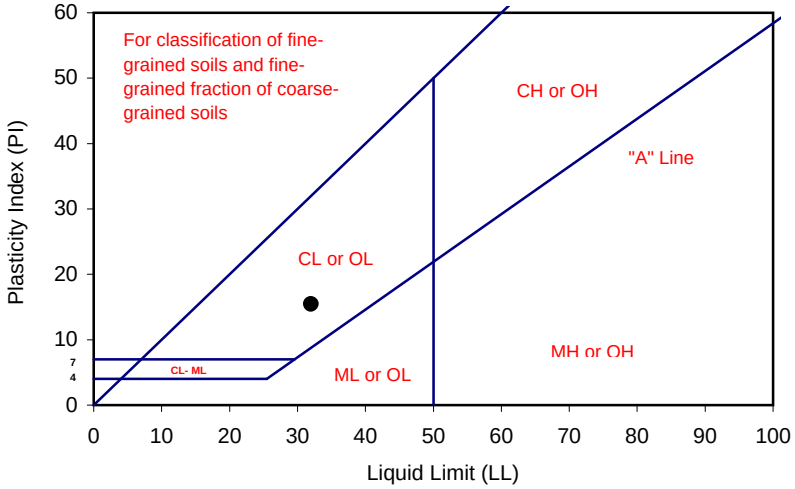
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			36	22	17	
Wet Wt. of Soil + Cont. (g)	9.87	9.51	22.84	20.60	21.07	
Dry Wt. of Soil + Cont. (g)	8.60	8.32	17.63	15.82	16.11	
Wt. of Container (g)	1.02	1.04	1.09	1.10	1.08	
Moisture Content (%) [Wn]	16.75	16.35	31.50	32.47	33.00	

Liquid Limit	**32**
Plastic Limit	**17**
Plasticity Index	**15**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.76

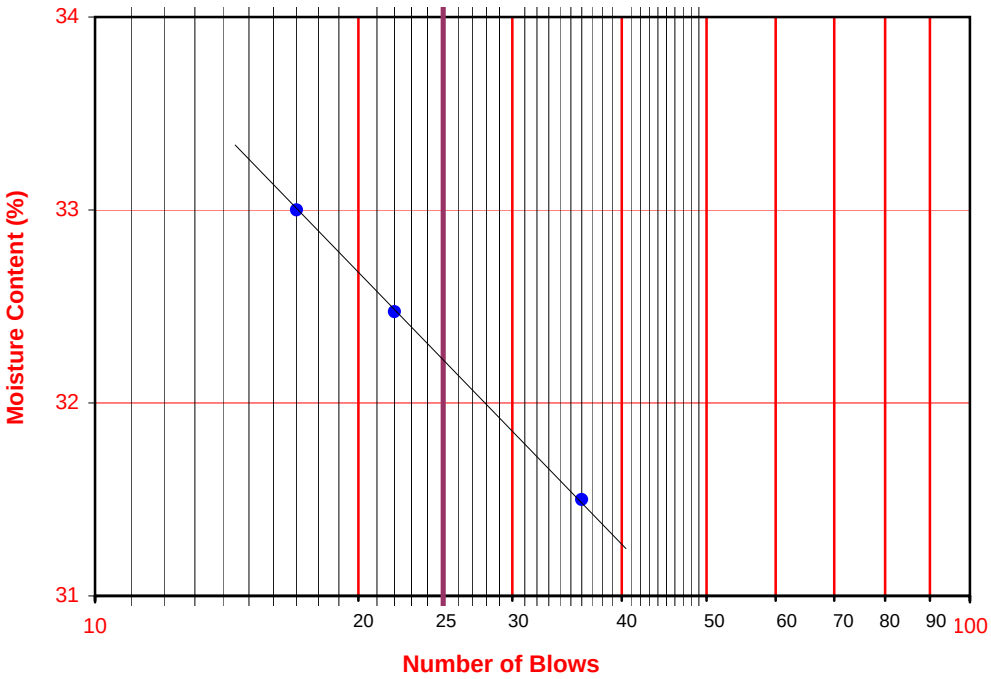
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



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:	09/02/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/03/08
Boring No.:	A-08-023	Checked By:	LF		
Sample No.:	D-5	Depth (ft.)	25.0		
Soil Identification:	Dark brown clayey sand (SC)				

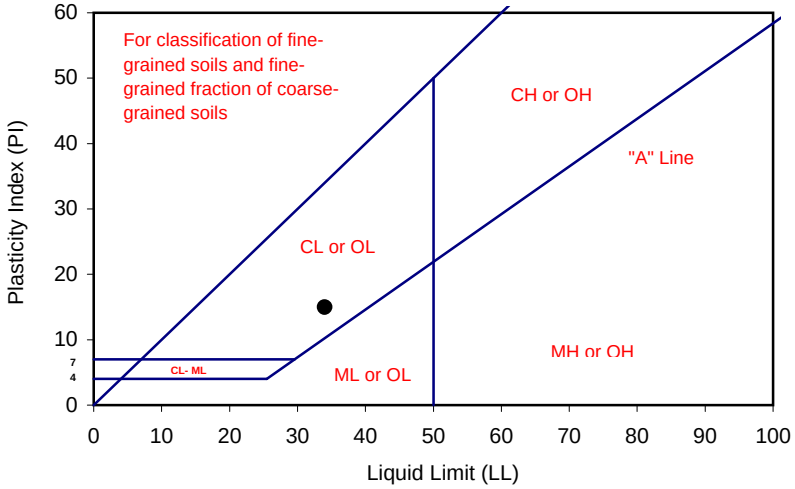
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	25	22	
Wet Wt. of Soil + Cont. (g)	10.53	9.55	22.64	23.24	20.78	
Dry Wt. of Soil + Cont. (g)	9.02	8.19	17.35	17.64	15.73	
Wt. of Container (g)	1.10	1.04	1.04	1.02	1.07	
Moisture Content (%) [Wn]	19.07	19.02	32.43	33.69	34.45	

Liquid Limit	**34**
Plastic Limit	**19**
Plasticity Index	**15**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 10.22

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



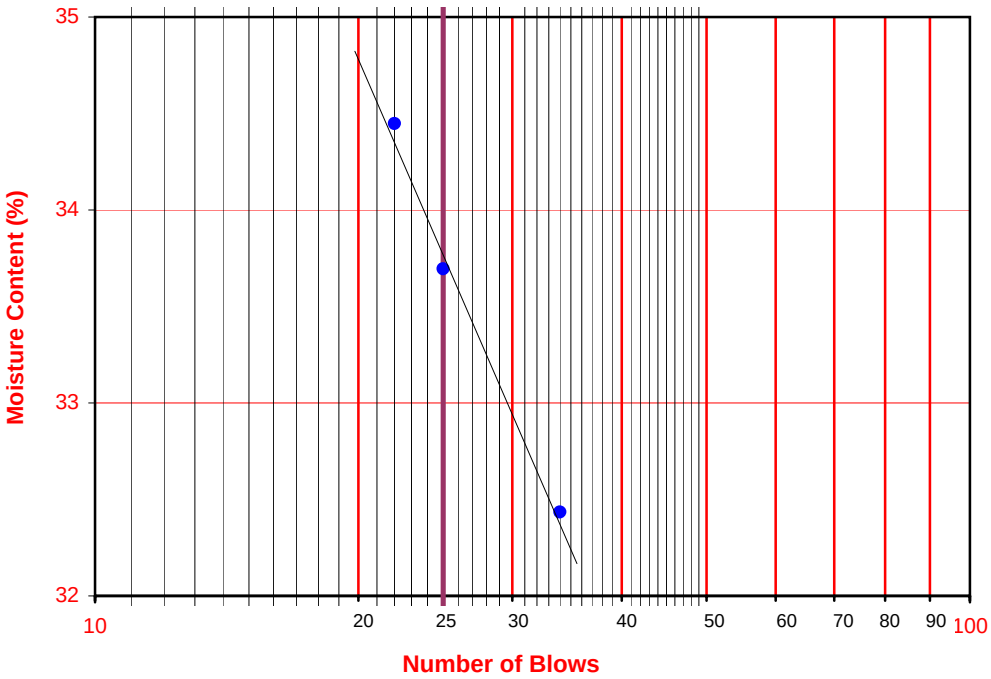
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	A. Santos	Date:	08/21/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/26/08
Boring No.:	A-08-023	Checked By:	LF		
Sample No.:	D-7	Depth (ft.)	35.0		
Soil Identification:	Grayish brown silty clay with sand (CL-ML)s				

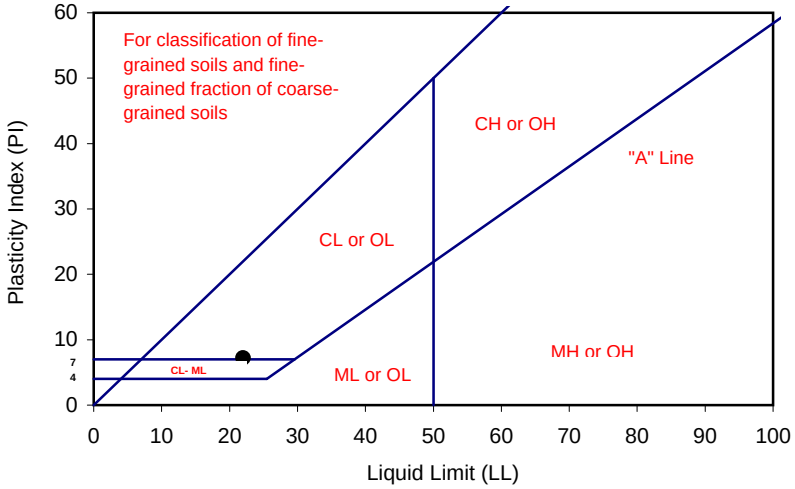
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	25	19	
Wet Wt. of Soil + Cont. (g)	11.82	11.30	20.62	23.50	21.20	
Dry Wt. of Soil + Cont. (g)	10.42	9.99	17.17	19.42	17.42	
Wt. of Container (g)	1.07	1.03	1.09	1.04	1.03	
Moisture Content (%) [Wn]	14.97	14.62	21.46	22.20	23.06	

Liquid Limit	**22**
Plastic Limit	**15**
Plasticity Index	**7**
Classification	**CL-ML**

PI at "A" - Line = 0.73(LL-20) 1.46

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



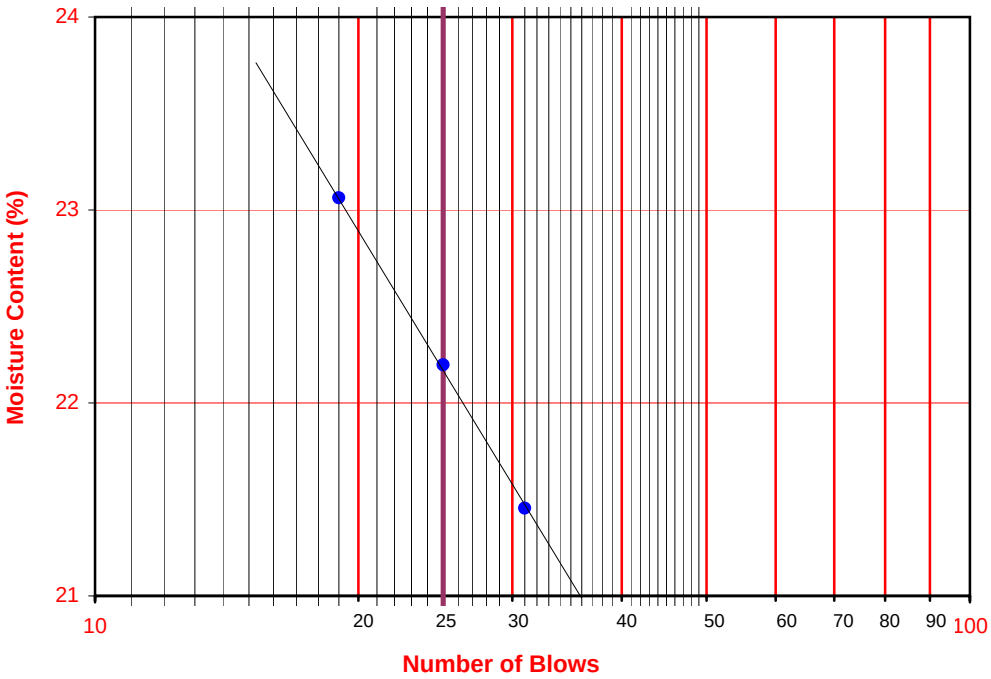
PROCEDURES USED

[ ] 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:	08/21/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/26/08
Boring No.:	A-08-023	Checked By:	LF		
Sample No.:	D-11	Depth (ft.)	55.0		
Soil Identification:	Yellowish brown lean clay (CL)				

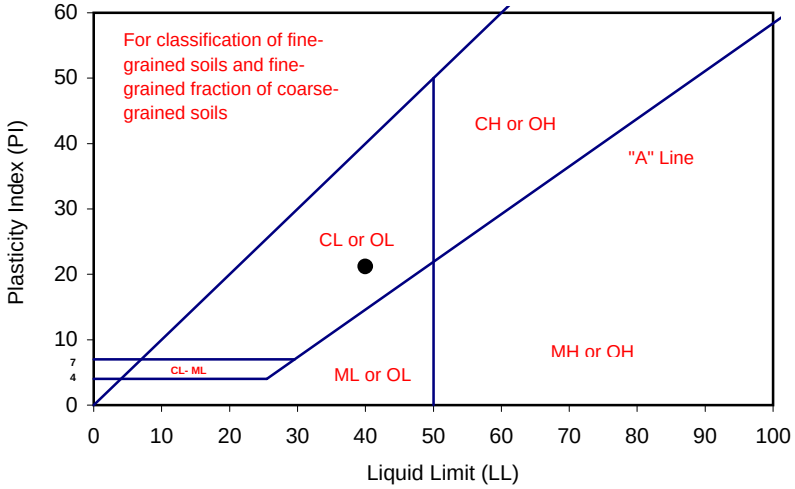
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			37	27	17	
Wet Wt. of Soil + Cont. (g)	10.43	10.22	21.03	22.64	21.69	
Dry Wt. of Soil + Cont. (g)	8.95	8.77	15.56	16.52	15.59	
Wt. of Container (g)	1.06	1.08	1.11	1.07	1.08	
Moisture Content (%) [Wn]	18.76	18.86	37.85	39.61	42.04	

Liquid Limit	**40**
Plastic Limit	**19**
Plasticity Index	**21**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 14.6

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



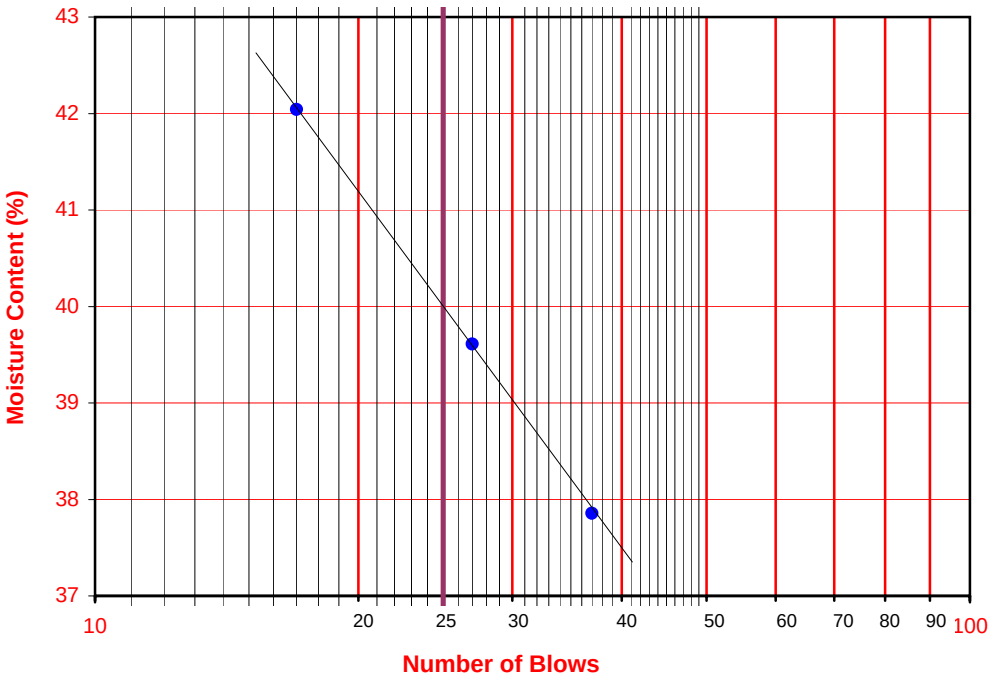
PROCEDURES USED

[ ] 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:	08/25/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/26/08
Boring No.:	A-08-023	Checked By:	LF		
Sample No.:	D-15	Depth (ft.)	75.0		
Soil Identification:	Yellowish brown lean clay (CL)				

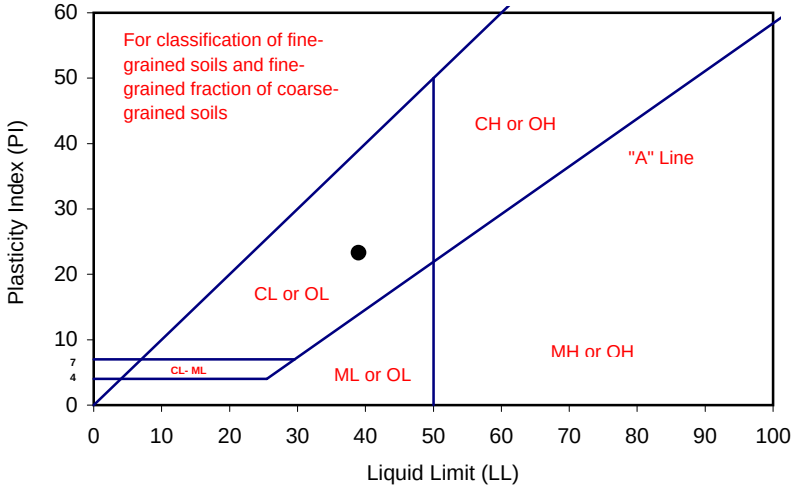
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			30	23	18	
Wet Wt. of Soil + Cont. (g)	9.09	9.43	22.00	20.78	21.12	
Dry Wt. of Soil + Cont. (g)	8.00	8.28	16.23	15.23	15.36	
Wt. of Container (g)	1.03	1.01	1.05	1.05	1.10	
Moisture Content (%) [Wn]	15.64	15.82	38.01	39.14	40.39	

Liquid Limit	**39**
Plastic Limit	**16**
Plasticity Index	**23**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 13.87

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



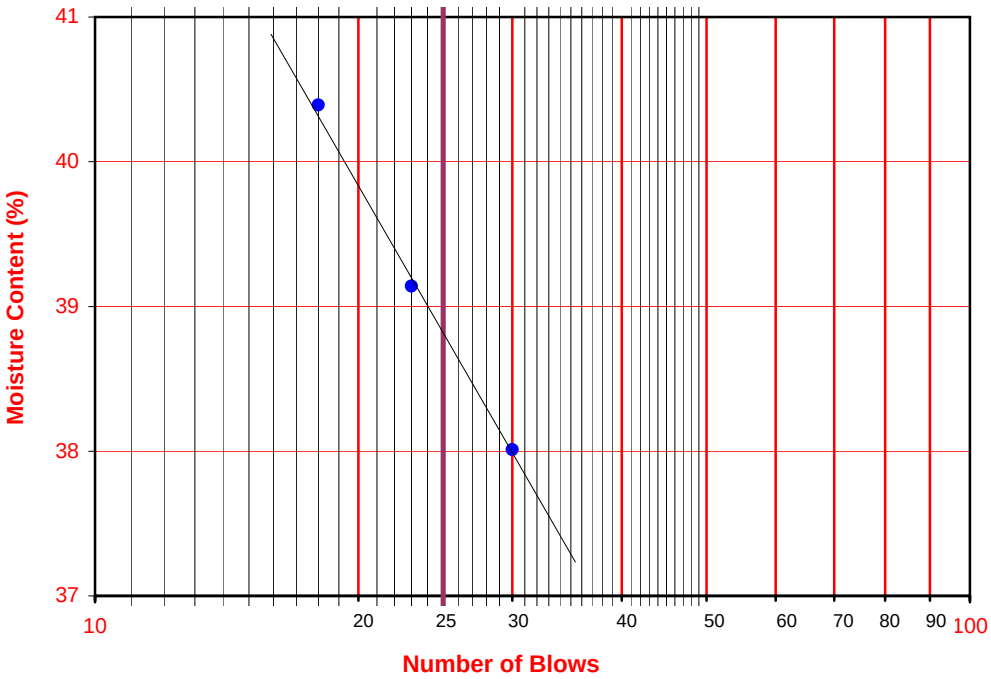
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	05/16/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/18/09
Boring No.:	A-08-024	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	0-7		
Soil Identification:	Olive lean clay with sand (CL)s				

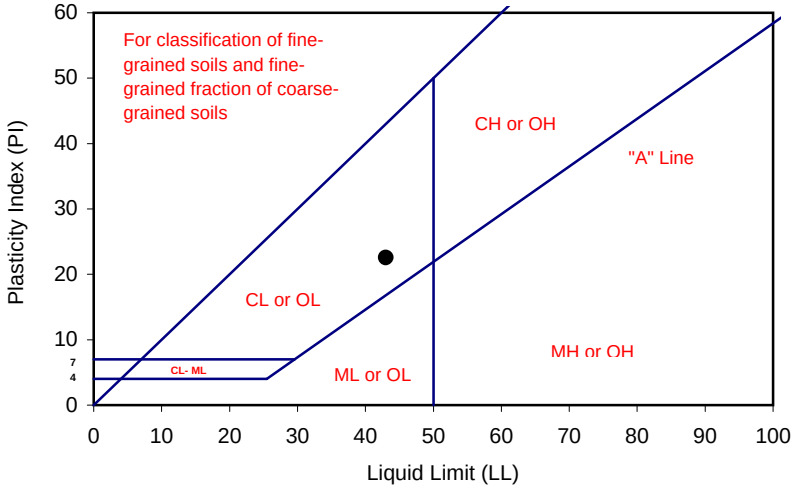
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	23	18
Wet Wt. of Soil + Cont. (g)	13.45	12.44	13.39	13.26	14.02	14.03
Dry Wt. of Soil + Cont. (g)	11.34	10.51	9.81	9.64	10.11	10.01
Wt. of Container (g)	1.05	1.04	1.07	1.04	1.07	1.01
Moisture Content (%) [Wn]	20.51	20.38	40.96	42.09	43.25	44.67

Liquid Limit	**43**
Plastic Limit	**20**
Plasticity Index	**23**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.79

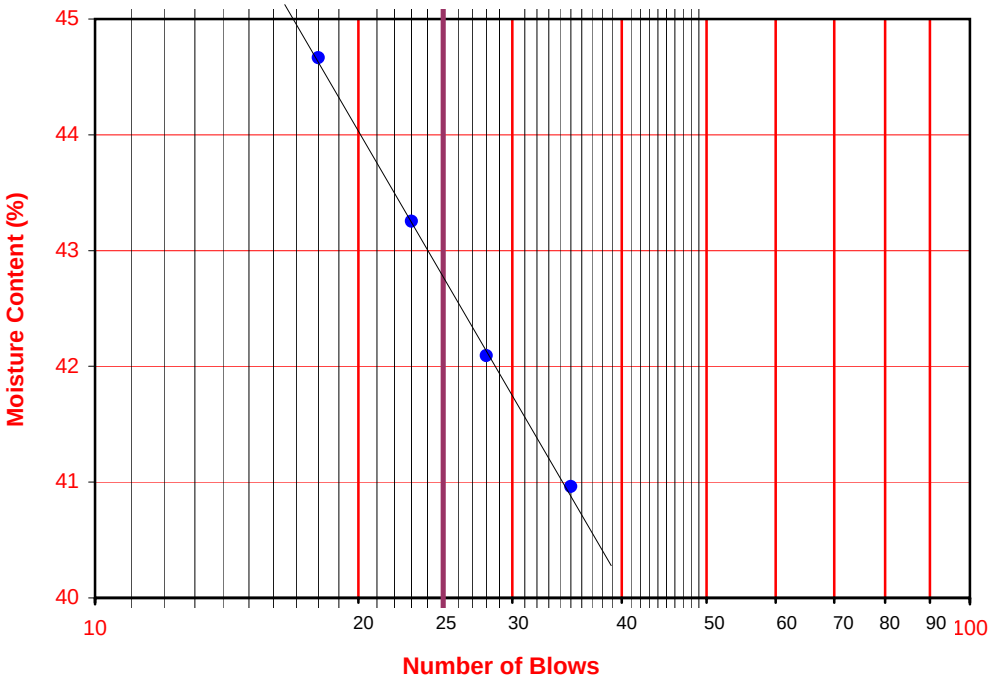
One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



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:	G. Bathala	Date:	05/21/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/22/09
Boring No.:	A-08-025	Checked By:	J. Ward		
Sample No.:	D-1	Depth (ft.)	5.0		
Soil Identification:	Olive lean clay with sand (CL)s				

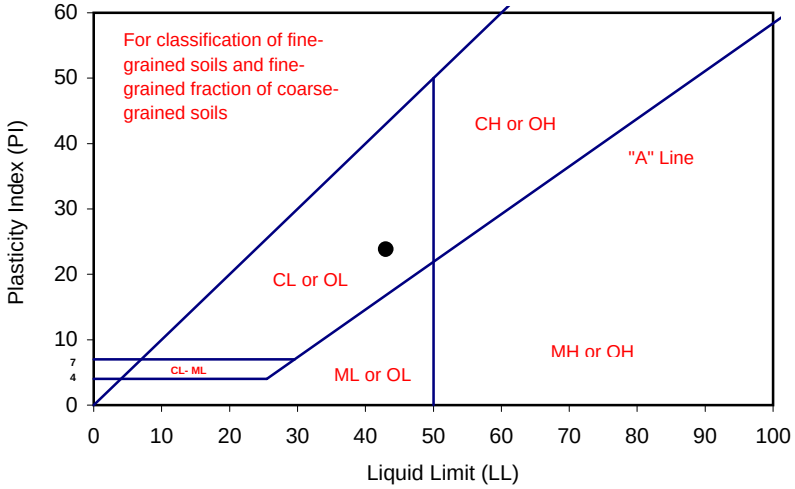
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	27	22	17
Wet Wt. of Soil + Cont. (g)	11.67	11.66	12.98	14.96	14.07	15.14
Dry Wt. of Soil + Cont. (g)	9.96	9.96	9.58	10.84	10.13	10.73
Wt. of Container (g)	1.07	1.06	1.08	1.12	1.05	1.10
Moisture Content (%) [Wn]	19.24	19.10	40.00	42.39	43.39	45.79

Liquid Limit	**43**
Plastic Limit	**19**
Plasticity Index	**24**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.79

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



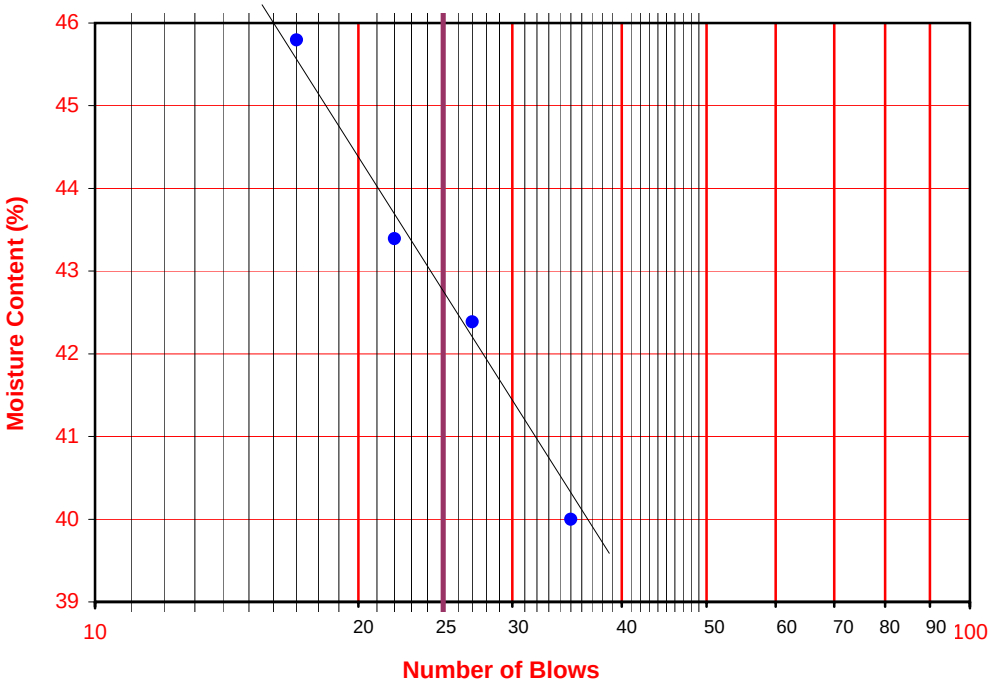
PROCEDURES USED

[ ] 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:	09/03/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/04/08
Boring No.:	A-08-025	Checked By:	LF		
Sample No.:	S-4	Depth (ft.)	20.0		
Soil Identification:	Olive brown lean clay (CL)				

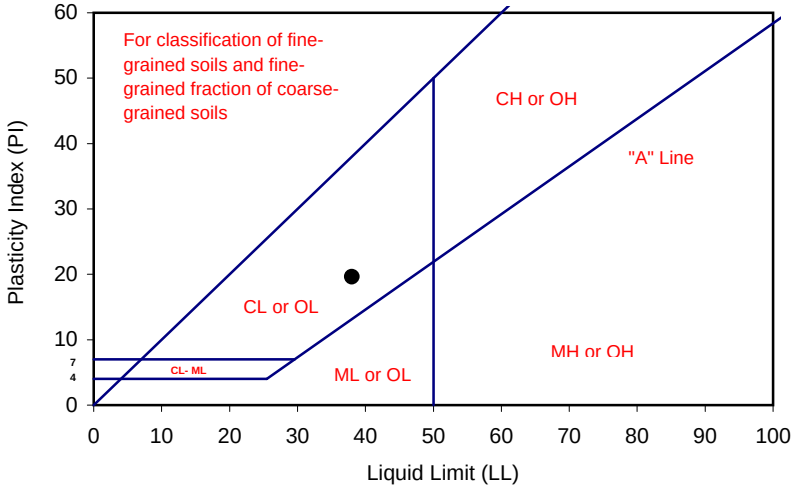
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			30	22	15	
Wet Wt. of Soil + Cont. (g)	9.37	9.27	21.72	21.04	20.22	
Dry Wt. of Soil + Cont. (g)	8.08	8.00	16.06	15.43	14.71	
Wt. of Container (g)	1.04	1.10	1.02	1.05	1.11	
Moisture Content (%) [Wn]	18.32	18.41	37.63	39.01	40.51	

Liquid Limit	**38**
Plastic Limit	**18**
Plasticity Index	**20**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 13.14

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



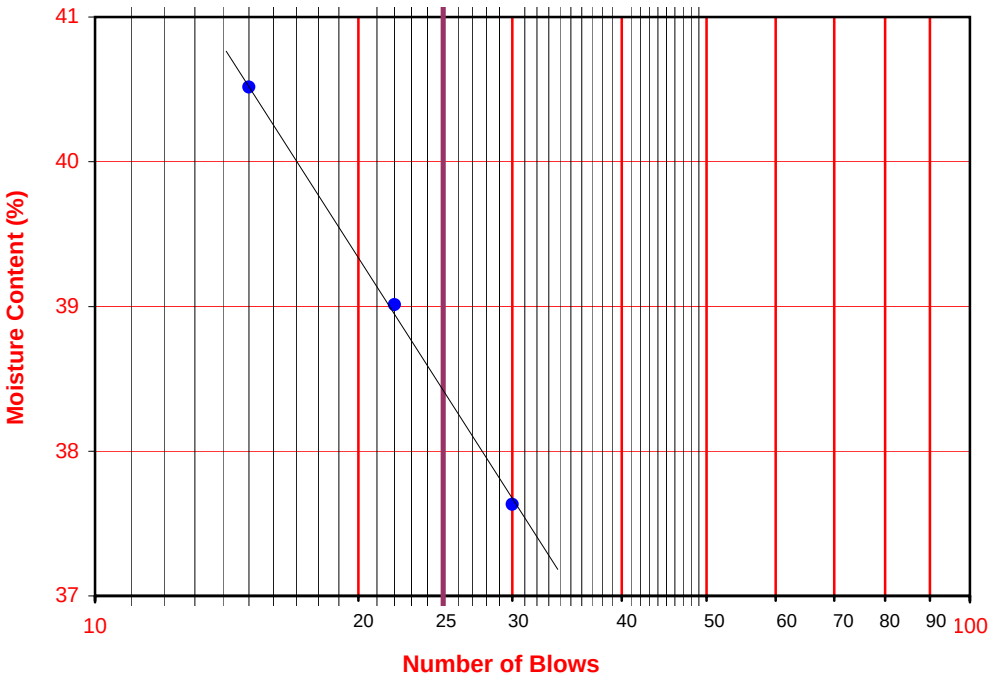
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/09/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/10/08
Boring No.:	A-08-025	Checked By:	LF		
Sample No.:	Bag-1	Depth (ft.)	20-25		
Soil Identification:	Olive lean clay (CL)				

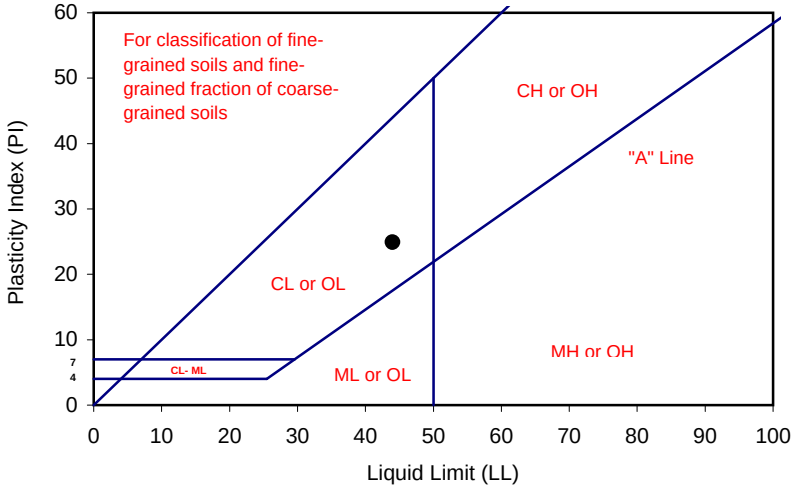
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	28	23	15
Wet Wt. of Soil + Cont. (g)	13.15	12.89	12.38	14.62	12.88	14.64
Dry Wt. of Soil + Cont. (g)	11.21	10.99	9.00	10.55	9.22	10.26
Wt. of Container (g)	1.07	1.04	1.01	1.08	1.04	1.06
Moisture Content (%) [Wn]	19.13	19.10	42.30	42.98	44.74	47.61

Liquid Limit	**44**
Plastic Limit	**19**
Plasticity Index	**25**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 17.52

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



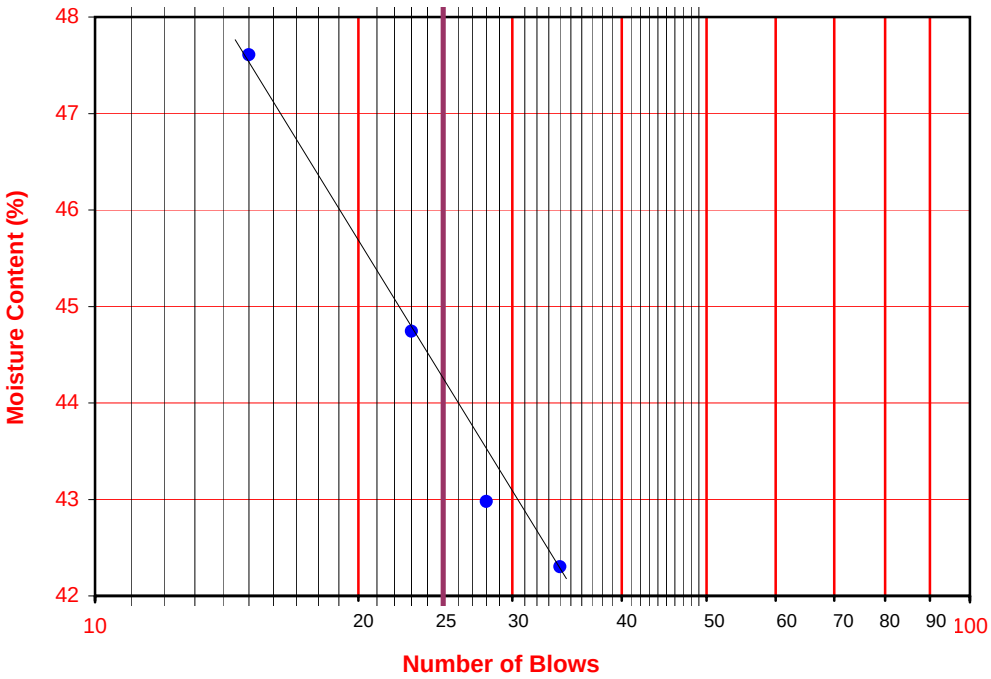
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	09/02/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/03/08
Boring No.:	A-08-025	Checked By:	LF		
Sample No.:	D-5	Depth (ft.)	25.0		
Soil Identification:	Olive lean clay (CL)				

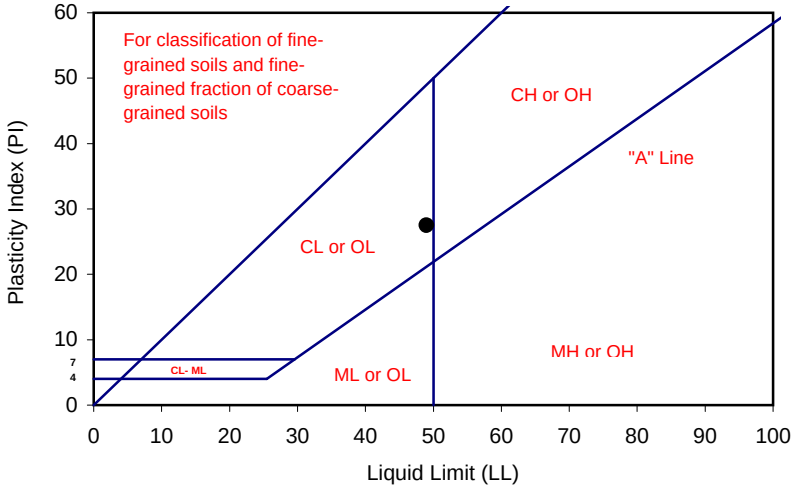
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	28	21	
Wet Wt. of Soil + Cont. (g)	10.38	11.01	13.33	12.91	15.21	
Dry Wt. of Soil + Cont. (g)	8.73	9.25	9.36	9.02	10.49	
Wt. of Container (g)	1.02	1.08	1.02	1.06	1.12	
Moisture Content (%) [Wn]	21.40	21.54	47.60	48.87	50.37	

Liquid Limit	**49**
Plastic Limit	**21**
Plasticity Index	**28**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 21.17

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



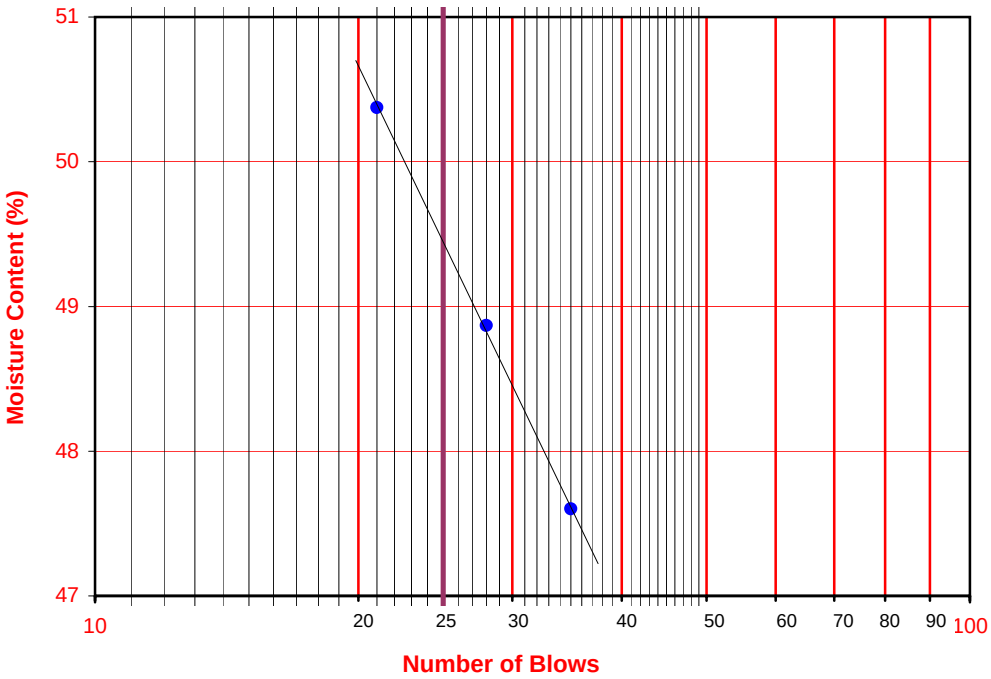
PROCEDURES USED

[ ] 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:	09/09/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/10/08
Boring No.:	A-08-025	Checked By:	LF		
Sample No.:	Bag-2	Depth (ft.)	25-30		
Soil Identification:	Olive brown lean clay with sand (CL)s				

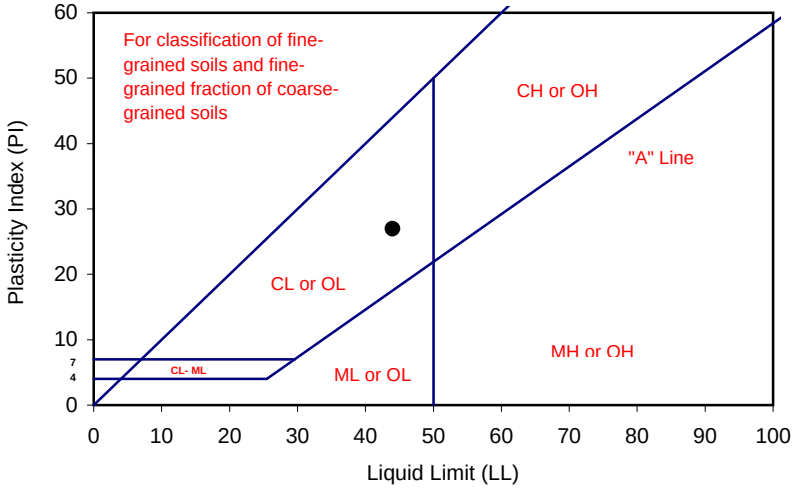
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			36	26	16	
Wet Wt. of Soil + Cont. (g)	9.58	9.89	21.64	20.66	21.18	
Dry Wt. of Soil + Cont. (g)	8.34	8.59	15.50	14.65	14.79	
Wt. of Container (g)	1.02	1.02	1.05	1.01	1.05	
Moisture Content (%) [Wn]	16.94	17.17	42.49	44.06	46.51	

Liquid Limit	**44**
Plastic Limit	**17**
Plasticity Index	**27**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 17.52

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



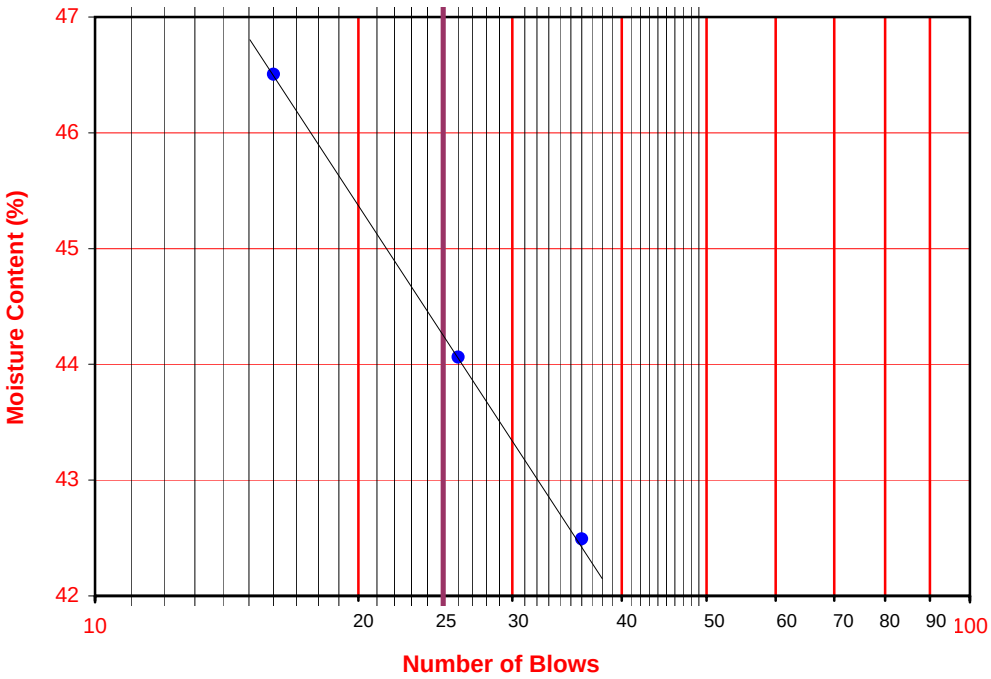
PROCEDURES USED

[ ] 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:	08/25/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/26/08
Boring No.:	A-08-025	Checked By:	LF		
Sample No.:	D-7	Depth (ft.)	35.0		
Soil Identification:	Olive brown lean clay (CL)				

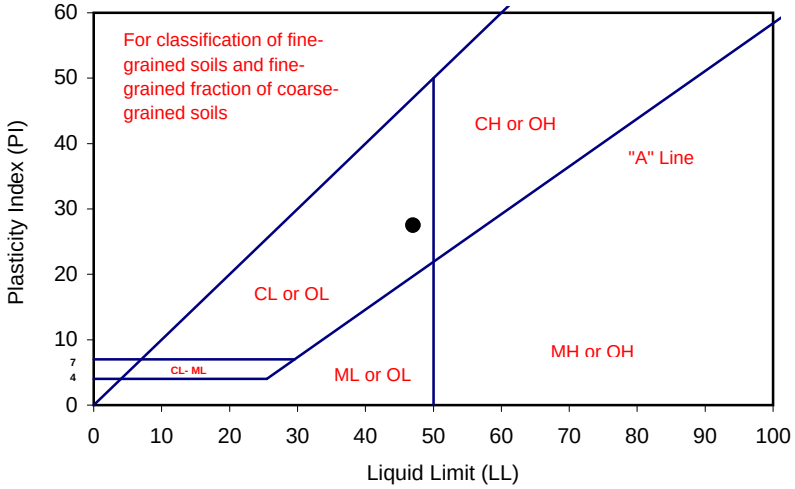
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	24	20	
Wet Wt. of Soil + Cont. (g)	9.49	9.32	19.94	20.10	22.31	
Dry Wt. of Soil + Cont. (g)	8.11	7.97	14.06	14.03	15.41	
Wt. of Container (g)	1.02	1.05	1.08	1.07	1.03	
Moisture Content (%) [Wn]	19.46	19.51	45.30	46.84	47.98	

Liquid Limit	**47**
Plastic Limit	**19**
Plasticity Index	**28**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 19.71

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



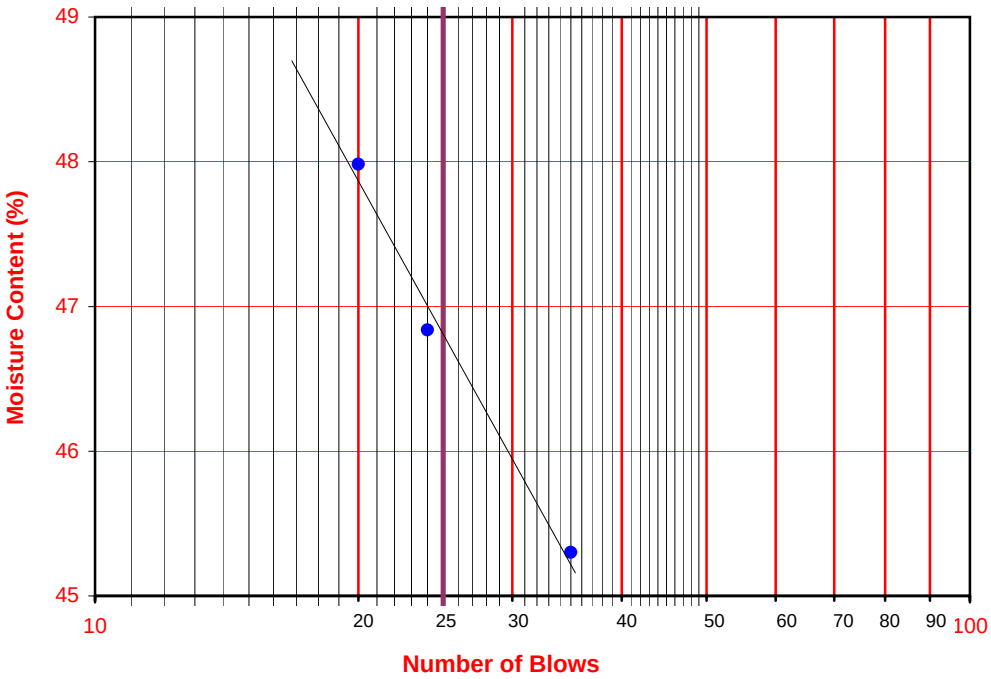
PROCEDURES USED

[ ] 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:	08/25/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/26/08
Boring No.:	A-08-025	Checked By:	LF		
Sample No.:	D-11	Depth (ft.)	55.0		
Soil Identification:	Dark olive clayey sand (SC)				

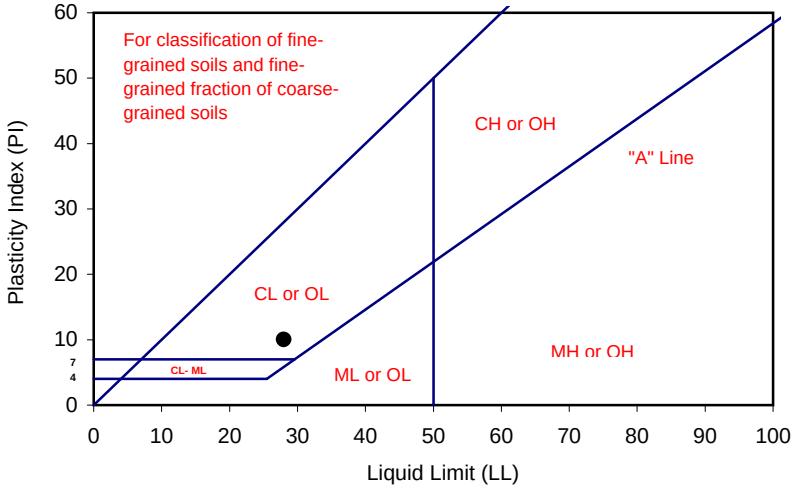
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			36	24	17	
Wet Wt. of Soil + Cont. (g)	10.10	9.67	21.09	20.51	21.48	
Dry Wt. of Soil + Cont. (g)	8.74	8.35	16.80	16.23	16.87	
Wt. of Container (g)	1.07	1.11	1.07	1.04	1.07	
Moisture Content (%) [Wn]	17.73	18.23	27.27	28.18	29.18	

Liquid Limit	**28**
Plastic Limit	**18**
Plasticity Index	**10**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 5.84

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



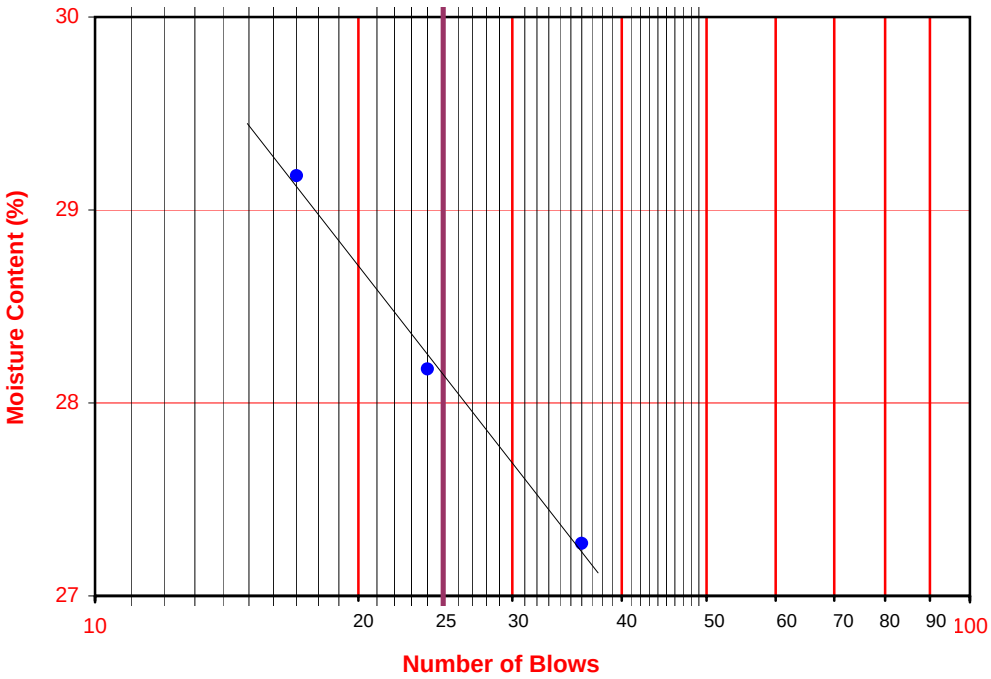
PROCEDURES USED

[ ] 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:	08/26/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/27/08
Boring No.:	A-08-025	Checked By:	LF		
Sample No.:	D-15	Depth (ft.)	75.0		
Soil Identification:	Dark olive brown clayey sand (SC)				

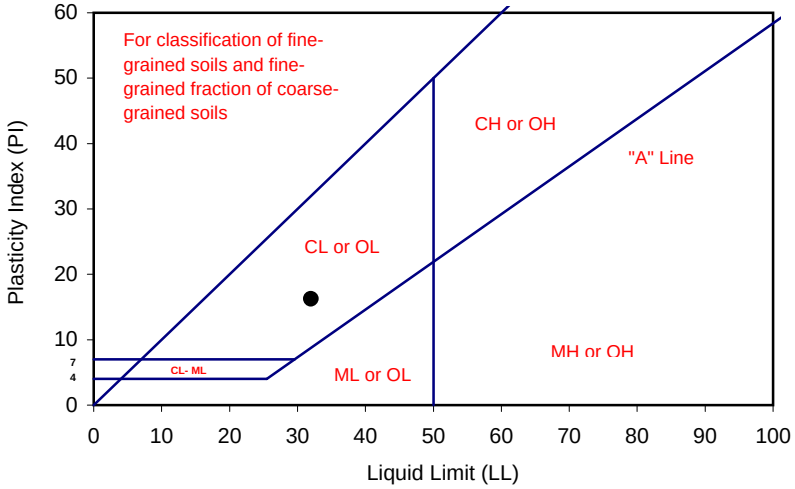
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	29	25	20
Wet Wt. of Soil + Cont. (g)	9.08	9.09	19.86	21.49	20.59	19.96
Dry Wt. of Soil + Cont. (g)	7.99	8.00	15.39	16.54	15.80	15.23
Wt. of Container (g)	1.07	1.07	1.03	1.07	1.08	1.02
Moisture Content (%) [Wn]	15.75	15.73	31.13	32.00	32.54	33.29

Liquid Limit	**32**
Plastic Limit	**16**
Plasticity Index	**16**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.76

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



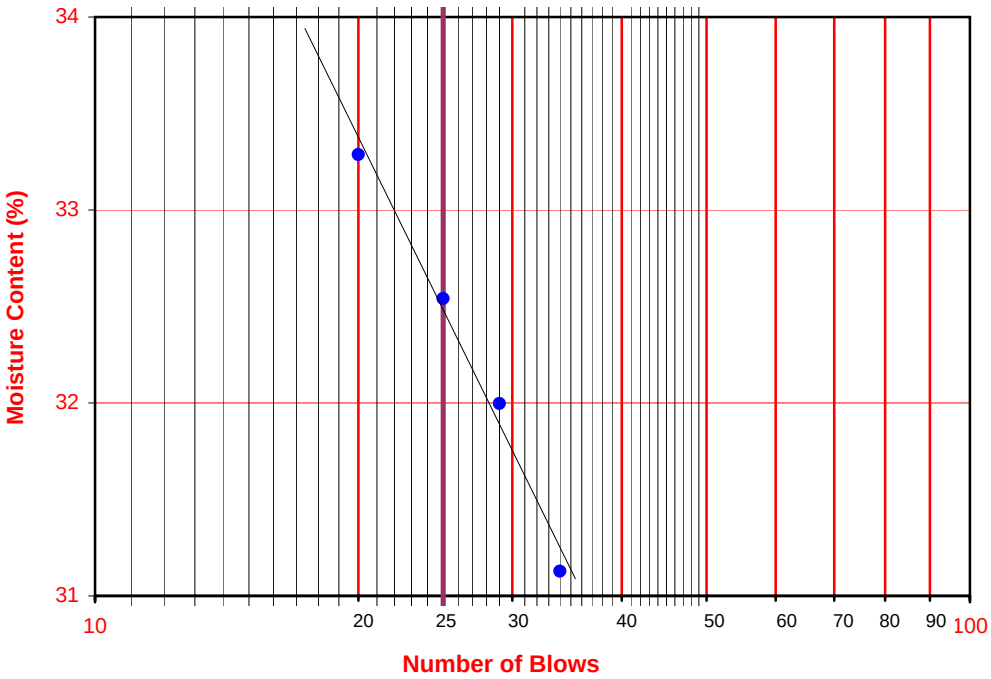
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/23/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/25/08
Boring No.:	A-08-026	Checked By:	LF		
Sample No.:	Bag-1	Depth (ft.)	5-10		
Soil Identification:	Yellowish brown sandy lean clay s(CL)				

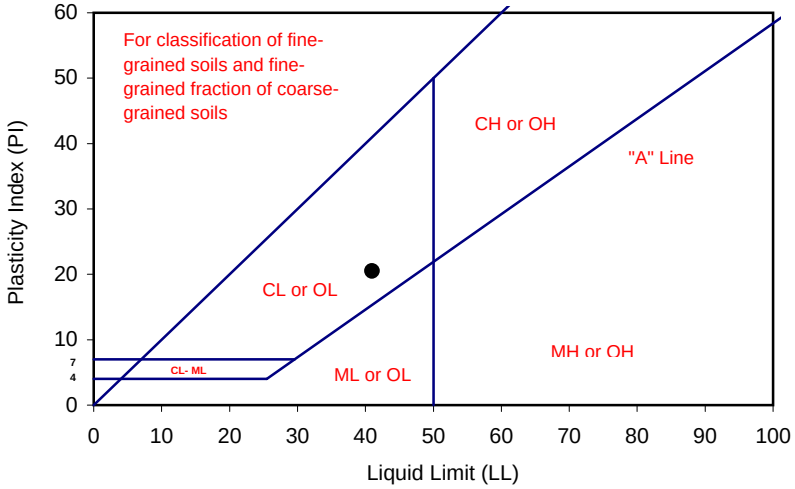
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			32	24	16	
Wet Wt. of Soil + Cont. (g)	12.51	13.30	15.13	14.45	15.20	
Dry Wt. of Soil + Cont. (g)	10.56	11.22	11.07	10.52	10.92	
Wt. of Container (g)	1.04	1.07	1.04	1.05	1.08	
Moisture Content (%) [Wn]	20.48	20.49	40.48	41.50	43.50	

Liquid Limit	**41**
Plastic Limit	**20**
Plasticity Index	**21**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 15.33

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



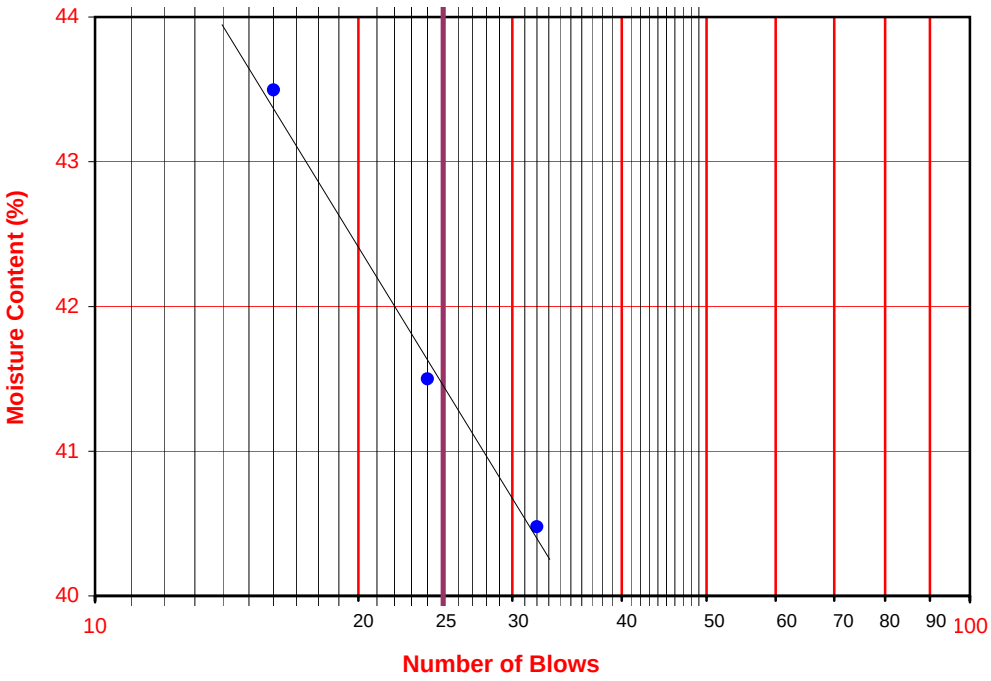
PROCEDURES USED

[ ] 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:	10/01/08
Project No. :	370900.02.GE.0S	Input By:	J. Ward	Date:	10/02/08
Boring No.:	A-08-026	Checked By:	J. Ward		
Sample No.:	D-4	Depth (ft.)	20.0		
Soil Identification:	Dark brown lean clay (CL)				

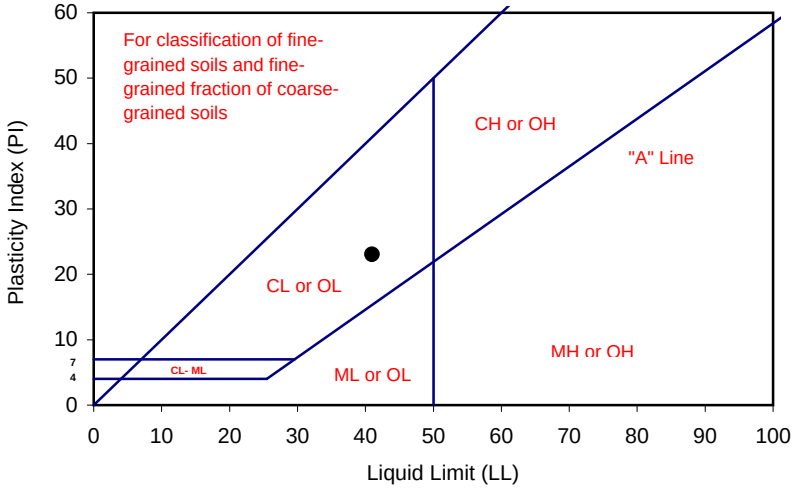
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			28	22	17	
Wet Wt. of Soil + Cont. (g)	10.65	11.23	19.85	19.99	20.03	
Dry Wt. of Soil + Cont. (g)	9.19	9.67	14.41	14.46	14.41	
Wt. of Container (g)	1.02	1.03	1.02	1.09	1.07	
Moisture Content (%) [Wn]	17.87	18.06	40.63	41.36	42.13	

Liquid Limit	**41**
Plastic Limit	**18**
Plasticity Index	**23**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 15.33

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



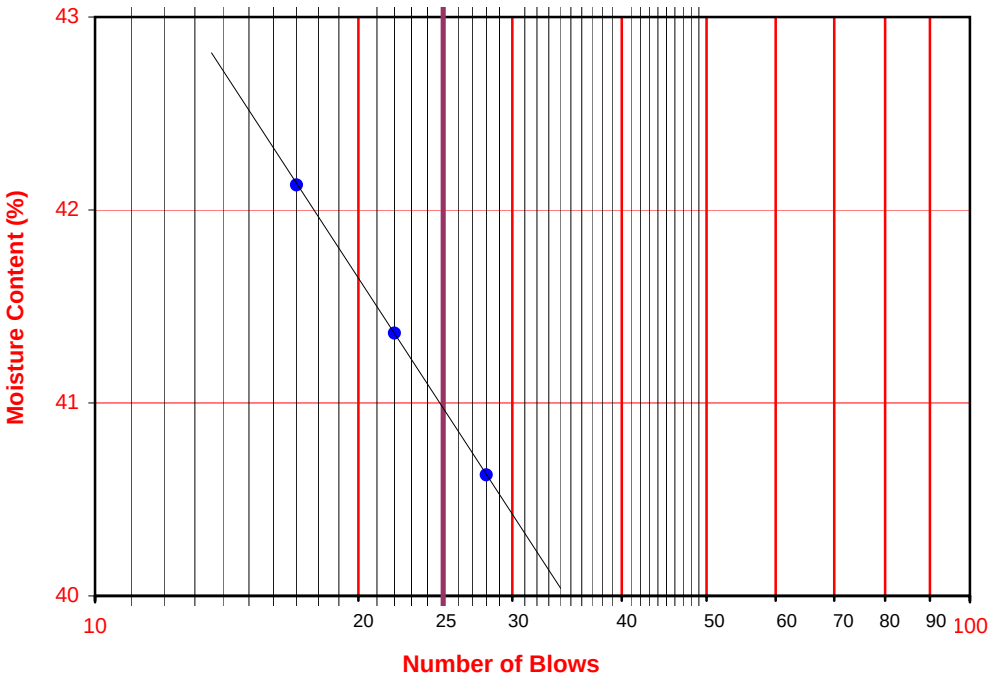
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/24/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/25/08
Boring No.:	A-08-026	Checked By:	LF		
Sample No.:	D-6	Depth (ft.)	30.0		
Soil Identification:	Yellowish brown lean clay (CL)				

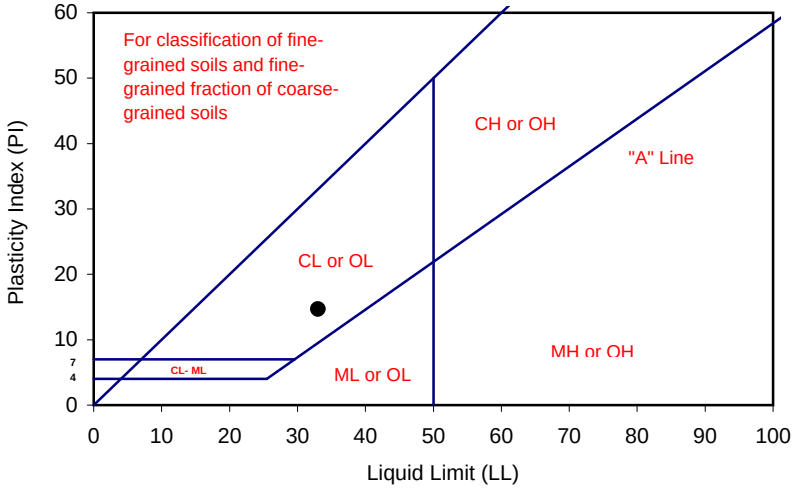
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			31	24	17	
Wet Wt. of Soil + Cont. (g)	13.82	13.04	15.18	14.24	16.40	
Dry Wt. of Soil + Cont. (g)	11.85	11.18	11.79	10.98	12.54	
Wt. of Container (g)	1.07	1.04	1.09	1.03	1.04	
Moisture Content (%) [Wn]	18.27	18.34	31.68	32.76	33.57	

Liquid Limit	**33**
Plastic Limit	**18**
Plasticity Index	**15**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 9.49

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



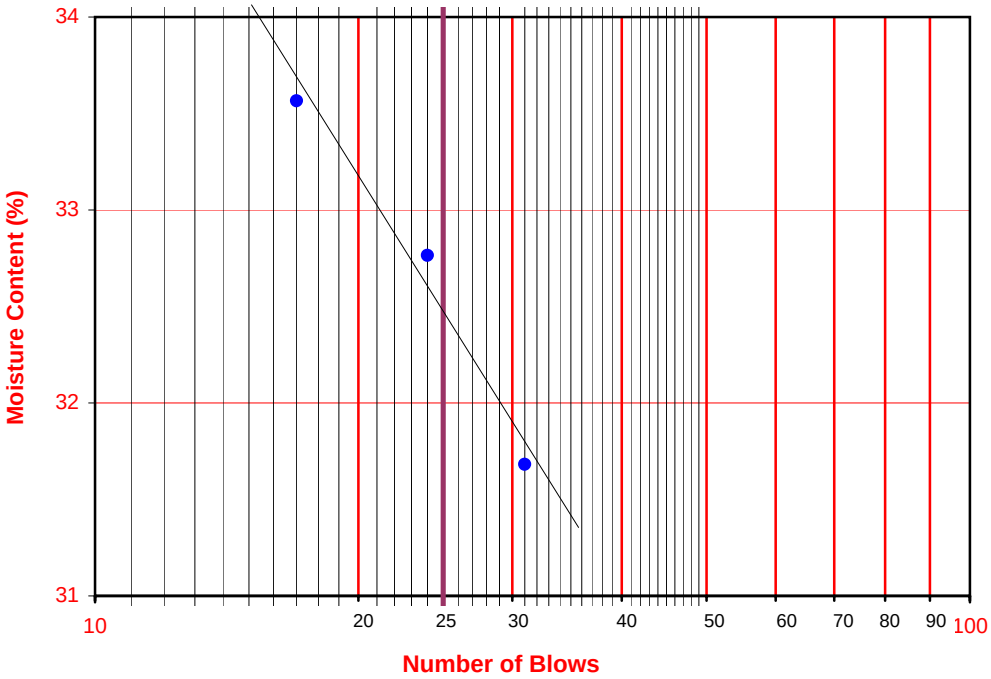
PROCEDURES USED

[ ] 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:	09/30/08
Project No. :	370900.02.GE.0S	Input By:	J. Ward	Date:	10/01/08
Boring No.:	A-08-026	Checked By:	J. Ward		
Sample No.:	D-10	Depth (ft.)	50.0		
Soil Identification:	Yellowish brown lean clay (CL)				

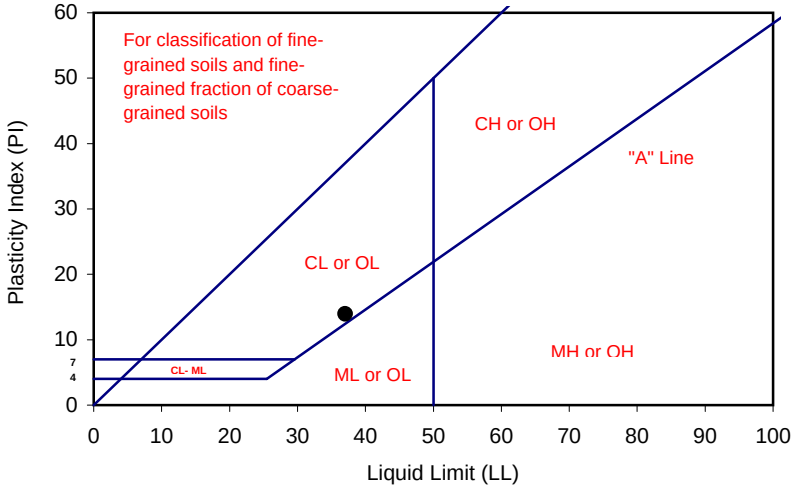
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	26	19	
Wet Wt. of Soil + Cont. (g)	9.74	9.18	21.29	20.43	20.09	
Dry Wt. of Soil + Cont. (g)	8.12	7.66	15.90	15.24	14.94	
Wt. of Container (g)	1.10	1.06	1.04	1.05	1.06	
Moisture Content (%) [Wn]	23.08	23.03	36.27	36.58	37.10	

Liquid Limit	**37**
Plastic Limit	**23**
Plasticity Index	**14**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 12.41

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



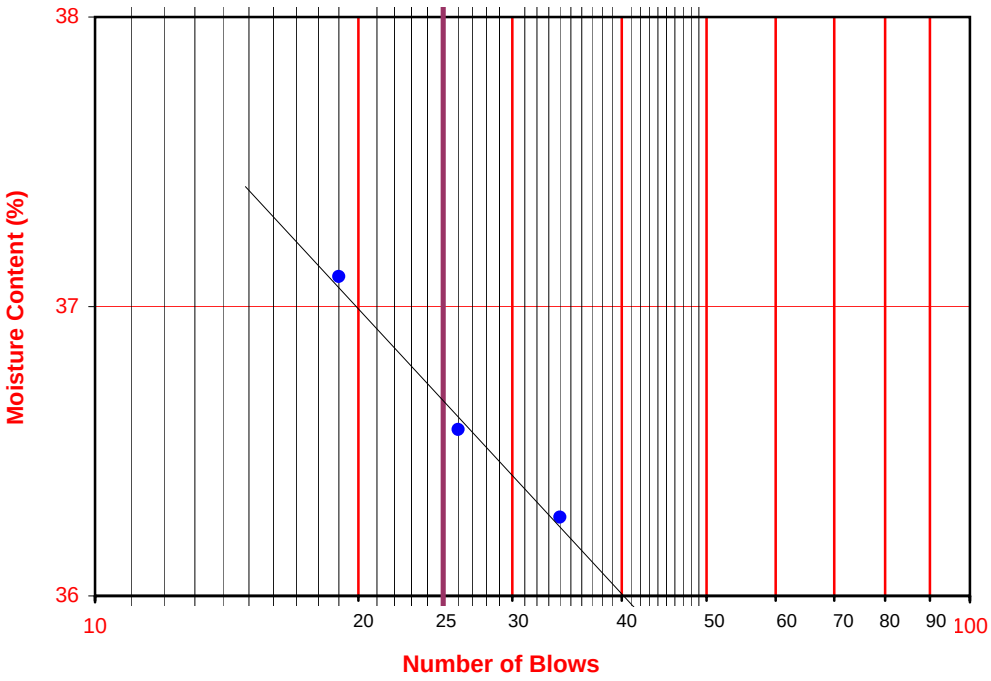
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	09/23/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	09/25/08
Boring No.:	A-08-026	Checked By:	LF		
Sample No.:	S-15	Depth (ft.)	75.0		
Soil Identification:	Yellowish brown lean clay with sand (CL)s				

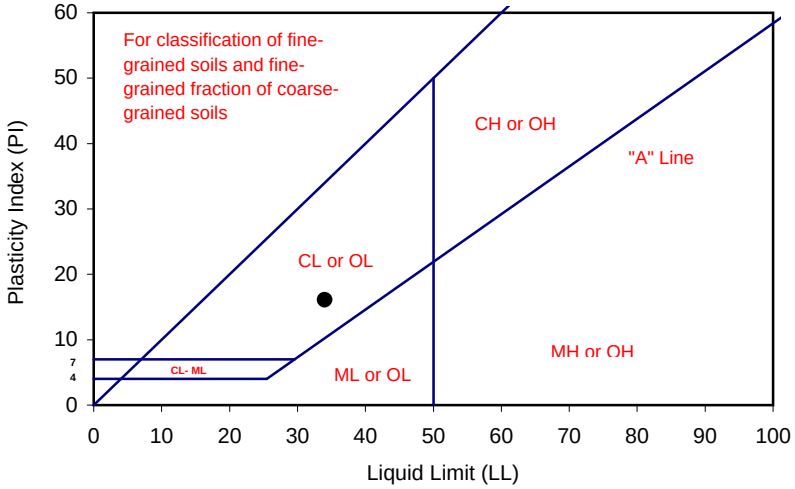
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	26	18	
Wet Wt. of Soil + Cont. (g)	11.46	11.97	13.08	15.28	15.00	
Dry Wt. of Soil + Cont. (g)	9.87	10.33	10.13	11.66	11.31	
Wt. of Container (g)	1.06	1.10	1.07	1.05	1.04	
Moisture Content (%) [Wn]	18.05	17.77	32.56	34.12	35.93	

Liquid Limit	**34**
Plastic Limit	**18**
Plasticity Index	**16**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 10.22

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



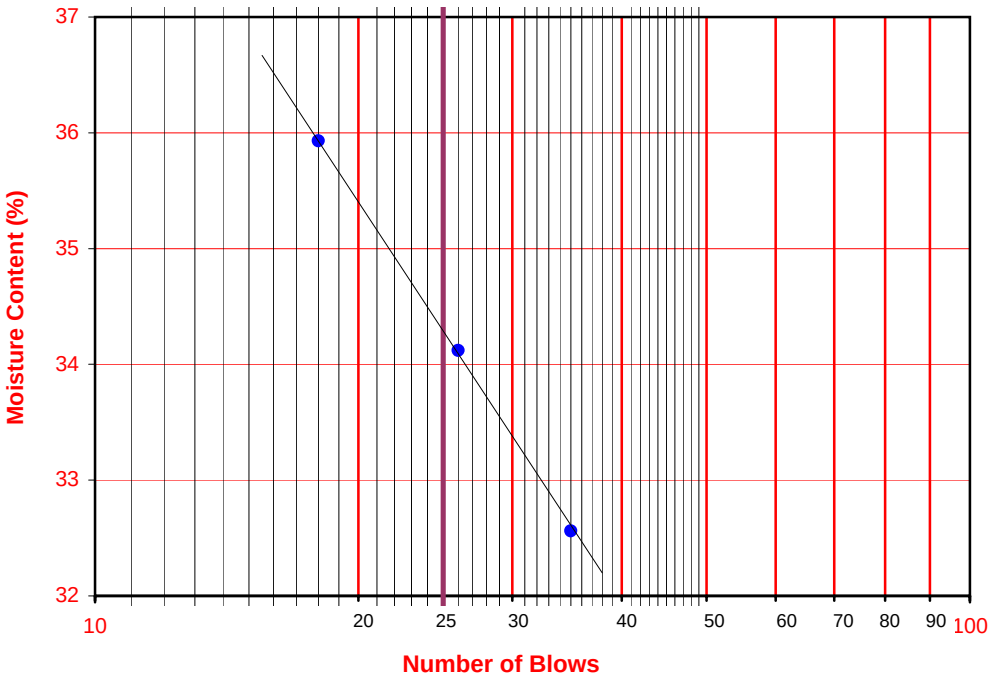
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

ATTERBERG LIMITS

ASTM D 4318

Project Name:	SR-57 Widening	Tested By:	G. Bathala	Date:	05/21/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/22/09
Boring No.:	A-08-027	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	0-7		
Soil Identification:	Pale olive sandy lean clay s(CL)				

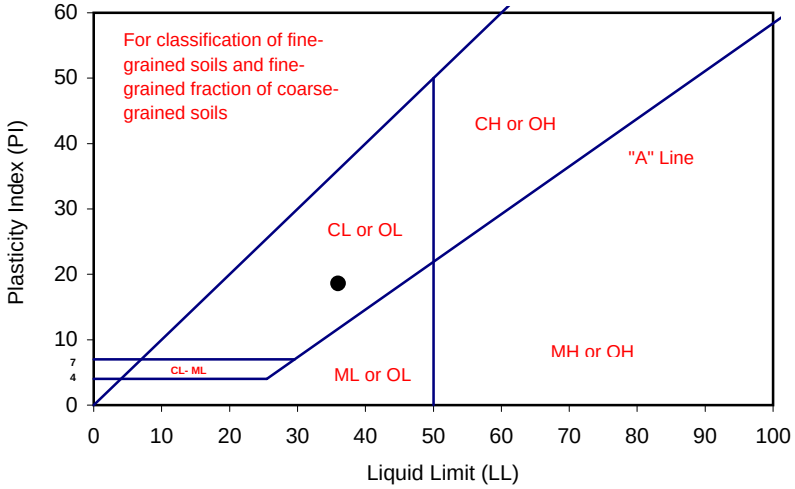
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			15	20	28	35
Wet Wt. of Soil + Cont. (g)	13.37	13.34	13.18	14.47	14.61	13.46
Dry Wt. of Soil + Cont. (g)	11.54	11.52	9.84	10.88	11.08	10.28
Wt. of Container (g)	1.06	1.05	1.05	1.07	1.08	1.07
Moisture Content (%) [Wn]	17.46	17.38	38.00	36.60	35.30	34.53

Liquid Limit	**36**
Plastic Limit	**17**
Plasticity Index	**19**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 11.68

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



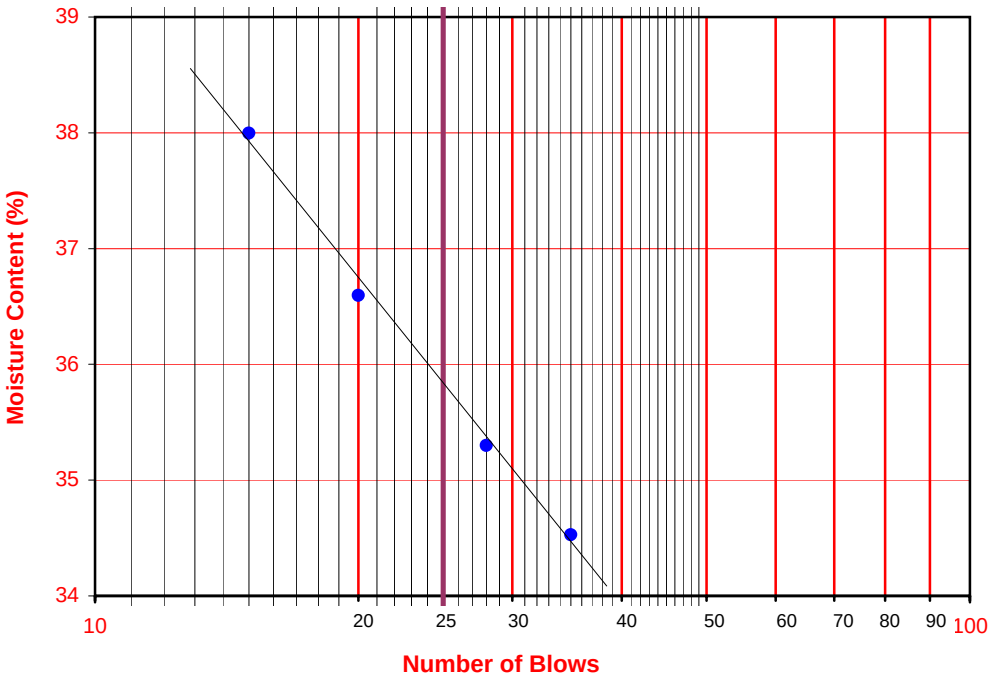
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/20/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/21/08
Boring No.:	A-08-027	Checked By:	LF		
Sample No.:	S-4	Depth (ft.)	20.0		
Soil Identification:	Olive brown clayey sand with gravel (SC)g				

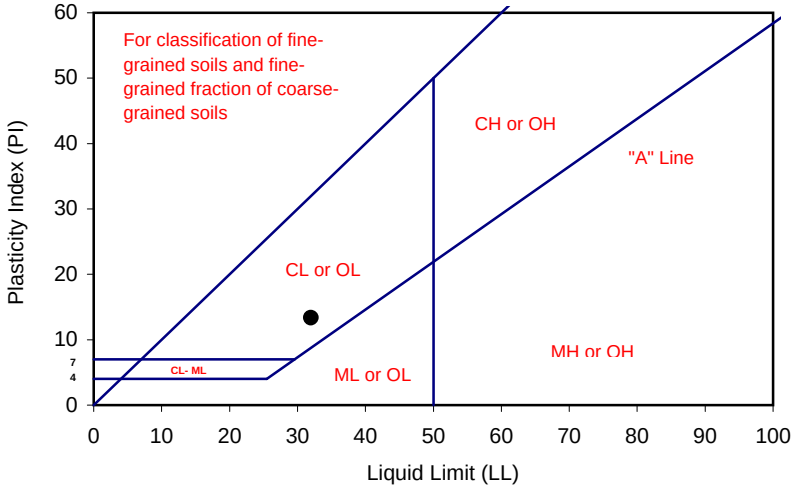
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			34	29	22	16
Wet Wt. of Soil + Cont. (g)	11.18	10.96	14.99	14.43	15.36	15.30
Dry Wt. of Soil + Cont. (g)	9.58	9.42	11.73	11.21	11.84	11.67
Wt. of Container (g)	1.04	1.10	1.09	1.10	1.04	1.06
Moisture Content (%) [Wn]	18.74	18.51	30.64	31.85	32.59	34.21

Liquid Limit	**32**
Plastic Limit	**19**
Plasticity Index	**13**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.76

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



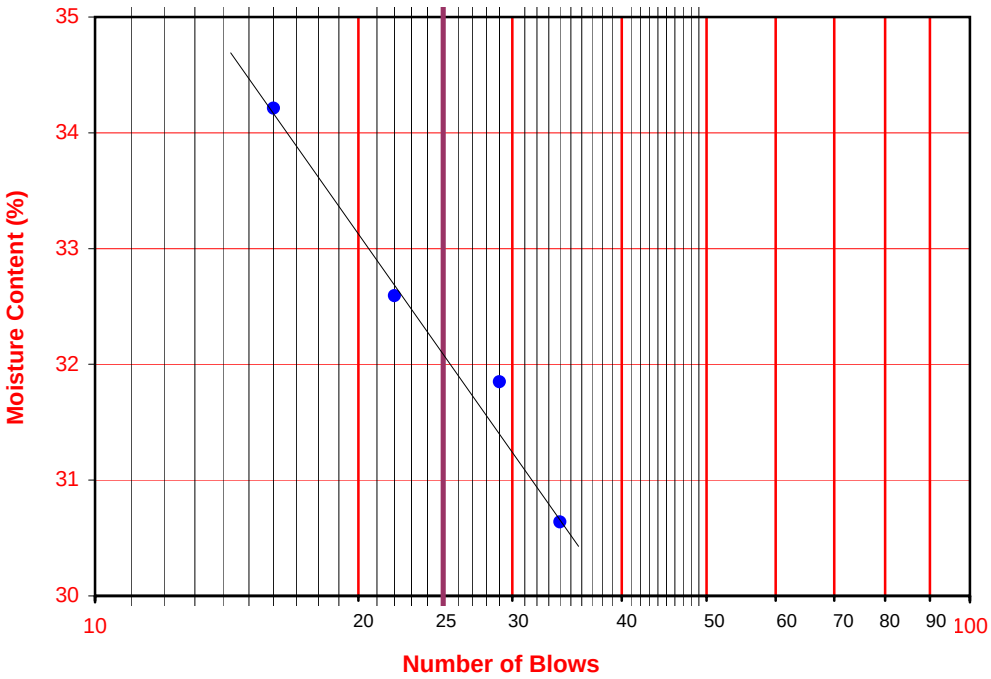
PROCEDURES USED

[ ] 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:	F. Tabibkhoei	Date:	05/21/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/22/09
Boring No.:	A-08-028	Checked By:	J. Ward		
Sample No.:	Bag-1	Depth (ft.)	0-7		
Soil Identification:	Olive sandy lean clay with gravel s(CL)g				

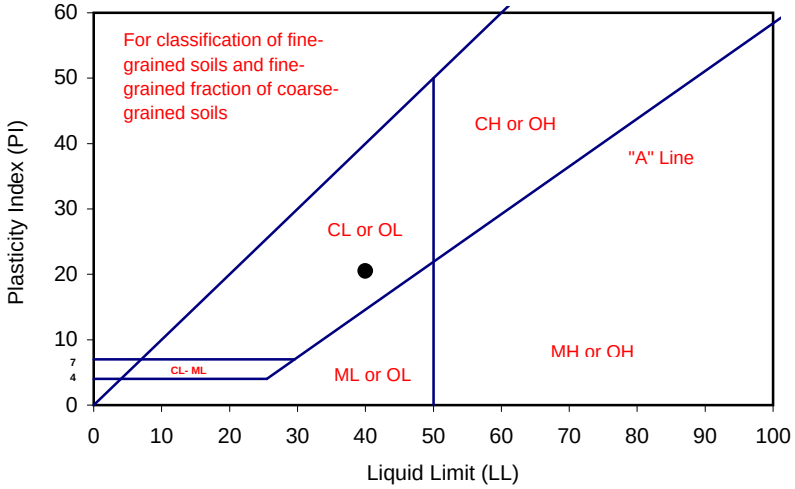
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	22	15	
Wet Wt. of Soil + Cont. (g)	44.41	44.46	39.08	50.58	50.50	
Dry Wt. of Soil + Cont. (g)	41.15	41.23	34.98	45.08	44.55	
Wt. of Container (g)	24.42	24.67	24.33	31.56	30.86	
Moisture Content (%) [Wn]	19.49	19.50	38.50	40.68	43.46	

Liquid Limit	**40**
Plastic Limit	**19**
Plasticity Index	**21**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 14.6

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



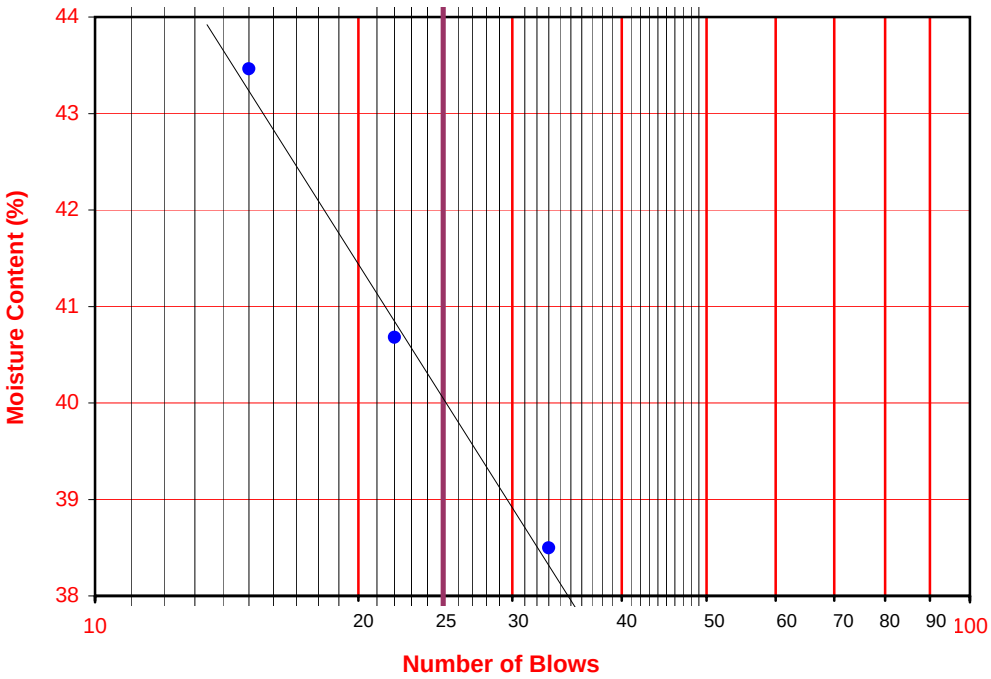
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/05/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/06/08
Boring No.:	A-08-028	Checked By:	LF		
Sample No.:	S-2	Depth (ft.)	10.0		
Soil Identification:	Olive sandy lean clay s(CL)				

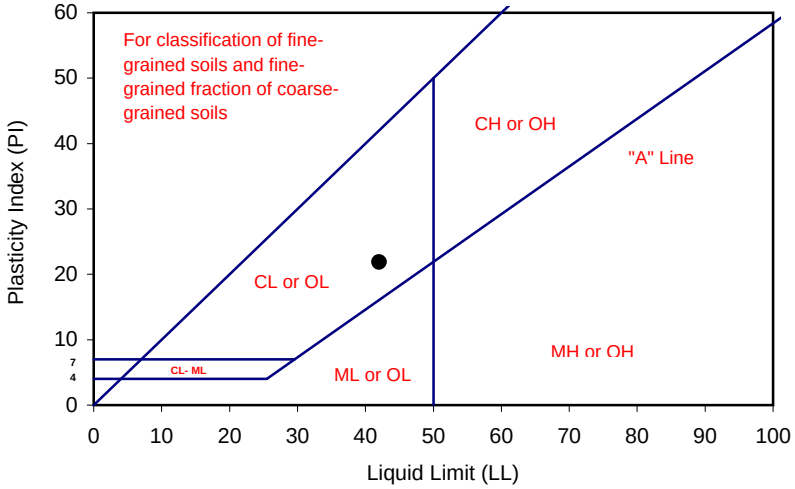
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			33	24	18	
Wet Wt. of Soil + Cont. (g)	13.54	12.65	14.91	14.09	16.35	
Dry Wt. of Soil + Cont. (g)	11.45	10.70	10.88	10.20	11.74	
Wt. of Container (g)	1.05	1.03	1.10	1.04	1.05	
Moisture Content (%) [Wn]	20.10	20.17	41.21	42.47	43.12	

Liquid Limit	**42**
Plastic Limit	**20**
Plasticity Index	**22**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 16.06

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



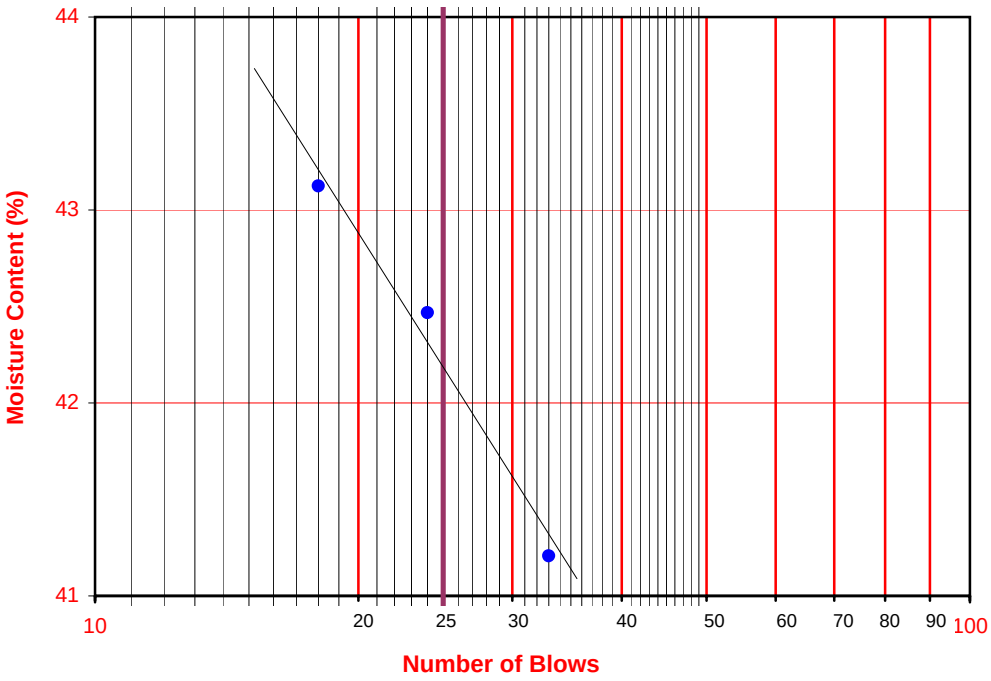
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/19/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/20/08
Boring No.:	A-08-028	Checked By:	LF		
Sample No.:	S-4	Depth (ft.)	20.0		
Soil Identification:	Pale olive clayey sand (SC)				

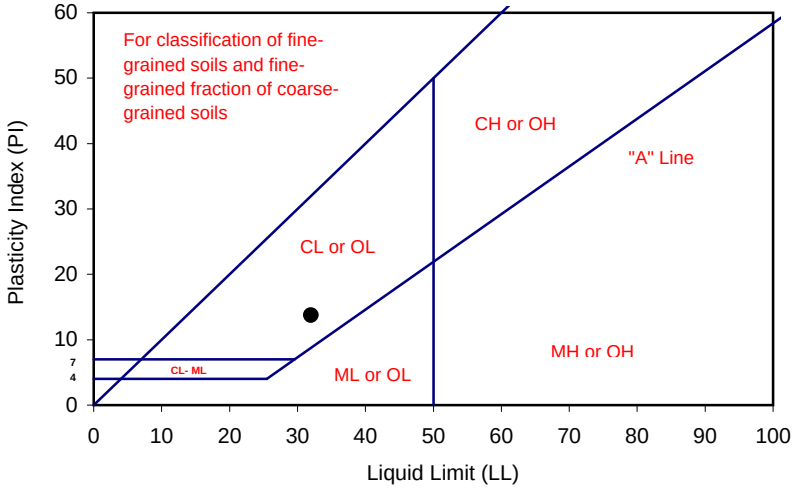
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			32	26	19	
Wet Wt. of Soil + Cont. (g)	14.08	13.23	15.06	14.59	15.27	
Dry Wt. of Soil + Cont. (g)	12.07	11.36	11.73	11.31	11.65	
Wt. of Container (g)	1.06	1.11	1.04	1.08	1.06	
Moisture Content (%) [Wn]	18.26	18.24	31.15	32.06	34.18	

Liquid Limit	**32**
Plastic Limit	**18**
Plasticity Index	**14**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 8.76

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



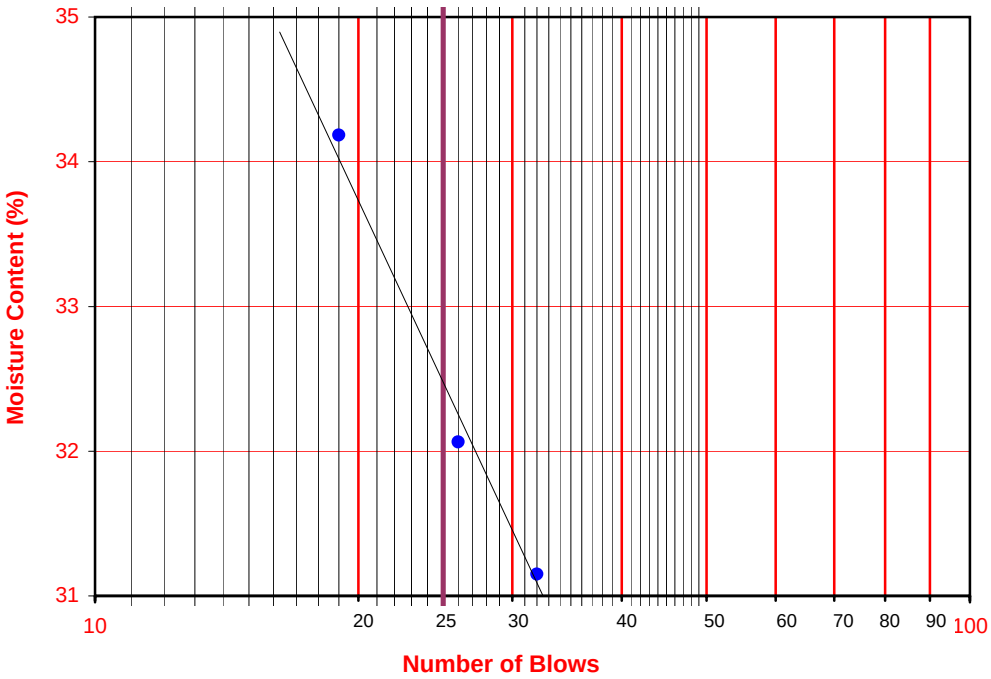
PROCEDURES USED

[ ] 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:	F. Tabibkhoei	Date:	05/21/09
Project No. :	370900.02.GE.OS	Input By:	J. Ward	Date:	05/22/09
Boring No.:	A-08-030	Checked By:	J. Ward		
Sample No.:	D-1	Depth (ft.)	5.0		
Soil Identification:	Yellowish brown fat clay with sand (CH)s				

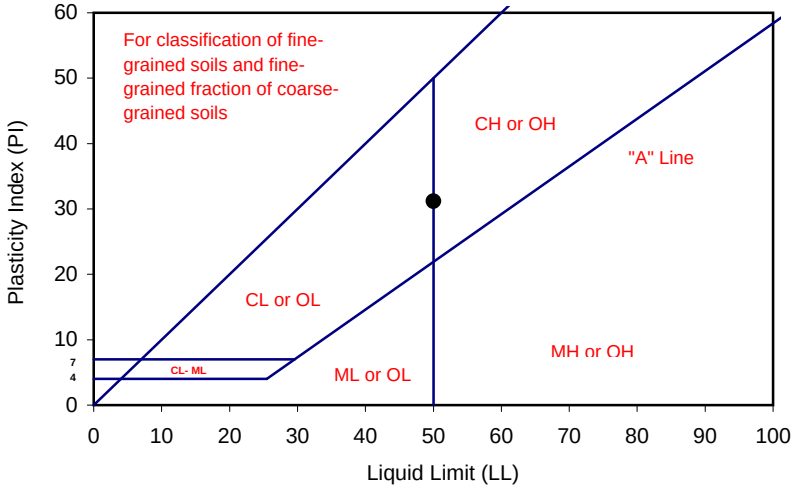
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	25	16	
Wet Wt. of Soil + Cont. (g)	50.78	42.92	38.89	43.52	62.41	
Dry Wt. of Soil + Cont. (g)	47.75	40.05	34.41	37.24	51.62	
Wt. of Container (g)	31.73	24.73	24.95	24.54	31.00	
Moisture Content (%) [Wn]	18.91	18.73	47.36	49.45	52.33	

Liquid Limit	**50**
Plastic Limit	**19**
Plasticity Index	**31**
Classification	**CH**

PI at "A" - Line = 0.73(LL-20) 21.9

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



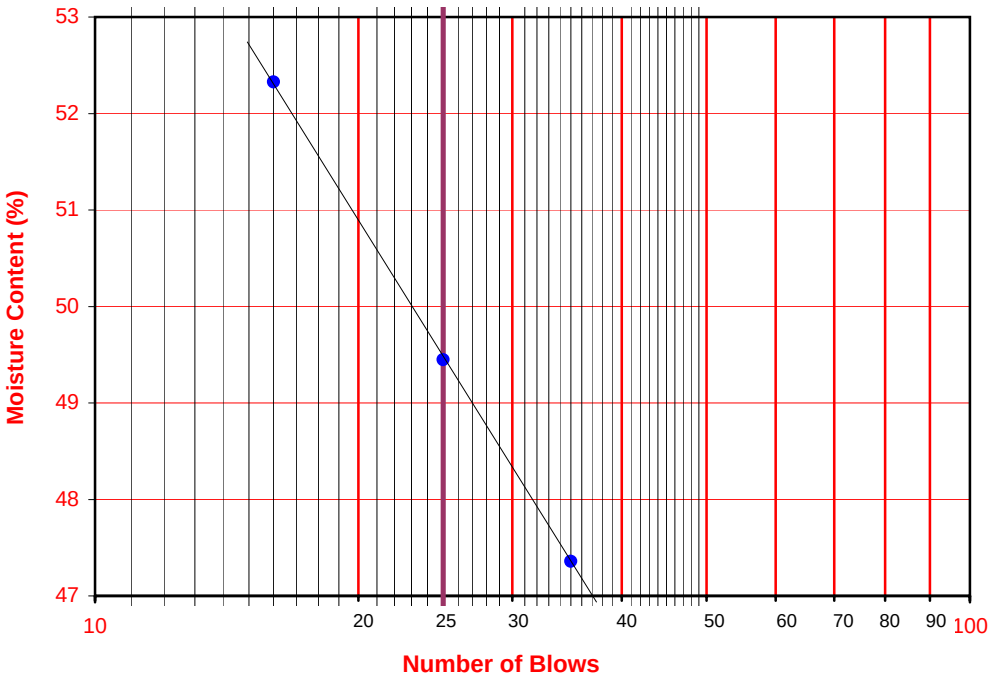
PROCEDURES USED

[ ] 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:	V. Juliano	Date:	08/18/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/20/08
Boring No.:	A-08-030	Checked By:	LF		
Sample No.:	S-6	Depth (ft.)	30.0		
Soil Identification:	Yellowish brown sandy lean clay s(CL)				

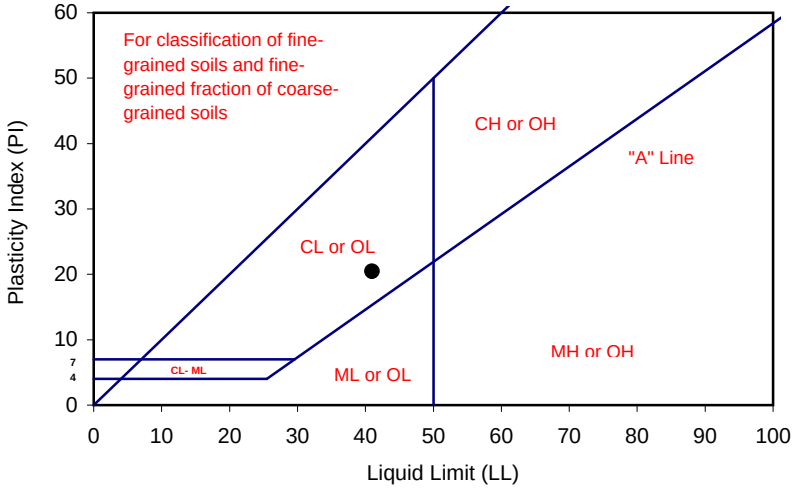
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			29	22	16	
Wet Wt. of Soil + Cont. (g)	10.54	11.43	14.39	13.49	14.28	
Dry Wt. of Soil + Cont. (g)	8.92	9.65	10.57	9.83	10.31	
Wt. of Container (g)	1.01	1.02	1.06	1.07	1.11	
Moisture Content (%) [Wn]	20.48	20.63	40.17	41.78	43.15	

Liquid Limit	**41**
Plastic Limit	**21**
Plasticity Index	**20**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 15.33

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



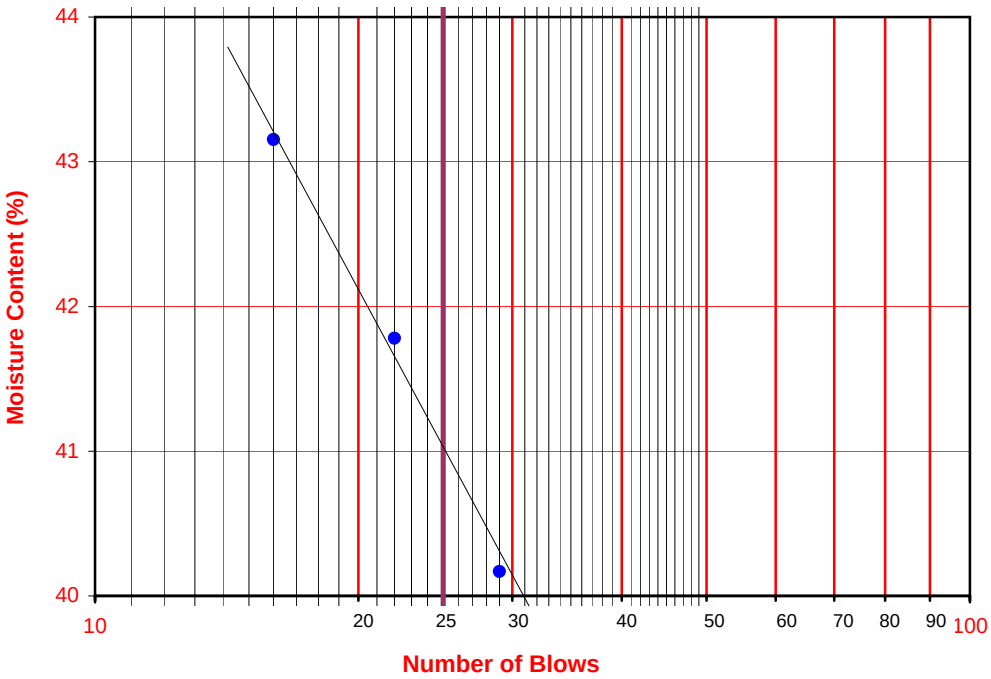
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/22/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/27/08
Boring No.:	A-08-030	Checked By:	LF		
Sample No.:	D-7	Depth (ft.)	35.0		
Soil Identification:	Yellowish brown lean clay with sand (CL)s				

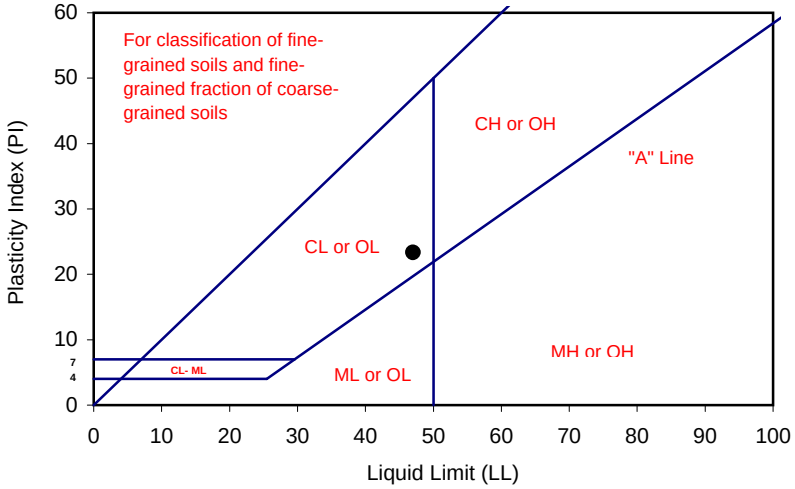
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			35	29	21	16
Wet Wt. of Soil + Cont. (g)	13.54	14.71	13.68	15.19	14.64	16.68
Dry Wt. of Soil + Cont. (g)	11.16	12.11	9.82	10.70	10.29	11.47
Wt. of Container (g)	1.11	1.10	1.09	1.01	1.09	1.06
Moisture Content (%) [Wn]	23.68	23.61	44.22	46.34	47.28	50.05

Liquid Limit	**47**
Plastic Limit	**24**
Plasticity Index	**23**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 19.71

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



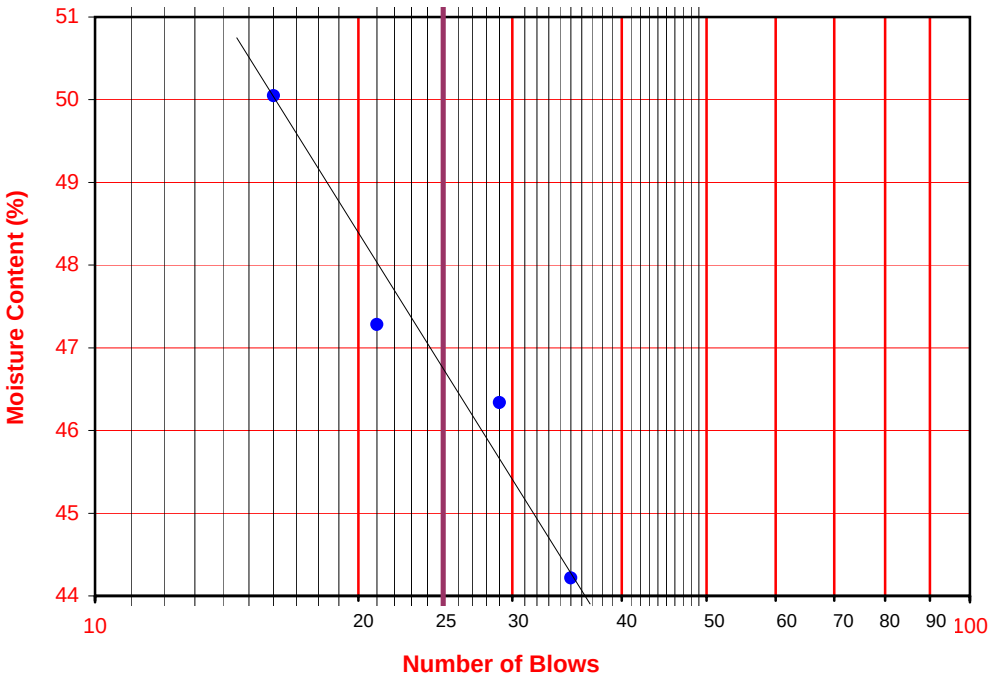
PROCEDURES USED

[ ] 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:	G. Bathala	Date:	08/11/08
Project No. :	370900.02.GE.0S	Input By:	LF	Date:	08/12/08
Boring No.:	A-08-030	Checked By:	LF		
Sample No.:	S-8	Depth (ft.)	40.0		
Soil Identification:	Yellowish brown sandy lean clay s(CL)				

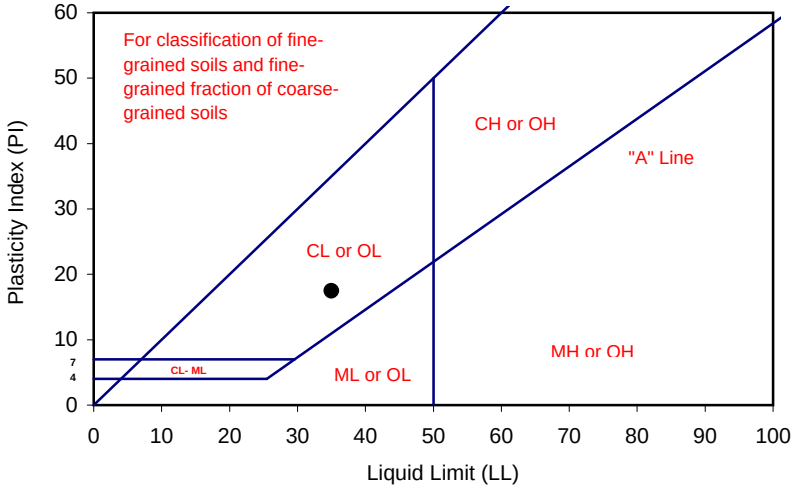
TEST	PLASTIC LIMIT		LIQUID LIMIT			
NO.	1	2	1	2	3	4
Number of Blows [N]			32	25	19	
Wet Wt. of Soil + Cont. (g)	13.86	14.93	14.85	15.19	14.68	
Dry Wt. of Soil + Cont. (g)	11.95	12.86	11.41	11.56	11.12	
Wt. of Container (g)	1.02	1.06	1.08	1.07	1.10	
Moisture Content (%) [Wn]	17.47	17.54	33.30	34.60	35.53	

Liquid Limit	**35**
Plastic Limit	**18**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) 10.95

One - Point Liquid Limit Calculation

$LL = Wn(N/25)^{0.12}$



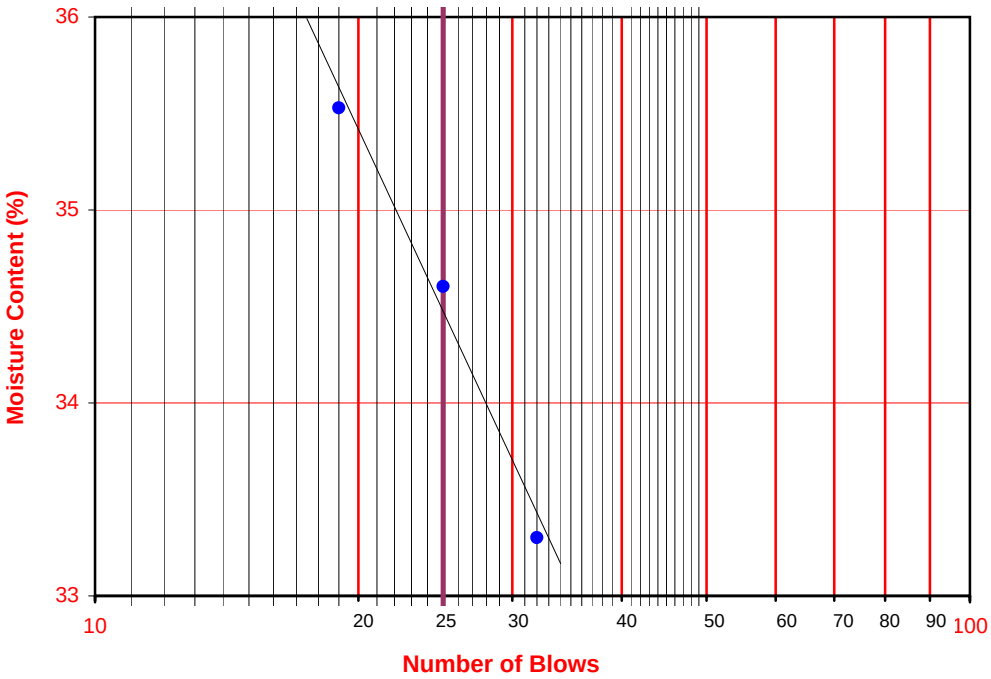
PROCEDURES USED

[ ] Wet Preparation
Multipoint - Wet

[X] Dry Preparation
Multipoint - Dry

[X] Procedure A
Multipoint Test

[ ] Procedure B
One-point Test



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	O. Figueroa	Date:	08/29/08
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	09/03/08
Boring No.:	A-08-001	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Olive brown sandy lean clay s(CL)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3658.0	3793.0	3881.0	3808.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1817.0	1952.0	2040.0	1967.0		
Wet Weight of Soil + Cont. (g)	421.30	463.80	428.50	394.00		
Dry Weight of Soil + Cont. (g)	401.40	432.00	391.40	352.20		
Weight of Container (g)	50.60	50.80	52.90	50.10		
Moisture Content (%)	5.67	8.34	10.96	13.84		
Wet Density (pcf)	121.0	130.0	135.9	131.0		
Dry Density (pcf)	114.5	120.0	122.5	115.1		

Maximum Dry Density (pcf) 122.5 **Optimum Moisture Content (%)** 11.0

PROCEDURE USED

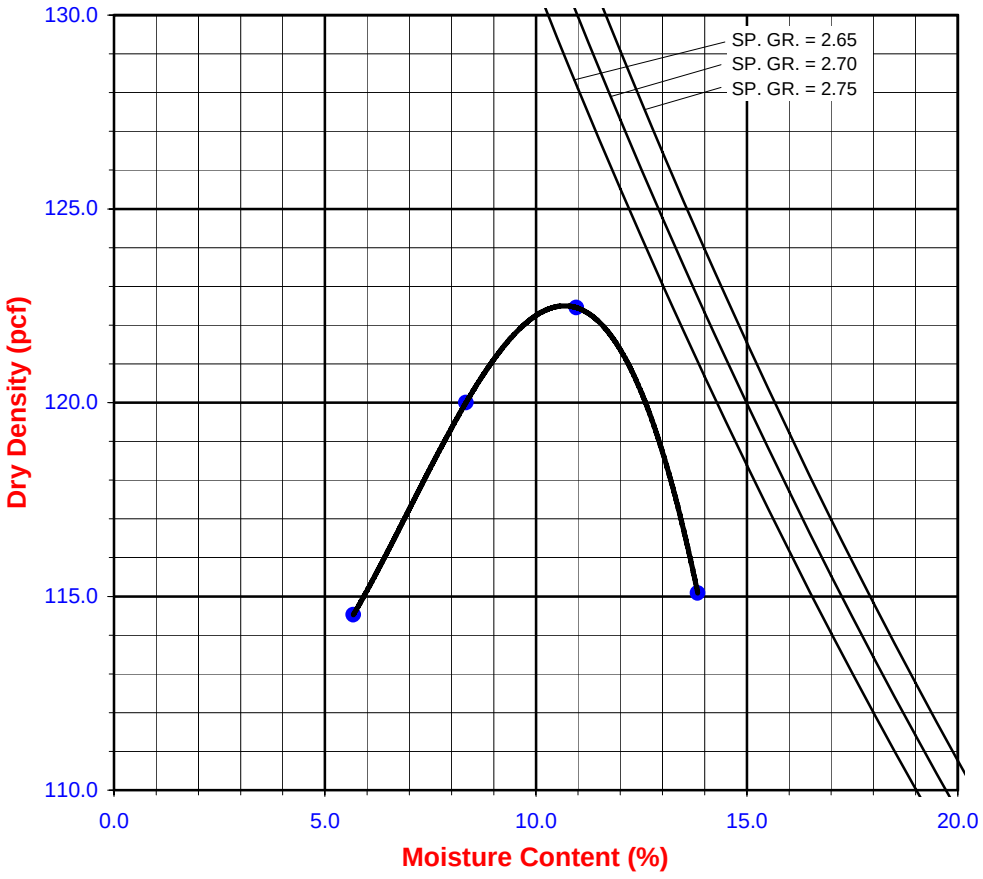
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
1:48:51
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	O. Figueroa	Date:	08/05/08
Project No.:	370900.02.GE.0S	Input By :	J. Ward	Date:	08/14/08
Boring No.:	A-08-002	Depth (ft.)	2-7		
Sample No. :	Bag-1				
Soil Identification:	Dark grayish brown sandy lean clay s(CL)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3723.0	3828.0	3875.0	3806.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1882.0	1987.0	2034.0	1965.0		
Wet Weight of Soil + Cont. (g)	423.60	403.70	379.80	371.80		
Dry Weight of Soil + Cont. (g)	395.20	370.10	342.00	328.50		
Weight of Container (g)	50.30	50.60	50.80	50.70		
Moisture Content (%)	8.23	10.52	12.98	15.59		
Wet Density (pcf)	125.3	132.3	135.5	130.9		
Dry Density (pcf)	115.8	119.7	119.9	113.2		

Maximum Dry Density (pcf) 120.5 **Optimum Moisture Content (%)** 12.0

PROCEDURE USED

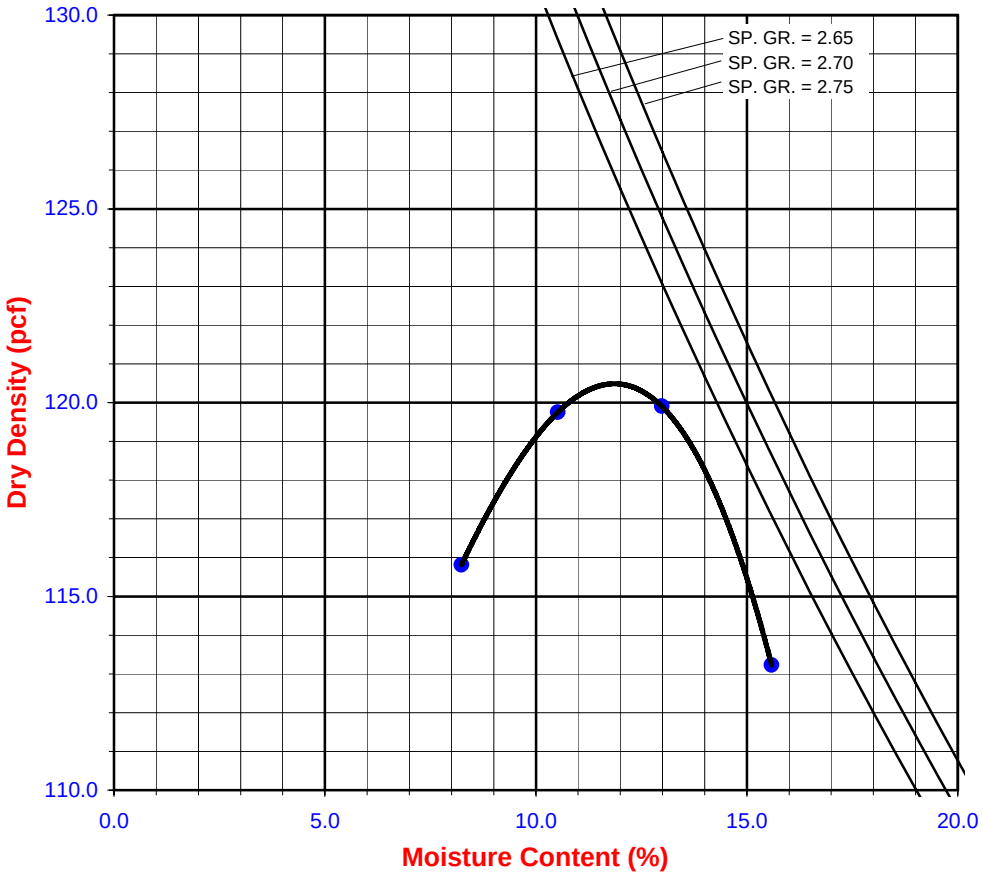
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
0:42:58
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	O. Figueroa	Date:	08/29/08
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	09/03/08
Boring No.:	A-08-003	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Yellowish brown sandy lean clay s(CL)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3655.0	3760.0	3835.0	3820.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1814.0	1919.0	1994.0	1979.0		
Wet Weight of Soil + Cont. (g)	442.80	449.00	413.40	418.80		
Dry Weight of Soil + Cont. (g)	412.20	409.90	371.10	368.70		
Weight of Container (g)	51.60	52.50	53.80	54.00		
Moisture Content (%)	8.49	10.94	13.33	15.92		
Wet Density (pcf)	120.8	127.8	132.8	131.8		
Dry Density (pcf)	111.4	115.2	117.2	113.7		

Maximum Dry Density (pcf) 117.0 **Optimum Moisture Content (%)** 13.5

PROCEDURE USED

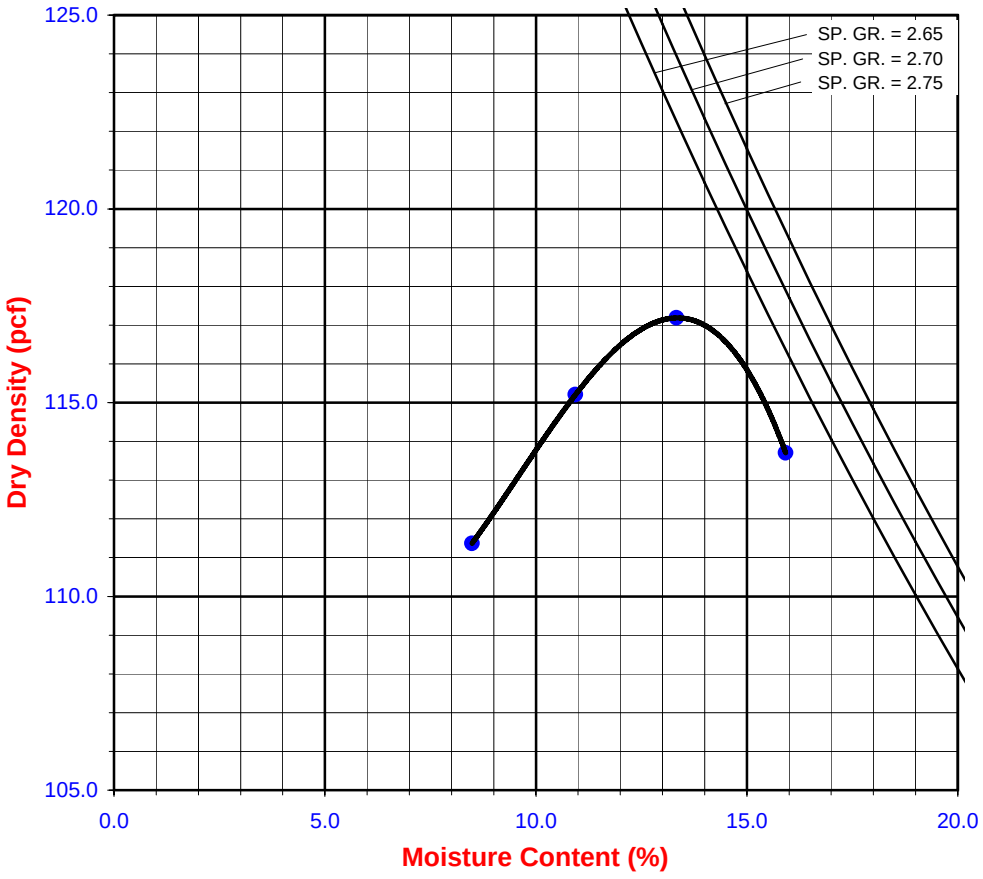
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
1:41:58
GR:SA:FI

Atterberg Limits:
LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Leighton

Project Name:	SR-57 Widening	Tested By :	O. Figueroa	Date:	08/04/08
Project No.:	370900.02.GE.0S	Input By :	J. Ward	Date:	08/07/08
Boring No.:	A-08-004	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Light olive brown poorly-graded sand with silt and gravel (SP-SM)g				

Preparation Method:	X	Moist	Scalp Fraction (%)		Rammer Weight (lb.) = 10.0
		Dry	#3/4		Height of Drop (in.) = 18.0
Compaction Method	X	Mechanical Ram	#3/8	18.0	
		Manual Ram	#4		Mold Volume (ft³) 0.03310

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3685.0	3733.0	3795.0	3808.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1844.0	1892.0	1954.0	1967.0		
Wet Weight of Soil + Cont. (g)	413.60	472.60	481.30	507.50		
Dry Weight of Soil + Cont. (g)	393.20	439.90	439.60	453.00		
Weight of Container (g)	50.70	54.30	52.60	50.10		
Moisture Content (%)	5.96	8.48	10.78	13.53		
Wet Density (pcf)	122.8	126.0	130.1	131.0		
Dry Density (pcf)	115.9	116.2	117.5	115.4		

Maximum Dry Density (pcf)	**117.5**	**Optimum Moisture Content (%)**	**11.5**
Corrected Dry Density (pcf)	**124.5**	**Corrected Moisture Content (%)**	**9.5**

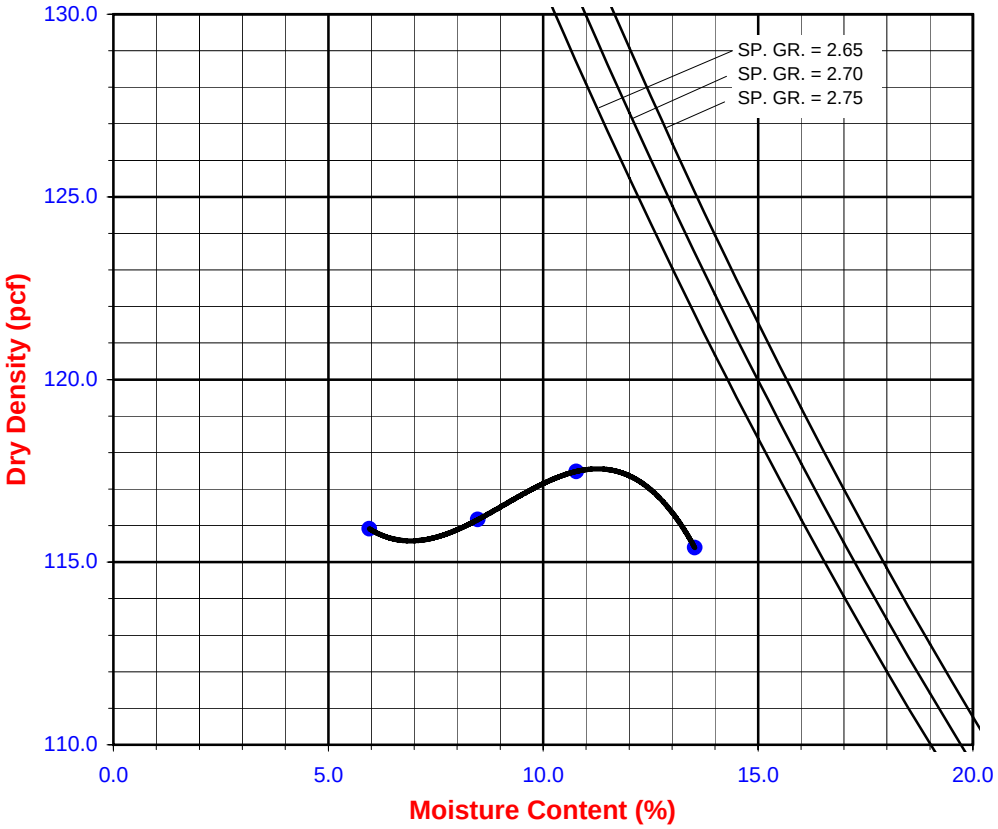
☐ **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☒ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

☐ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
21:72:7
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	08/28/08
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	08/29/08
Boring No.:	A-08-005	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Olive yellow sandy lean clay s(CL)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3668.0	3753.0	3800.0	3765.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1827.0	1912.0	1959.0	1924.0		
Wet Weight of Soil + Cont. (g)	408.80	406.10	416.70	527.60		
Dry Weight of Soil + Cont. (g)	377.20	368.10	370.70	459.80		
Weight of Container (g)	51.90	53.90	54.50	54.30		
Moisture Content (%)	9.71	12.09	14.55	16.72		
Wet Density (pcf)	121.7	127.3	130.5	128.1		
Dry Density (pcf)	110.9	113.6	113.9	109.8		

Maximum Dry Density (pcf) 114.5 **Optimum Moisture Content (%)** 13.5

PROCEDURE USED

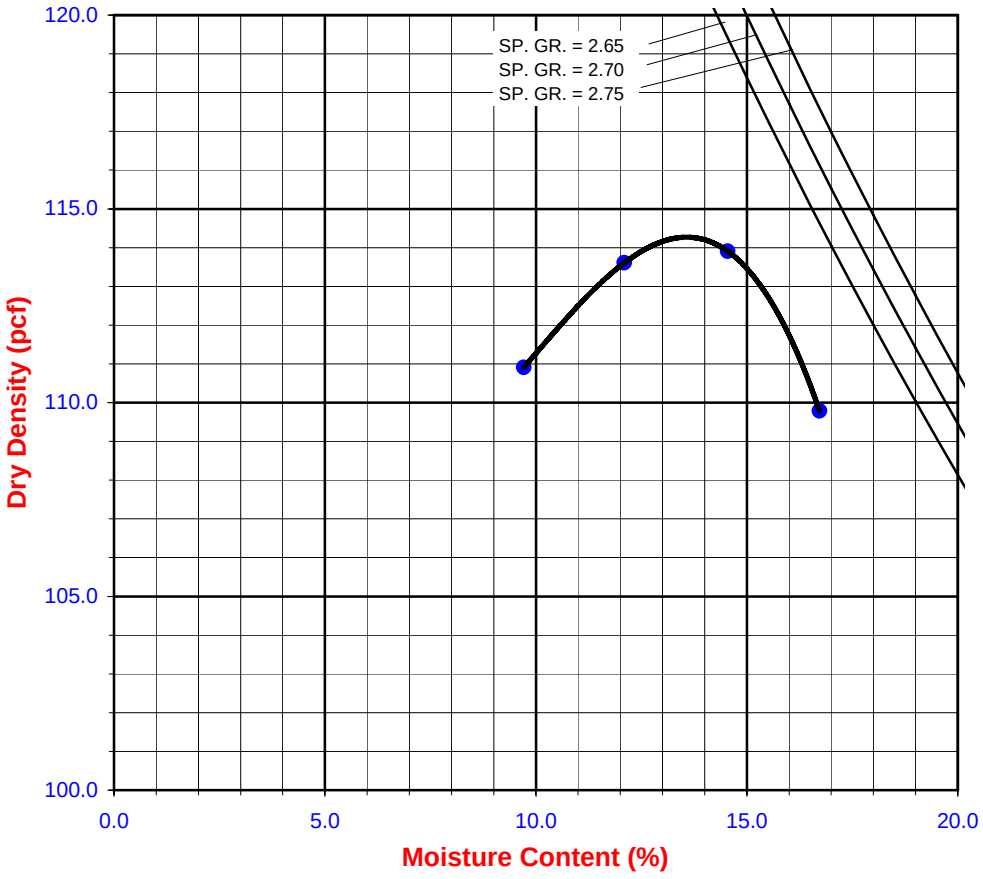
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
1:48:51
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	O. Figueroa	Date:	08/18/08
Project No.:	370900.02.GE.0S	Input By :	J. Ward	Date:	08/19/08
Boring No.:	A-08-008	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Yellowish brown lean clay with sand (CL)s				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3681.0	3739.0	3784.0	3758.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1840.0	1898.0	1943.0	1917.0		
Wet Weight of Soil + Cont. (g)	422.10	407.00	372.10	395.10		
Dry Weight of Soil + Cont. (g)	389.70	368.40	330.20	343.60		
Weight of Container (g)	49.00	53.60	54.20	54.30		
Moisture Content (%)	9.51	12.26	15.18	17.80		
Wet Density (pcf)	122.6	126.4	129.4	127.7		
Dry Density (pcf)	111.9	112.6	112.4	108.4		

Maximum Dry Density (pcf) **113.0** **Optimum Moisture Content (%)** **13.5**

PROCEDURE USED

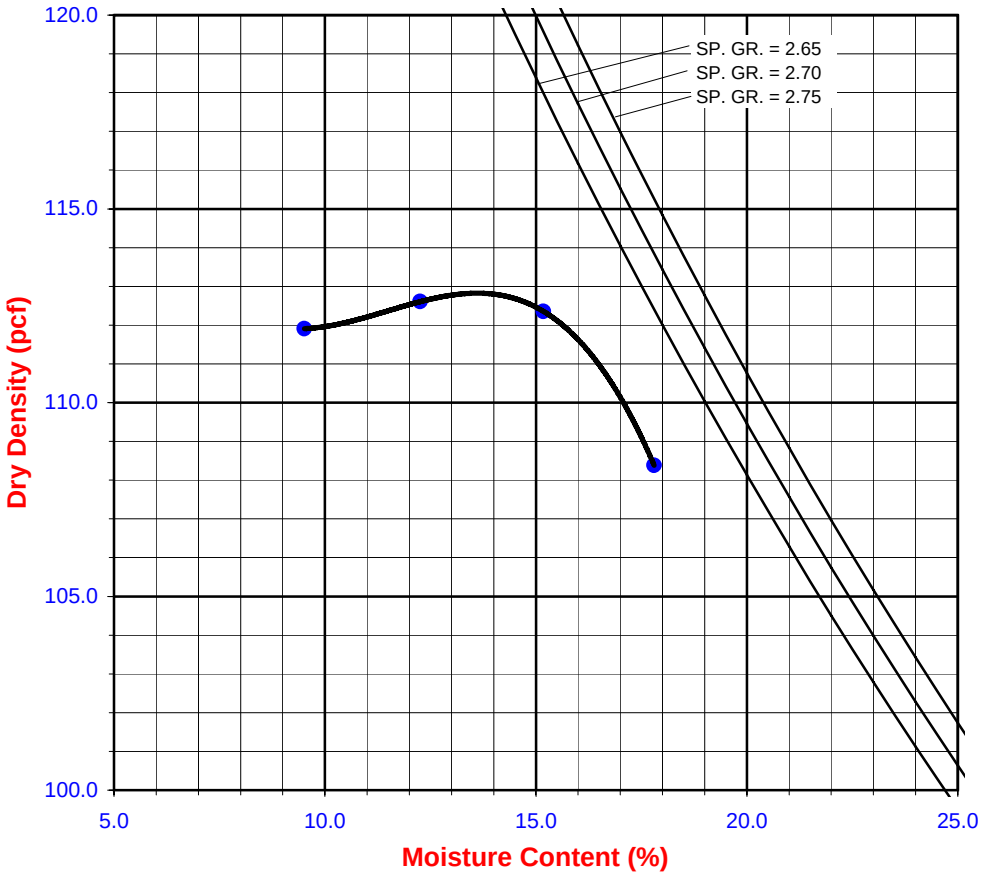
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
0:15:85
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	08/22/08
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	08/26/08
Boring No.:	A-08-009	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Olive brown clayey sand (SC)				

Preparation Method:		
	X	Moist
		Dry
Compaction Method	X	Mechanical Ram
		Manual Ram

Scalp Fraction (%)	
#3/4	
#3/8	
#4	5.0

Rammer Weight (lb.) = 10.0

Height of Drop (in.) = 18.0

Mold Volume (ft³) 0.03310

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3755.0	3838.0	3849.0	3782.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1914.0	1997.0	2008.0	1941.0		
Wet Weight of Soil + Cont. (g)	369.80	440.00	474.10	509.30		
Dry Weight of Soil + Cont. (g)	344.00	400.00	423.40	443.90		
Weight of Container (g)	50.30	54.20	54.50	49.20		
Moisture Content (%)	8.78	11.57	13.74	16.57		
Wet Density (pcf)	127.5	133.0	133.7	129.3		
Dry Density (pcf)	117.2	119.2	117.6	110.9		

Maximum Dry Density (pcf) 119.0

Corrected Dry Density (pcf) 121.0

Optimum Moisture Content (%) 11.5

Corrected Moisture Content (%) 11.0

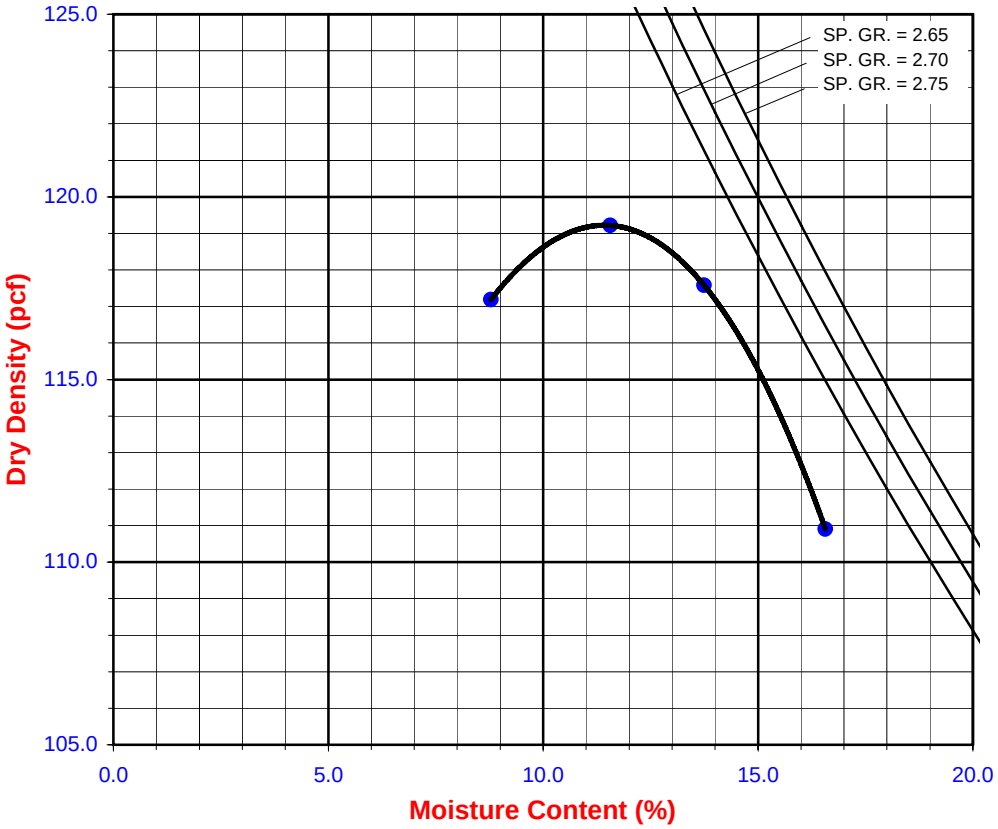
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
5:50:45
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	O. Figueroa	Date:	08/05/08
Project No.:	370900.02.GE.0S	Input By :	J. Ward	Date:	08/07/08
Boring No.:	A-08-010	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Yellowish brown clayey sand (SC)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3759.0	3875.0	3871.0	3804.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1918.0	2034.0	2030.0	1963.0		
Wet Weight of Soil + Cont. (g)	421.90	406.10	378.60	378.70		
Dry Weight of Soil + Cont. (g)	394.00	371.40	340.90	334.50		
Weight of Container (g)	50.40	50.00	52.90	50.80		
Moisture Content (%)	8.12	10.80	13.09	15.58		
Wet Density (pcf)	127.7	135.5	135.2	130.7		
Dry Density (pcf)	118.2	122.3	119.6	113.1		

Maximum Dry Density (pcf) 122.5 **Optimum Moisture Content (%)** 10.5

PROCEDURE USED

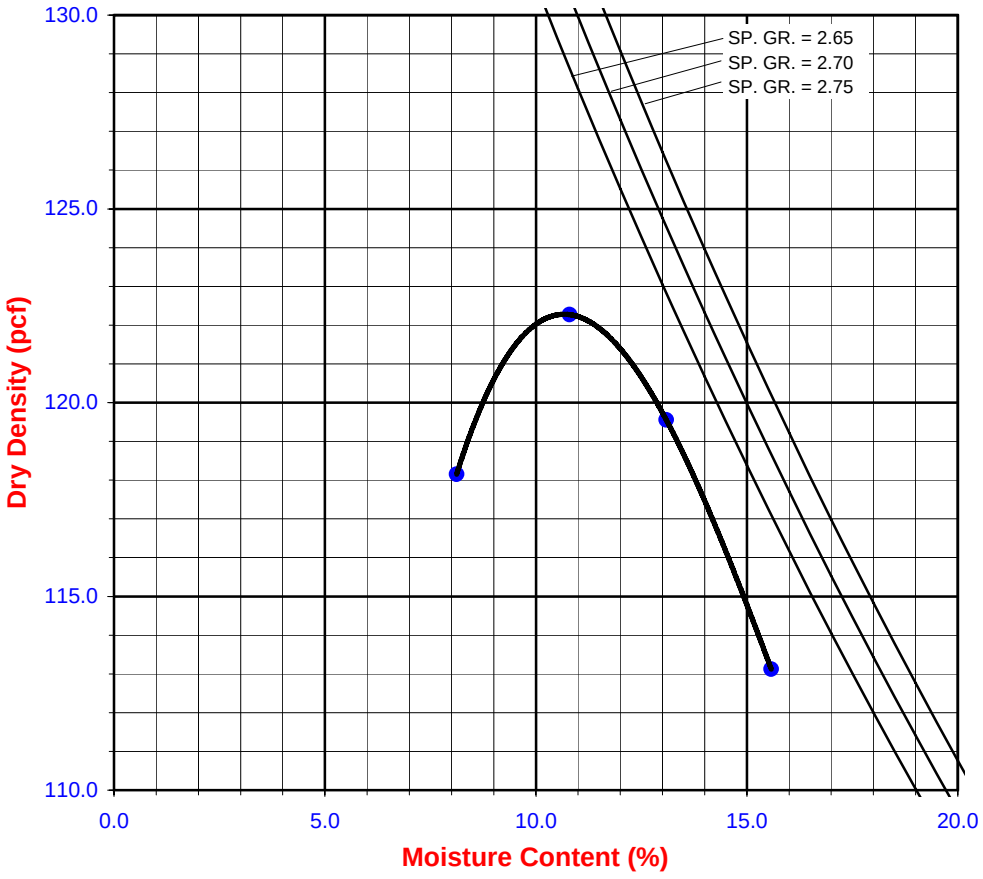
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
3:53:44
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	08/28/08
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	08/29/08
Boring No.:	A-08-011	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Yellowish brown clayey sand (SC)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3731.0	3838.0	3859.0	3811.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1890.0	1997.0	2018.0	1970.0		
Wet Weight of Soil + Cont. (g)	389.50	403.70	442.00	492.70		
Dry Weight of Soil + Cont. (g)	366.70	372.30	399.30	435.80		
Weight of Container (g)	50.90	50.10	54.30	54.60		
Moisture Content (%)	7.22	9.75	12.38	14.93		
Wet Density (pcf)	125.9	133.0	134.4	131.2		
Dry Density (pcf)	117.4	121.2	119.6	114.2		

Maximum Dry Density (pcf) 121.5 **Optimum Moisture Content (%)** 10.0

PROCEDURE USED

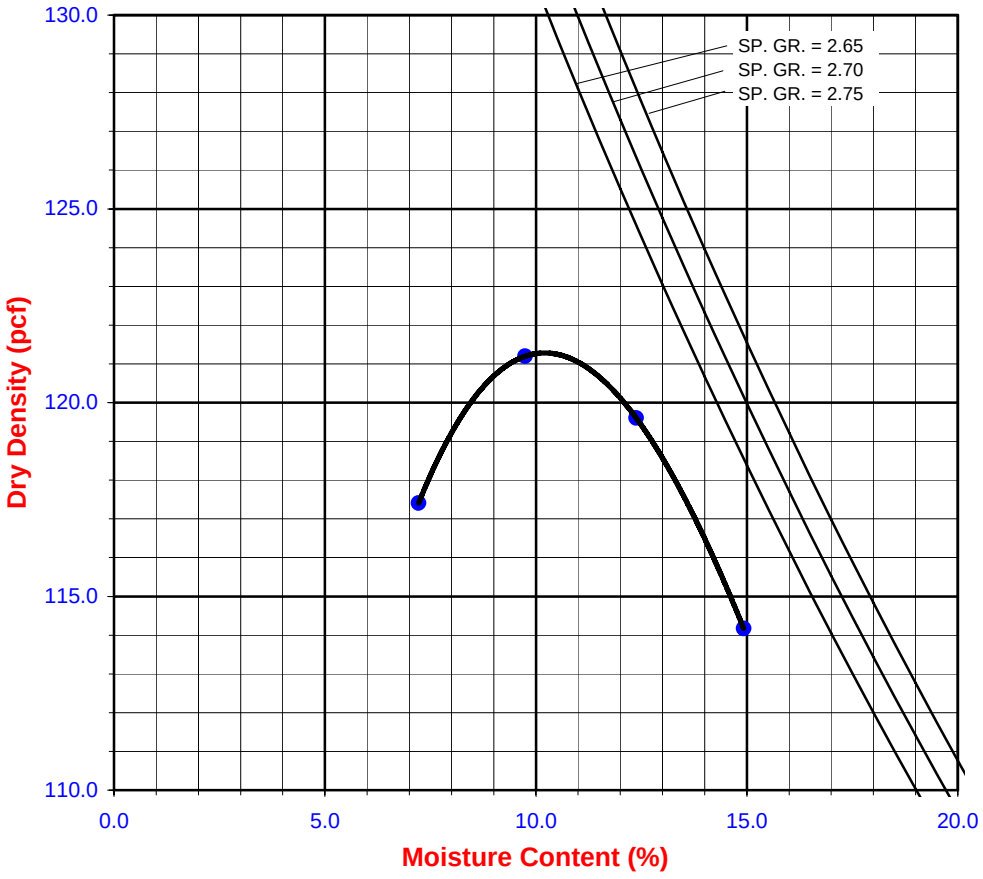
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
2:55:43
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	01/29/05
Project No.:	370900.02.GE.0S	Input By :	J. Ward	Date:	08/26/08
Boring No.:	A-08-014	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Yellowish brown clayey sand (SC) with caliche				

Preparation Method:	X	Moist	Scalp Fraction (%)		Rammer Weight (lb.) =	10.0
		Dry	#3/4		Height of Drop (in.) =	18.0
Compaction Method	X	Mechanical Ram	#3/8			
		Manual Ram	#4	7.5	Mold Volume (ft³)	0.03310

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3678.0	3781.0	3837.0	3781.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1837.0	1940.0	1996.0	1940.0		
Wet Weight of Soil + Cont. (g)	434.60	425.20	451.30	455.40		
Dry Weight of Soil + Cont. (g)	406.70	389.90	405.50	400.10		
Weight of Container (g)	50.40	51.50	54.30	50.70		
Moisture Content (%)	7.83	10.43	13.04	15.83		
Wet Density (pcf)	122.4	129.2	132.9	129.2		
Dry Density (pcf)	113.5	117.0	117.6	111.6		

Maximum Dry Density (pcf)	**118.0**	**Optimum Moisture Content (%)**	**12.0**
Corrected Dry Density (pcf)	**120.5**	**Corrected Moisture Content (%)**	**11.0**

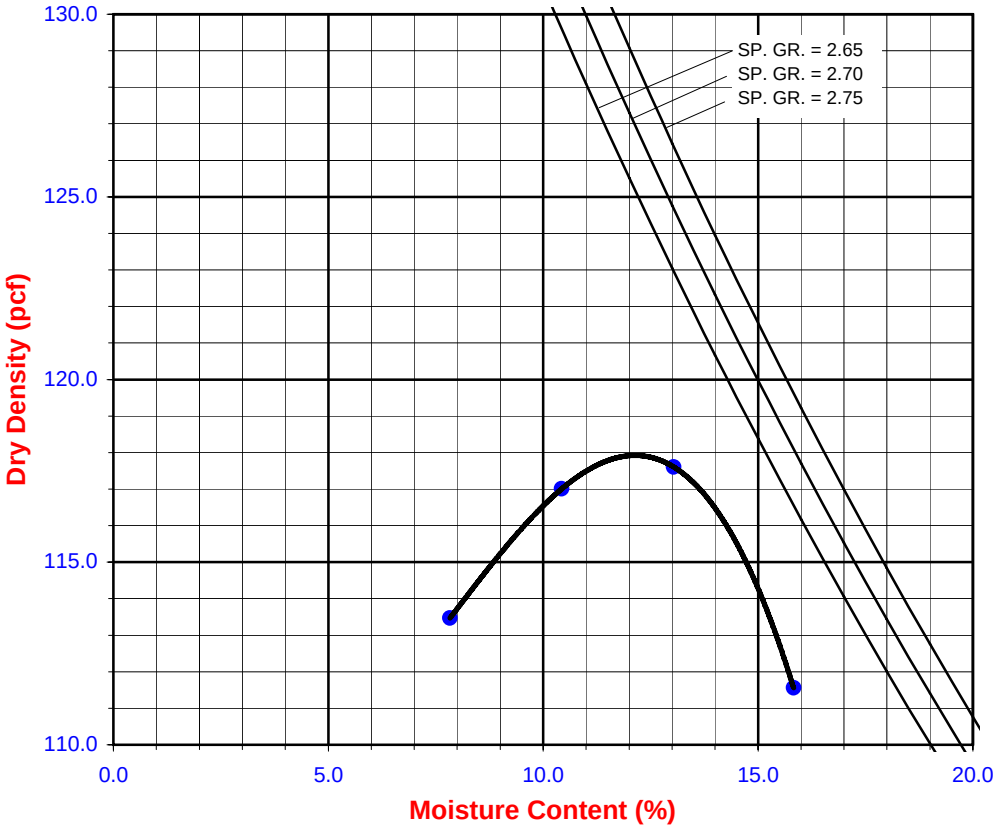
X **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

☐ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
8:51:41
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	08/26/08
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	09/10/08
Boring No.:	A-08-015	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Dark brown lean clay with sand (CL)s				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3557.0	3690.0	3755.0	3742.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1716.0	1849.0	1914.0	1901.0		
Wet Weight of Soil + Cont. (g)	476.20	400.20	373.70	423.10		
Dry Weight of Soil + Cont. (g)	442.50	365.10	335.50	371.80		
Weight of Container (g)	51.10	54.20	54.30	51.40		
Moisture Content (%)	8.61	11.29	13.58	16.01		
Wet Density (pcf)	114.3	123.2	127.5	126.6		
Dry Density (pcf)	105.2	110.7	112.2	109.1		

Maximum Dry Density (pcf) 112.0 **Optimum Moisture Content (%)** 13.5

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

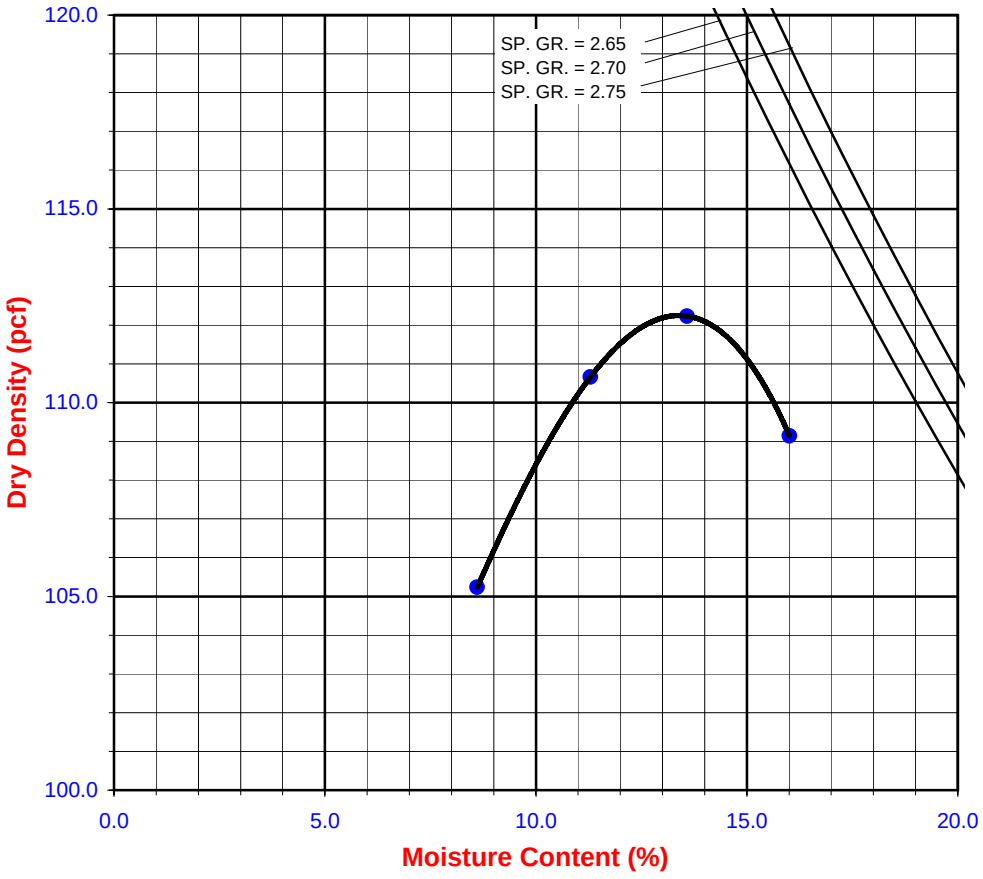
Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

47,21,26

LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	O. Figueroa	Date:	08/27/08
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	08/29/08
Boring No.:	A-08-016	Depth (ft.)	15-20		
Sample No. :	Bag-1				
Soil Identification:	Olive brown lean clay with sand (CL)s				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3630.0	3774.0	3816.0	3805.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1789.0	1933.0	1975.0	1964.0		
Wet Weight of Soil + Cont. (g)	456.60	414.40	380.80	406.10		
Dry Weight of Soil + Cont. (g)	429.90	382.00	344.60	360.50		
Weight of Container (g)	54.20	54.20	51.00	51.40		
Moisture Content (%)	7.11	9.88	12.33	14.75		
Wet Density (pcf)	119.2	128.7	131.5	130.8		
Dry Density (pcf)	111.2	117.2	117.1	114.0		

Maximum Dry Density (pcf) 117.5 **Optimum Moisture Content (%)** 11.0

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

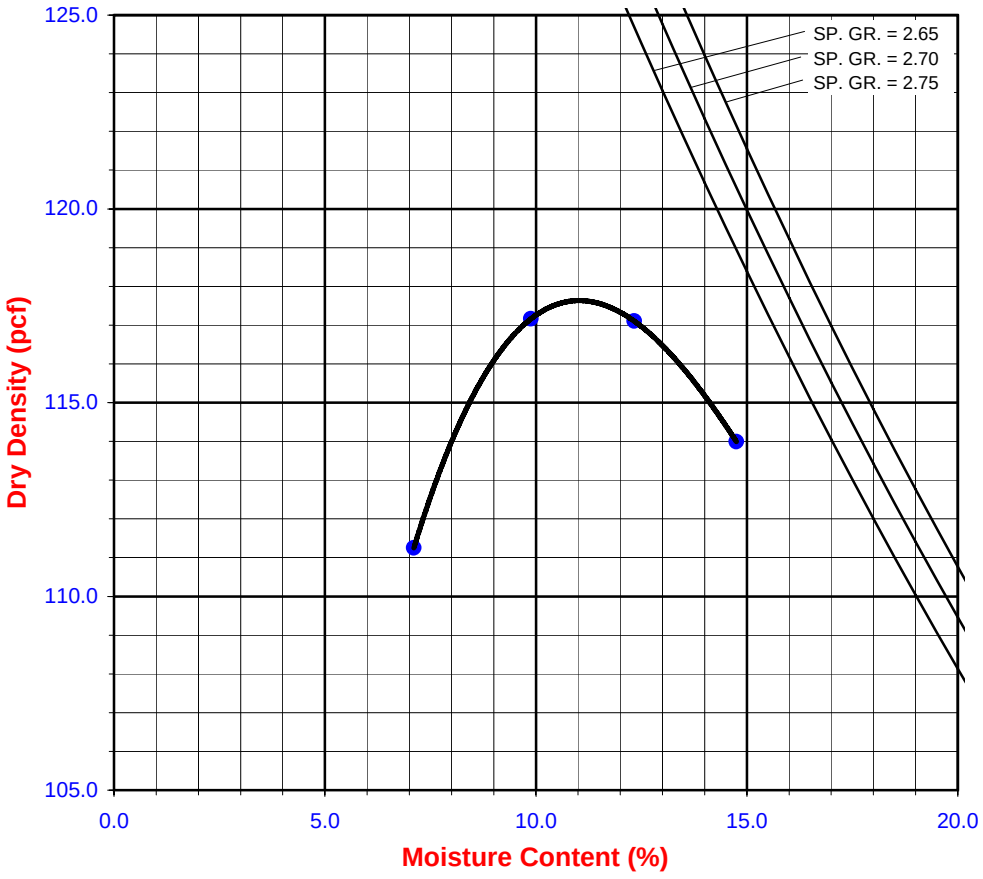
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	08/14/07
Project No.:	370900.02.GE.0S	Input By :	J. Ward	Date:	08/25/08
Boring No.:	A-08-018	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Dark brown sandy lean clay s(CL)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3681.0	3780.0	3783.0	3770.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1840.0	1939.0	1942.0	1929.0		
Wet Weight of Soil + Cont. (g)	454.40	434.60	398.00	550.50		
Dry Weight of Soil + Cont. (g)	427.50	401.90	361.40	487.40		
Weight of Container (g)	51.50	54.20	54.70	50.80		
Moisture Content (%)	7.15	9.40	11.93	14.45		
Wet Density (pcf)	122.6	129.1	129.3	128.5		
Dry Density (pcf)	114.4	118.0	115.6	112.3		

Maximum Dry Density (pcf) 118.0 **Optimum Moisture Content (%)** 9.5

PROCEDURE USED

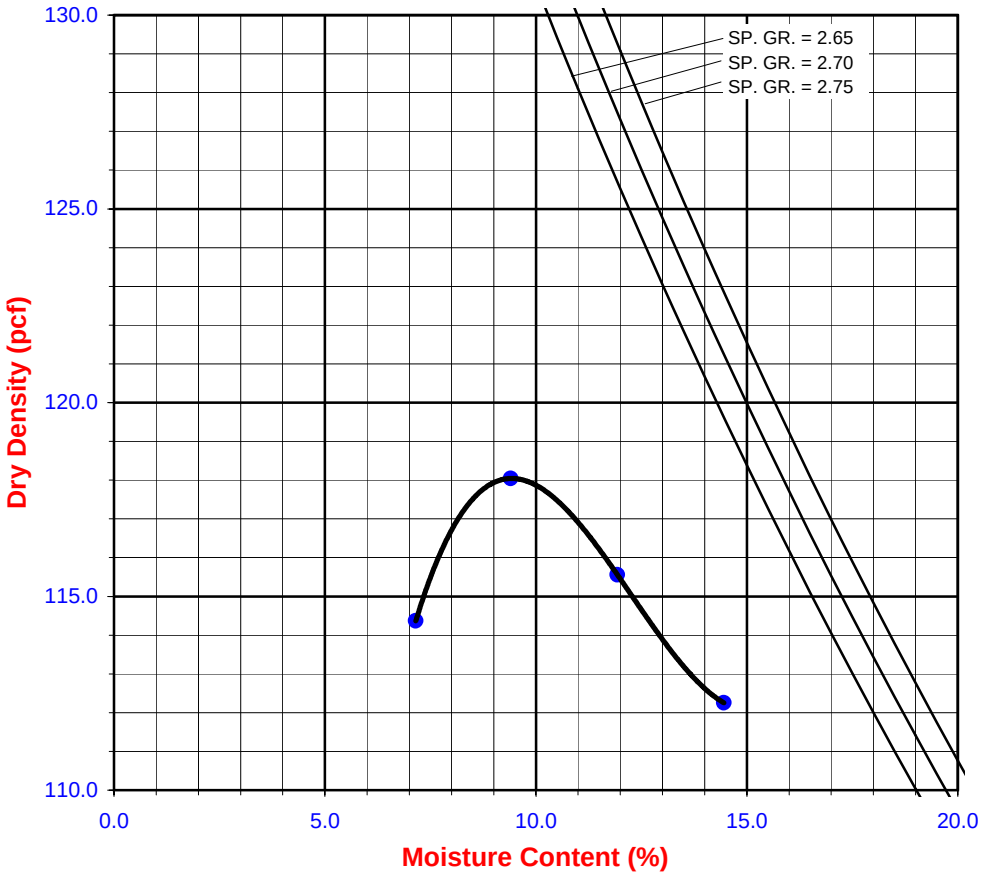
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
0:47:53
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	08/25/08
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	08/27/08
Boring No.:	A-08-021	Depth (ft.)	2-7		
Sample No. :	Bag-1				
Soil Identification:	Yellowish brown sandy lean clay s(CL) with caliche				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3625.0	3697.0	3723.0	3699.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1784.0	1856.0	1882.0	1858.0		
Wet Weight of Soil + Cont. (g)	414.00	372.30	398.70	406.30		
Dry Weight of Soil + Cont. (g)	379.70	336.10	352.60	352.40		
Weight of Container (g)	51.00	54.20	54.70	54.50		
Moisture Content (%)	10.44	12.84	15.47	18.09		
Wet Density (pcf)	118.8	123.6	125.3	123.7		
Dry Density (pcf)	107.6	109.5	108.6	104.8		

Maximum Dry Density (pcf) 109.5 **Optimum Moisture Content (%)** 13.5

PROCEDURE USED

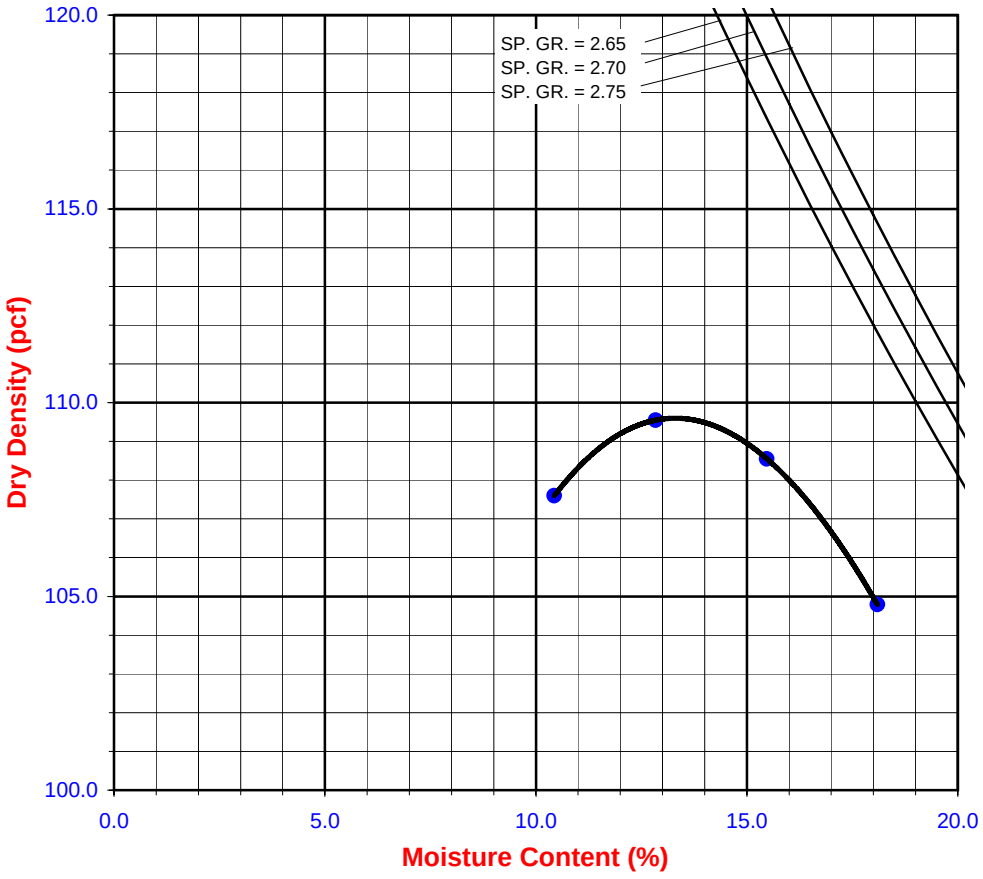
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
2:28:70
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	08/22/07
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	08/26/08
Boring No.:	A-08-022	Depth (ft.)	2-7		
Sample No. :	Bag-1				
Soil Identification:	Brown clayey sand (SC)				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3632.0	3782.0	3799.0	3780.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1791.0	1941.0	1958.0	1939.0		
Wet Weight of Soil + Cont. (g)	438.20	414.40	425.70	431.60		
Dry Weight of Soil + Cont. (g)	417.20	386.90	389.70	386.60		
Weight of Container (g)	51.50	54.50	54.30	51.10		
Moisture Content (%)	5.74	8.27	10.73	13.41		
Wet Density (pcf)	119.3	129.3	130.4	129.1		
Dry Density (pcf)	112.8	119.4	117.8	113.9		

Maximum Dry Density (pcf) 119.5 **Optimum Moisture Content (%)** 9.0

PROCEDURE USED

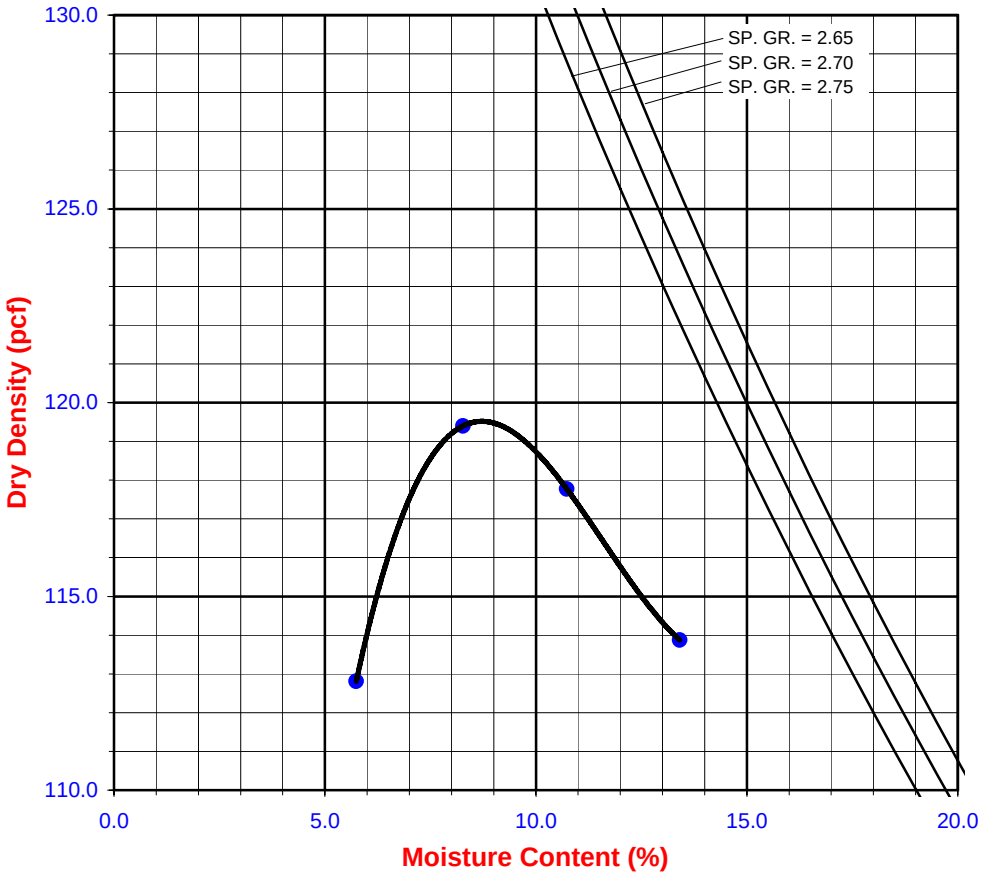
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
1:52:47
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	08/28/08
Project No.:	370900.02.GE.0S	Input By :	LF	Date:	09/03/08
Boring No.:	A-08-024	Depth (ft.)	2-7		
Sample No. :	Bag-1				
Soil Identification:	Olive lean clay with sand (CL)s				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310 *Ram Weight = 10 lb.; Drop = 18 in.*

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3619.0	3693.0	3738.0	3771.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1778.0	1852.0	1897.0	1930.0		
Wet Weight of Soil + Cont. (g)	455.90	441.30	383.40	392.10		
Dry Weight of Soil + Cont. (g)	430.70	407.40	347.90	348.40		
Weight of Container (g)	50.80	50.20	51.60	52.90		
Moisture Content (%)	6.63	9.49	11.98	14.79		
Wet Density (pcf)	118.4	123.4	126.3	128.5		
Dry Density (pcf)	111.1	112.7	112.8	112.0		

Maximum Dry Density (pcf) **113.0** **Optimum Moisture Content (%)** **11.0**

PROCEDURE USED

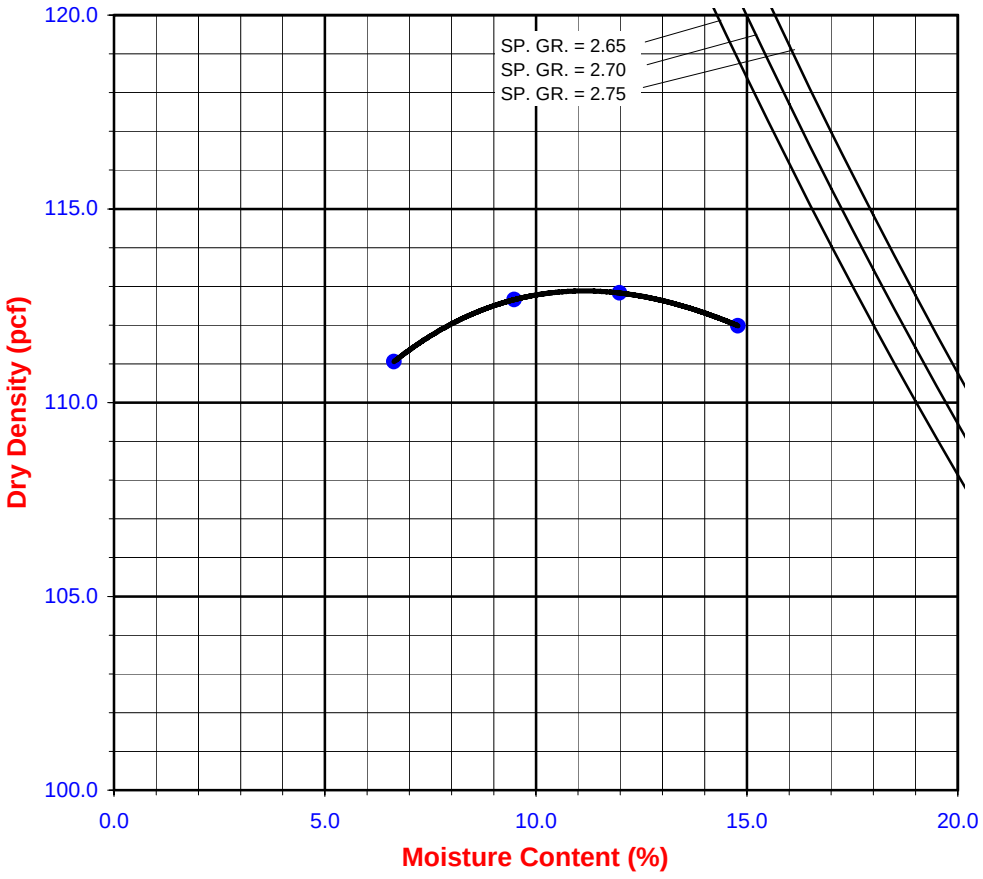
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
2:24:74
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	O. Figueroa	Date:	08/18/08
Project No.:	370900.02.GE.0	Input By :	LF	Date:	08/19/08
Boring No.:	A-08-027	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Pale olive sandy lean clay s(CL)				

Preparation Method:	X	Moist	Scalp Fraction (%)		Rammer Weight (lb.) = 10.0
		Dry	#3/4		Height of Drop (in.) = 18.0
Compaction Method	X	Mechanical Ram	#3/8		
		Manual Ram	#4	7.6	Mold Volume (ft³) 0.03310

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3674.0	3804.0	3860.0	3823.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1833.0	1963.0	2019.0	1982.0		
Wet Weight of Soil + Cont. (g)	449.90	429.40	387.00	364.60		
Dry Weight of Soil + Cont. (g)	422.60	394.70	348.70	322.30		
Weight of Container (g)	54.60	54.30	54.60	51.60		
Moisture Content (%)	7.42	10.19	13.02	15.63		
Wet Density (pcf)	122.1	130.7	134.5	132.0		
Dry Density (pcf)	113.7	118.6	119.0	114.2		

Maximum Dry Density (pcf)	**119.5**	**Optimum Moisture Content (%)**	**12.0**
Corrected Dry Density (pcf)	**122.0**	**Corrected Moisture Content (%)**	**11.0**

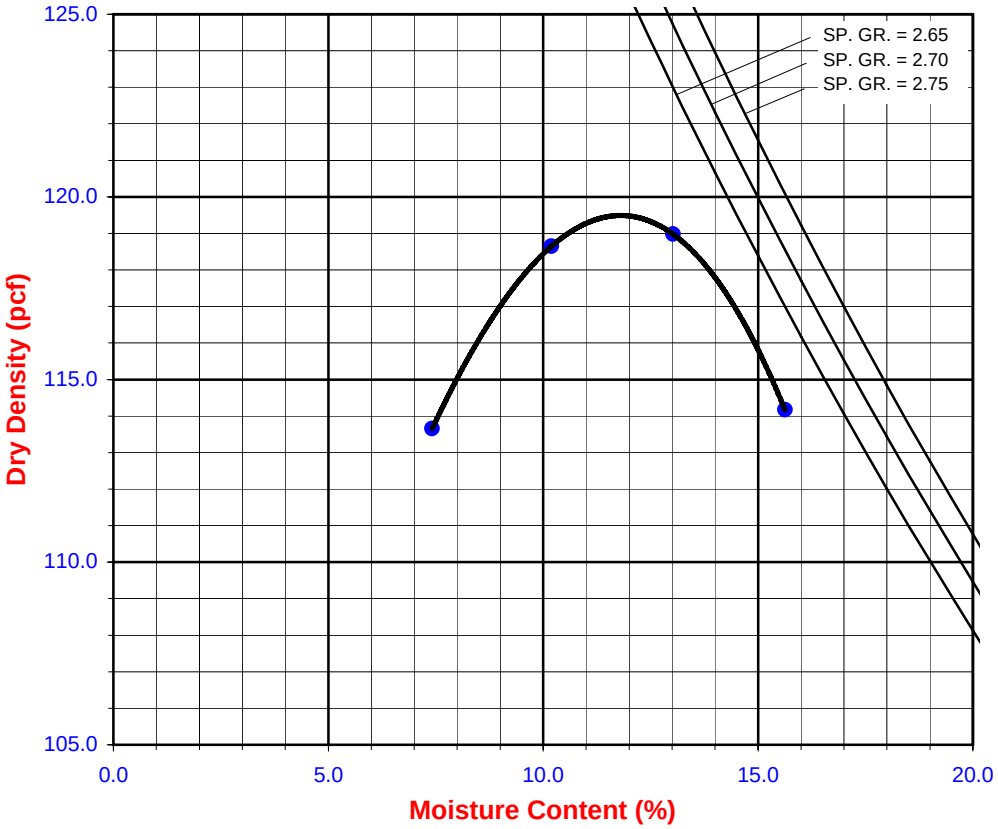
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
8:39:53
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SR-57 Widening	Tested By :	G. Berdy	Date:	08/08/08
Project No.:	370900.02.GE.0S	Input By :	J. Ward	Date:	09/10/08
Boring No.:	A-08-028	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Olive sandy lean clay with gravel s(CL)g				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03310

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3702.0	3792.0	3803.0	3794.0		
Weight of Mold (g)	1841.0	1841.0	1841.0	1841.0		
Net Weight of Soil (g)	1861.0	1951.0	1962.0	1953.0		
Wet Weight of Soil + Cont. (g)	426.50	417.10	425.60	449.80		
Dry Weight of Soil + Cont. (g)	398.20	381.60	381.90	396.50		
Weight of Container (g)	49.10	49.20	49.30	53.70		
Moisture Content (%)	8.11	10.68	13.14	15.55		
Wet Density (pcf)	123.9	129.9	130.7	130.1		
Dry Density (pcf)	114.7	117.4	115.5	112.6		

Maximum Dry Density (pcf) 117.5 **Optimum Moisture Content (%)** 10.5

PROCEDURE USED

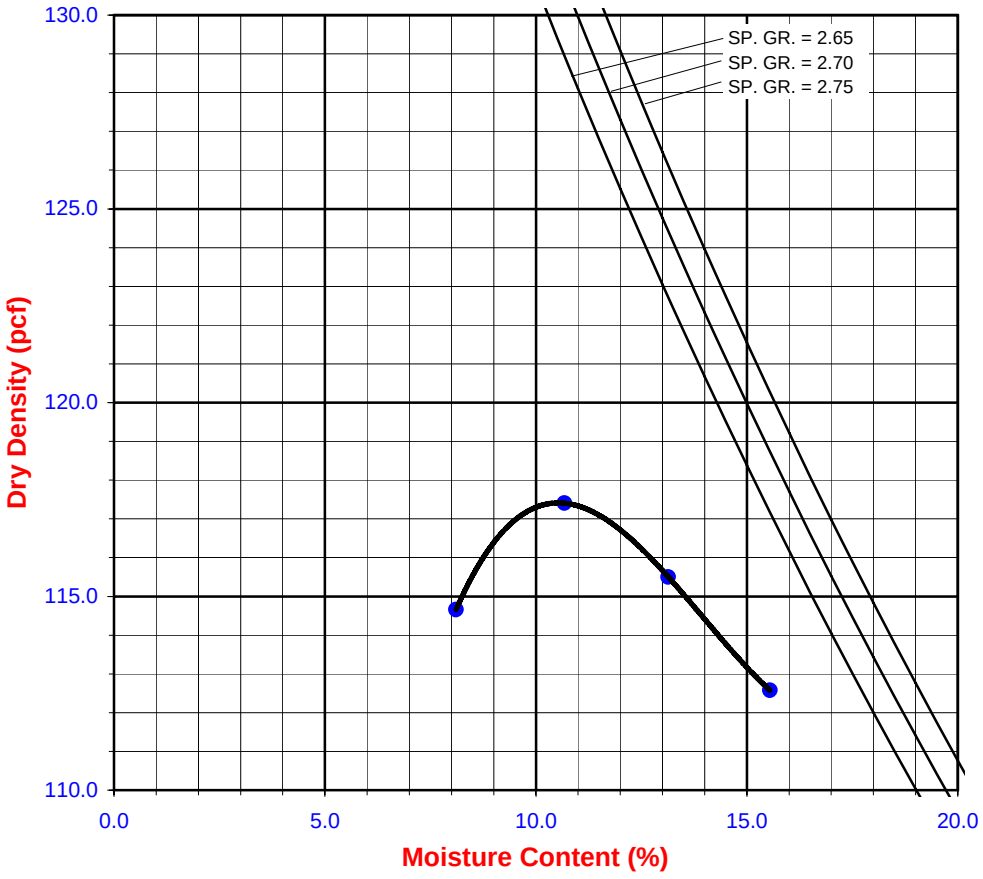
[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
16:23:61
GR:SA:FI

Atterberg Limits:
LL,PL,PI



Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/21/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-002	Depth (ft.)	2-7		
Sample No. :	Bag-1				
Soil Identification:	Dark grayish brown sandy lean clay s(CL)				

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	1.0485
Wt. Comp. Soil + Mold	(g)	558.30	437.00
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)	798.10	600.80
Dry Wt. of Soil + Cont.	(g)	725.50	522.50
Wt. of Container	(g)	0.00	163.80
Moisture Content	(%)	10.01	21.83
Wet Density	(pcf)	119.0	125.7
Dry Density	(pcf)	108.2	103.2
Void Ratio		0.558	0.634
Total Porosity		0.358	0.388
Pore Volume	(cc)	74.2	84.2
Degree of Saturation (%) [S_{meas}]		**48.4**	93.0

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.)
08/21/08	13:36	1.0	0	0.1680
08/21/08	13:46	1.0	10	0.1670
Add Distilled Water to the Specimen				
08/21/08	14:08	1.0	22	0.2115
08/22/08	7:17	1.0	1051	0.2165
08/22/08	9:34	1.0	1188	0.2165

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:	08/20/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	08/21/08
Boring No.:	A-08-004	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Light olive brown poorly graded sand with silt and gravel (SP-SM)g				

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	0.9995
Wt. Comp. Soil + Mold	(g)	584.90	408.30
Wt. of Mold	(g)	191.90	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	787.80	600.20
Dry Wt. of Soil + Cont.	(g)	712.90	547.50
Wt. of Container	(g)	0.00	191.90
Moisture Content	(%)	10.51	14.82
Wet Density	(pcf)	118.5	123.2
Dry Density	(pcf)	107.3	107.3
Void Ratio		0.572	0.571
Total Porosity		0.364	0.363
Pore Volume	(cc)	75.3	75.2
Degree of Saturation (%) [S_{meas}]		**49.6**	70.1

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.)
08/20/08	15:29	1.0	0	0.1335
08/20/08	15:39	1.0	10	0.1330
Add Distilled Water to the Specimen				
08/20/08	15:43	1.0	4	0.1330
08/21/08	7:00	1.0	921	0.1330
08/21/08	9:07	1.0	1048	0.1330

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**0**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/25/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	08/27/08
Boring No.:	A-08-008	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Yellowish brown lean clay with sand (CL)s				

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	1.1010
Wt. Comp. Soil + Mold	(g)	560.90	428.20
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)	741.90	618.50
Dry Wt. of Soil + Cont.	(g)	656.60	518.30
Wt. of Container	(g)	0.00	190.30
Moisture Content	(%)	12.99	30.55
Wet Density	(pcf)	111.8	117.3
Dry Density	(pcf)	98.9	89.9
Void Ratio		0.704	0.876
Total Porosity		0.413	0.467
Pore Volume	(cc)	85.5	106.4
Degree of Saturation (%) [S_{meas}]		**49.8**	94.2

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.)
08/25/08	11:04	1.0	0	0.1490
08/25/08	11:14	1.0	10	0.1485
Add Distilled Water to the Specimen				
08/25/08	11:20	1.0	6	0.1610
08/26/08	7:16	1.0	1202	0.2500
08/26/08	8:28	1.0	1274	0.2500

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**102**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/25/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	08/27/08
Boring No.:	A-08-010	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Yellowish brown 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	1.0335
Wt. Comp. Soil + Mold	(g)	579.50	431.40
Wt. of Mold	(g)	181.20	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	801.70	612.60
Dry Wt. of Soil + Cont.	(g)	730.20	543.90
Wt. of Container	(g)	0.00	181.20
Moisture Content	(%)	9.79	18.94
Wet Density	(pcf)	120.1	125.9
Dry Density	(pcf)	109.4	105.9
Void Ratio		0.541	0.593
Total Porosity		0.351	0.372
Pore Volume	(cc)	72.6	79.6
Degree of Saturation (%) [S_{meas}]		**48.9**	86.3

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.)
08/25/08	11:57	1.0	0	0.1470
08/25/08	12:07	1.0	10	0.1465
Add Distilled Water to the Specimen				
08/25/08	12:42	1.0	35	0.1730
08/26/08	7:10	1.0	1143	0.1805
08/26/08	8:33	1.0	1226	0.1805

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**34**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/27/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	08/28/08
Boring No.:	A-08-012	Depth (ft.)	35-40		
Sample No. :	Bag-1				
Soil Identification:	Olive lean clay with sand (CL)s				

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	1.0700
Wt. Comp. Soil + Mold	(g)	543.50	436.80
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)	769.00	600.60
Dry Wt. of Soil + Cont.	(g)	689.70	504.30
Wt. of Container	(g)	0.00	163.80
Moisture Content	(%)	11.50	28.28
Wet Density	(pcf)	114.5	123.1
Dry Density	(pcf)	102.7	96.0
Void Ratio		0.641	0.756
Total Porosity		0.391	0.431
Pore Volume	(cc)	80.9	95.4
Degree of Saturation (%) [S_{meas}]		**48.4**	101.0

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.)
08/27/08	14:12	1.0	0	0.2280
08/27/08	14:22	1.0	10	0.2275
Add Distilled Water to the Specimen				
08/27/08	14:38	1.0	16	0.2760
08/28/08	7:18	1.0	1016	0.2980
08/28/08	8:20	1.0	1078	0.2980

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**71**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/29/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-013	Depth (ft.)	15-20		
Sample No. :	Bag-1				
Soil Identification:	Olive fat clay with sand (CH)s				

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	1.1150
Wt. Comp. Soil + Mold	(g)	543.20	423.50
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)	710.10	613.80
Dry Wt. of Soil + Cont.	(g)	617.40	497.20
Wt. of Container	(g)	0.00	190.30
Moisture Content	(%)	15.01	37.99
Wet Density	(pcf)	106.4	114.6
Dry Density	(pcf)	92.6	83.0
Void Ratio		0.821	1.030
Total Porosity		0.451	0.508
Pore Volume	(cc)	93.4	117.1
Degree of Saturation (%) [S_{meas}]		**49.3**	99.5

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.)
08/29/08	14:48	1.0	0	0.1185
08/29/08	14:58	1.0	10	0.1175
Add Distilled Water to the Specimen				
08/29/08	15:20	1.0	22	0.1800
09/02/08	7:15	1.0	5297	0.2335
09/02/08	8:25	1.0	5367	0.2335

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**116**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/29/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-013	Depth (ft.)	25-30		
Sample No. :	Bag-2				
Soil Identification:	Olive fat clay (CH)				

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	1.0885
Wt. Comp. Soil + Mold	(g)	538.50	432.10
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)	741.90	595.90
Dry Wt. of Soil + Cont.	(g)	656.60	495.40
Wt. of Container	(g)	0.00	163.80
Moisture Content	(%)	12.99	30.31
Wet Density	(pcf)	113.0	119.7
Dry Density	(pcf)	100.0	91.9
Void Ratio		0.685	0.835
Total Porosity		0.407	0.455
Pore Volume	(cc)	84.2	102.5
Degree of Saturation (%) [S_{meas}]		**51.2**	98.1

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.)
08/29/08	14:07	1.0	0	0.1860
08/29/08	14:17	1.0	10	0.1860
Add Distilled Water to the Specimen				
08/29/08	14:28	1.0	11	0.2280
09/02/08	7:18	1.0	5341	0.2745
09/02/08	8:20	1.0	5403	0.2745

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**89**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/22/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	08/26/08
Boring No.:	A-08-015	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Dark brown lean clay with sand (CL)s				

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	1.0845
Wt. Comp. Soil + Mold	(g)	536.60	427.70
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)	741.90	591.50
Dry Wt. of Soil + Cont.	(g)	656.60	493.70
Wt. of Container	(g)	0.00	163.80
Moisture Content	(%)	12.99	29.65
Wet Density	(pcf)	112.5	119.0
Dry Density	(pcf)	99.5	91.8
Void Ratio		0.694	0.837
Total Porosity		0.410	0.456
Pore Volume	(cc)	84.8	102.3
Degree of Saturation (%) [S_{meas}]		**50.5**	95.6

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.)
08/22/08	10:54	1.0	0	0.1585
08/22/08	11:04	1.0	10	0.1580
Add Distilled Water to the Specimen				
08/22/08	11:33	1.0	29	0.2060
08/25/08	7:15	1.0	4091	0.2430
08/25/08	8:20	1.0	4156	0.2430

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**85**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/21/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-018	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Dark brown sandy lean clay s(CL)				

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	1.0350
Wt. Comp. Soil + Mold	(g)	595.70	430.80
Wt. of Mold	(g)	203.60	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	787.80	634.40
Dry Wt. of Soil + Cont.	(g)	712.90	558.50
Wt. of Container	(g)	0.00	203.60
Moisture Content	(%)	10.51	21.39
Wet Density	(pcf)	118.3	125.6
Dry Density	(pcf)	107.0	103.4
Void Ratio		0.575	0.630
Total Porosity		0.365	0.386
Pore Volume	(cc)	75.6	82.8
Degree of Saturation (%) [S_{meas}]		**49.3**	91.7

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.)
08/21/08	15:06	1.0	0	0.1535
08/21/08	15:16	1.0	10	0.1520
Add Distilled Water to the Specimen				
08/21/08	15:20	1.0	4	0.1580
08/22/08	7:15	1.0	959	0.1880
08/22/08	9:41	1.0	1105	0.1885

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:	08/27/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	08/28/08
Boring No.:	A-08-024	Depth (ft.)	2-7		
Sample No. :	Bag-1				
Soil Identification:	Olive lean clay with sand (CL)s				

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	1.0685
Wt. Comp. Soil + Mold	(g)	575.40	440.00
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)	778.10	630.30
Dry Wt. of Soil + Cont.	(g)	701.00	537.20
Wt. of Container	(g)	0.00	190.30
Moisture Content	(%)	11.00	26.84
Wet Density	(pcf)	116.2	124.2
Dry Density	(pcf)	104.7	97.9
Void Ratio		0.611	0.721
Total Porosity		0.379	0.419
Pore Volume	(cc)	78.5	92.7
Degree of Saturation (%) [S_{meas}]		**48.6**	100.4

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.)
08/27/08	15:18	1.0	0	0.1230
08/27/08	15:28	1.0	10	0.1225
Add Distilled Water to the Specimen				
08/27/08	15:35	1.0	7	0.1340
08/28/08	7:10	1.0	942	0.1915
08/28/08	8:20	1.0	1012	0.1915

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**69**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/21/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-027	Depth (ft.)	0-7		
Sample No. :	Bag-1				
Soil Identification:	Pale olive sandy lean clay s(CL)				

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	1.0620
Wt. Comp. Soil + Mold	(g)	585.80	433.60
Wt. of Mold	(g)	191.90	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	781.90	625.50
Dry Wt. of Soil + Cont.	(g)	705.60	547.40
Wt. of Container	(g)	0.00	191.90
Moisture Content	(%)	10.81	21.97
Wet Density	(pcf)	118.8	123.2
Dry Density	(pcf)	107.2	101.0
Void Ratio		0.572	0.670
Total Porosity		0.364	0.401
Pore Volume	(cc)	75.3	88.2
Degree of Saturation (%) [S_{meas}]		**51.0**	88.6

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.)
08/21/08	11:33	1.0	0	0.1380
08/21/08	11:43	1.0	10	0.1375
Add Distilled Water to the Specimen				
08/21/08	11:47	1.0	4	0.1500
08/22/08	7:20	1.0	1177	0.2000
08/22/08	8:27	1.0	1244	0.2000

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**63**

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SR-57 Widening	Tested By:	G. Berdy	Date:	08/21/08
Project No. :	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-030	Depth (ft.)	25-30		
Sample No. :	Bag-2				
Soil Identification:	Light olive brown sandy lean clay s(CL)				

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	1.0400
Wt. Comp. Soil + Mold	(g)	584.80	434.80
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)	651.60	625.10
Dry Wt. of Soil + Cont.	(g)	592.20	548.90
Wt. of Container	(g)	0.00	190.30
Moisture Content	(%)	10.03	21.25
Wet Density	(pcf)	119.0	126.1
Dry Density	(pcf)	108.1	104.0
Void Ratio		0.559	0.621
Total Porosity		0.358	0.383
Pore Volume	(cc)	74.2	82.5
Degree of Saturation (%) [S_{meas}]		**48.5**	92.4

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.)
08/21/08	14:08	1.0	0	0.1725
08/21/08	14:18	1.0	10	0.1725
Add Distilled Water to the Specimen				
08/21/08	14:24	1.0	6	0.1970
08/22/08	7:18	1.0	1020	0.2125
08/22/08	8:56	1.0	1118	0.2125

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**40**

Leighton

R-VALUE TEST RESULTS

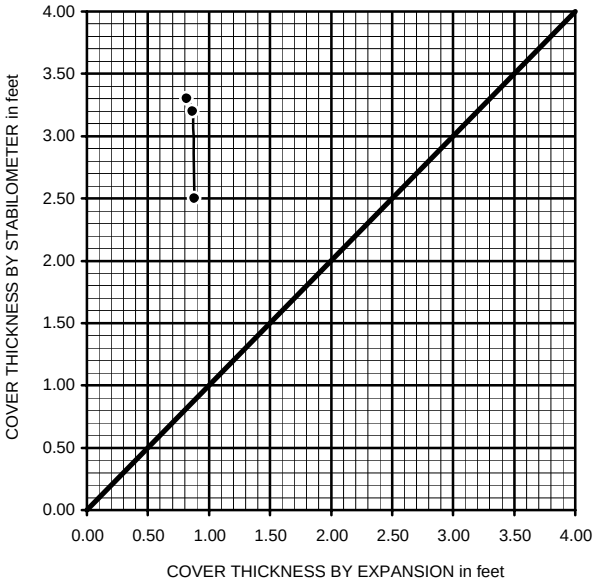
DOT CA Test 301

PROJECT NAME:	SR-57 Widening	PROJECT NUMBER:	370900.02.GE.OS
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	A-08-002 @ 2-7'
SAMPLE DESCRIPTION:	s(CL)	TECHNICIAN:	SCF
		DATE COMPLETED	8/4/2008

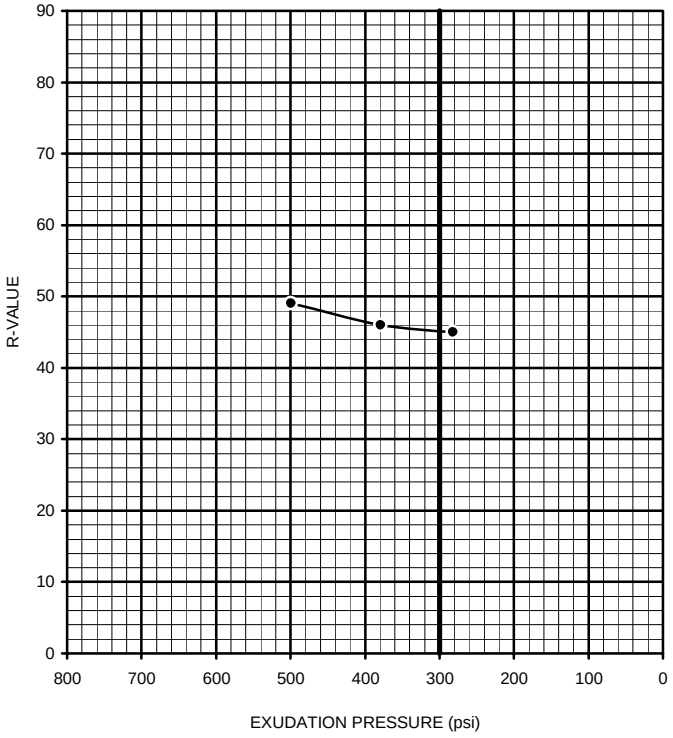
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	16.9	17.2	17.7
HEIGHT OF SAMPLE, Inches	2.55	2.48	2.53
DRY DENSITY, pcf	109.7	108.6	109.2
COMPACTOR PRESSURE, psi	150	125	75
EXUDATION PRESSURE, psi	500	379	282
EXPANSION, Inches x 10exp-4	99	96	75
STABILITY Ph 2,000 lbs (160 psi)	63	65	67
TURNS DISPLACEMENT	4.04	4.22	4.28
R-VALUE UNCORRECTED	49	46	45
R-VALUE CORRECTED	49	46	45

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.82	0.86	0.88
EXPANSION PRESSURE THICKNESS, ft.	3.30	3.20	2.50

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	45
R-VALUE BY EXUDATION:	45
EQUILIBRIUM R-VALUE:	45

Leighton

R-VALUE TEST RESULTS

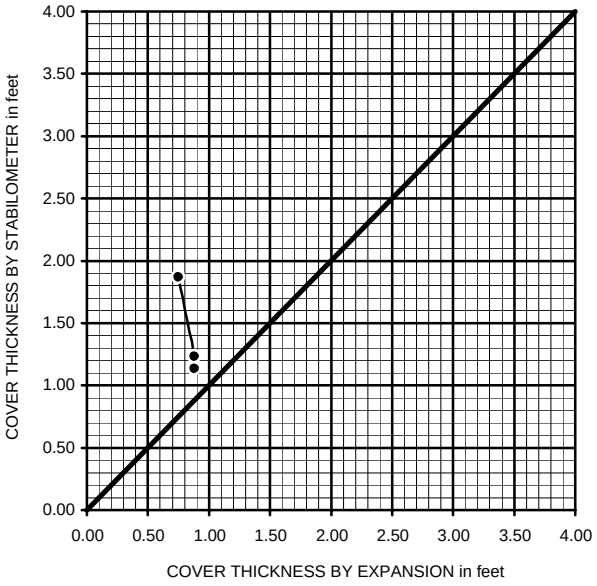
DOT CA Test 301

PROJECT NAME:	SR-57 Widening	PROJECT NUMBER:	370900.02.GE.0S
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	A-08-009 @ 0-7'
SAMPLE DESCRIPTION:	SC	TECHNICIAN:	SCF
		DATE COMPLETED	8//18/2008

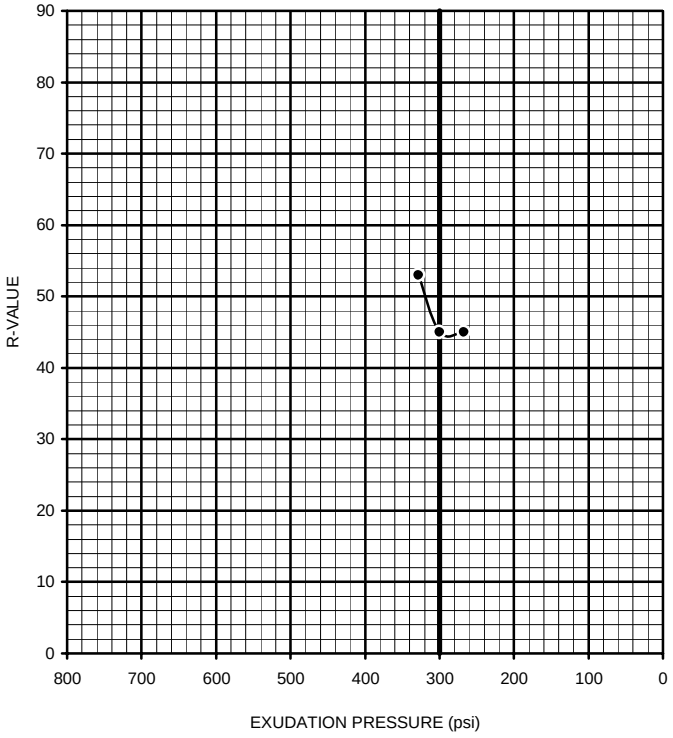
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	14.1	14.6	14.8
HEIGHT OF SAMPLE, Inches	2.48	2.55	2.58
DRY DENSITY, pcf	116.0	116.1	112.9
COMPACTOR PRESSURE, psi	200	125	110
EXUDATION PRESSURE, psi	328	300	267
EXPANSION, Inches x 10exp-4	56	37	34
STABILITY Ph 2,000 lbs (160 psi)	59	70	71
TURNS DISPLACEMENT	3.85	3.86	3.82
R-VALUE UNCORRECTED	53	45	45
R-VALUE CORRECTED	53	45	45

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.75	0.88	0.88
EXPANSION PRESSURE THICKNESS, ft.	1.87	1.23	1.13

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	45
R-VALUE BY EXUDATION:	45
EQUILIBRIUM R-VALUE:	45

Leighton

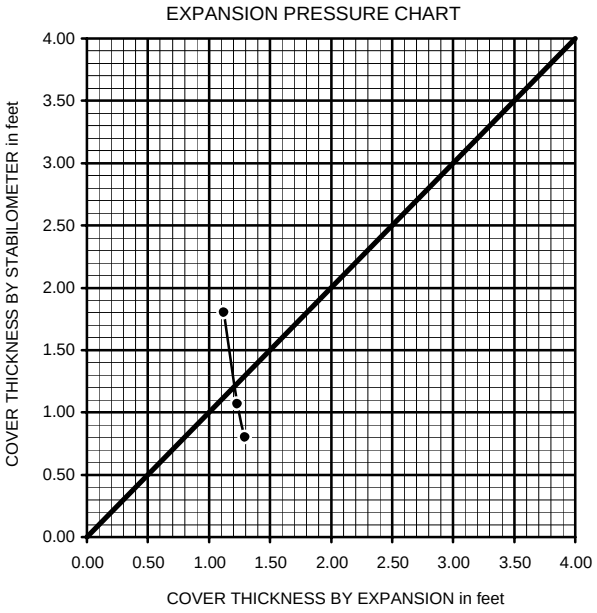
R-VALUE TEST RESULTS

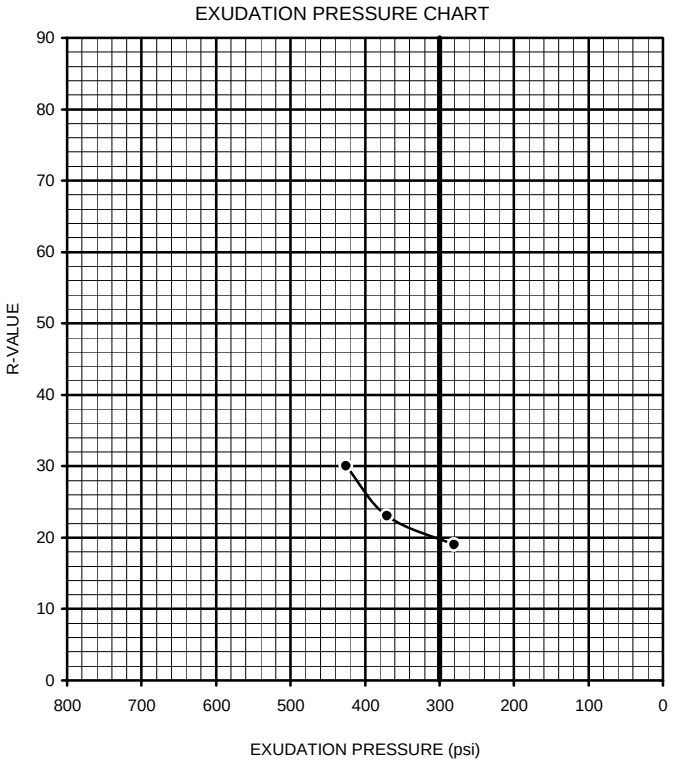
DOT CA Test 301

PROJECT NAME:	SR-57 Widening	PROJECT NUMBER:	370900.02.GE.0S
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	A-08-018 @ 0-7'
SAMPLE DESCRIPTION:	s(CL)	TECHNICIAN:	SCF
		DATE COMPLETED	8/4/2008

TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	14.4	14.9	15.3
HEIGHT OF SAMPLE, Inches	2.47	2.63	2.55
DRY DENSITY, pcf	117.5	114.7	114.0
COMPACTOR PRESSURE, psi	50	50	50
EXUDATION PRESSURE, psi	425	371	280
EXPANSION, Inches x 10exp-4	54	32	24
STABILITY Ph 2,000 lbs (160 psi)	106	119	123
TURNS DISPLACEMENT	2.99	3.04	3.20
R-VALUE UNCORRECTED	30	22	19
R-VALUE CORRECTED	30	23	19

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	1.12	1.23	1.30
EXPANSION PRESSURE THICKNESS, ft.	1.80	1.07	0.80





R-VALUE BY EXPANSION:	25
R-VALUE BY EXUDATION:	20
EQUILIBRIUM R-VALUE:	20

Leighton

R-VALUE TEST RESULTS

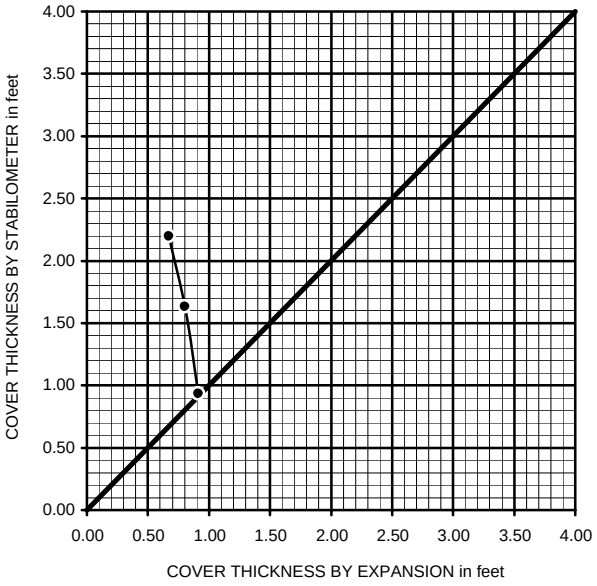
DOT CA Test 301

PROJECT NAME:	SR-57 Widening	PROJECT NUMBER:	370900.02.GE.0S
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	A-08-022 @ 2-7'
SAMPLE DESCRIPTION:	SC	TECHNICIAN:	SCF
		DATE COMPLETED	8//18/2008

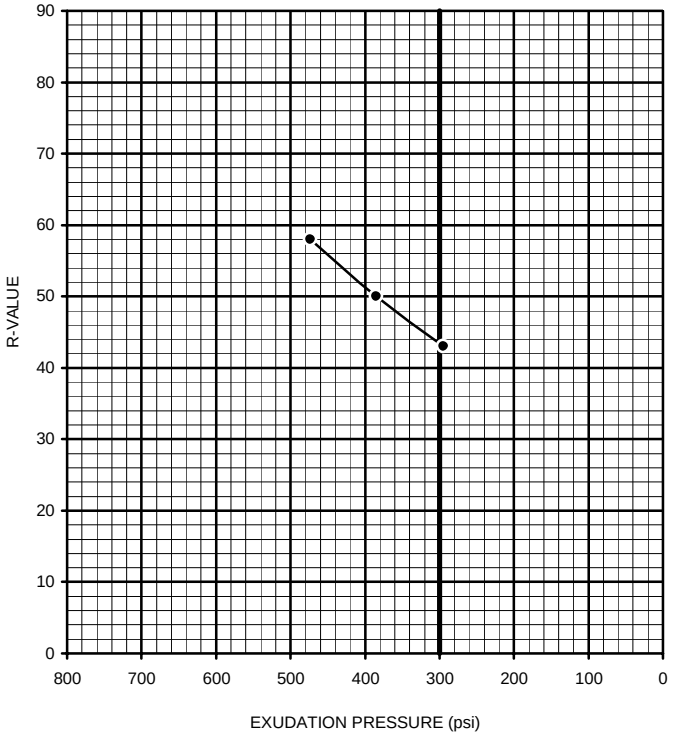
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	12.9	13.4	13.8
HEIGHT OF SAMPLE, Inches	2.44	2.52	2.59
DRY DENSITY, pcf	120.8	119.0	117.9
COMPACTOR PRESSURE, psi	150	115	80
EXUDATION PRESSURE, psi	474	385	294
EXPANSION, Inches x 10exp-4	66	49	28
STABILITY Ph 2,000 lbs (160 psi)	61	76	84
TURNS DISPLACEMENT	2.89	2.77	2.95
R-VALUE UNCORRECTED	58	50	43
R-VALUE CORRECTED	58	50	43

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.67	0.80	0.91
EXPANSION PRESSURE THICKNESS, ft.	2.20	1.63	0.93

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	44
R-VALUE BY EXUDATION:	44
EQUILIBRIUM R-VALUE:	44

Leighton

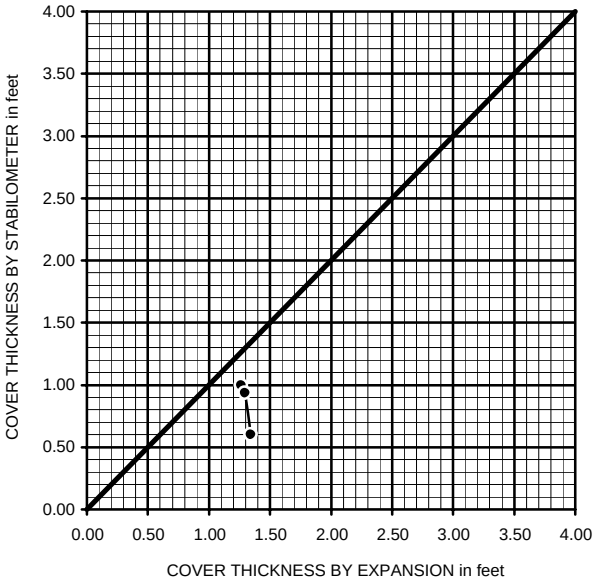
R-VALUE TEST RESULTS

PROJECT NAME:	SR-57 Widening	PROJECT NUMBER:	370900.02.GE.OS
SAMPLE NUMBER:	Bag-1	SAMPLE LOCATION:	A-08-028 @ 0-7'
SAMPLE DESCRIPTION:	s(CL)g	TESTED BY:	SCF
SAMPLED BY:	RB	DATE COMPLETED	8/13/2008

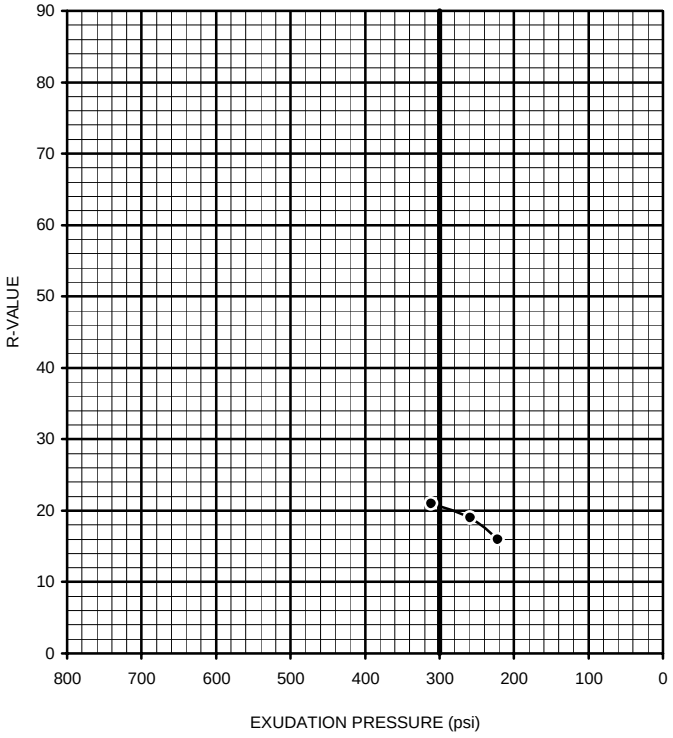
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	18.2	18.4	18.7
HEIGHT OF SAMPLE, Inches	2.56	2.52	2.43
DRY DENSITY, pcf	110.9	109.2	107.6
COMPACTOR PRESSURE, psi	50	50	50
EXUDATION PRESSURE, psi	311	259	221
EXPANSION, Inches x 10exp-4	30	28	18
STABILITY Ph 2,000 lbs (160 psi)	120	124	126
TURNS DISPLACEMENT	3.08	3.17	3.25
R-VALUE UNCORRECTED	21	19	17
R-VALUE CORRECTED	21	19	16

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	1.26	1.30	1.34
EXPANSION PRESSURE THICKNESS, ft.	1.00	0.93	0.60

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	26
R-VALUE BY EXUDATION:	21
EQUILIBRIUM R-VALUE:	21

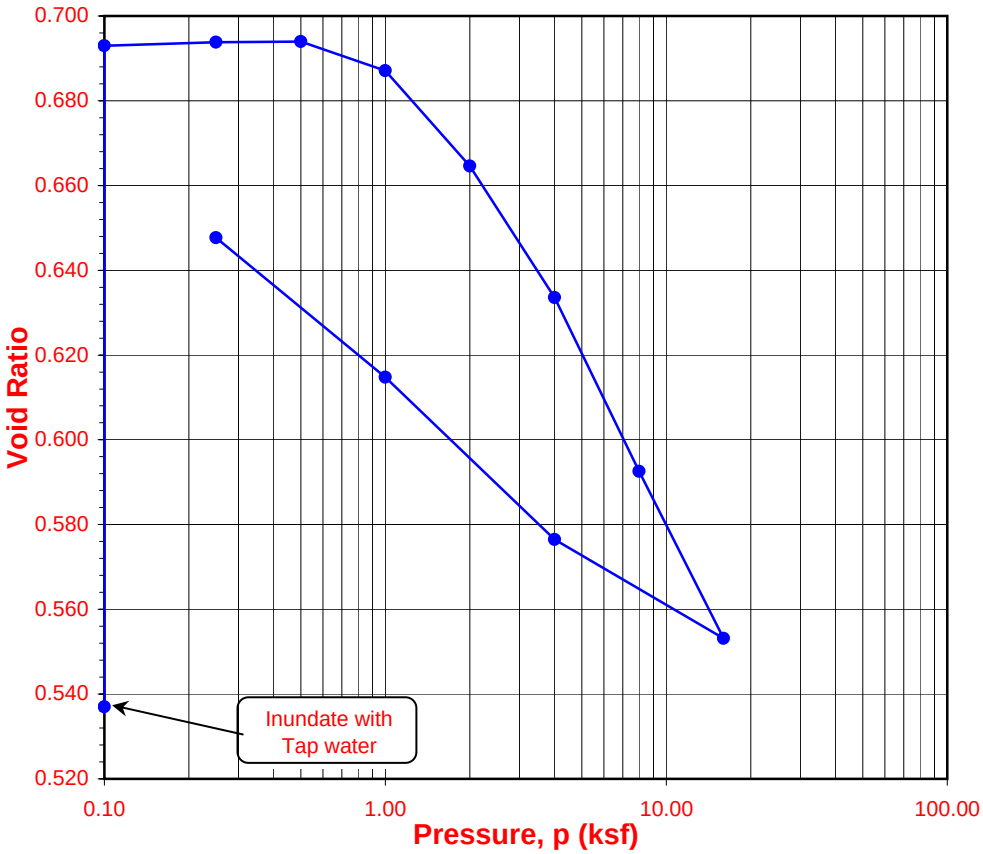
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

(ASTM D 2435)

Leighton

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/24/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Boring No.:	A-08-002	Depth (ft.):	15.0		
Sample No.:	D-3	Sample Type:	Drive		
Soil Identification:	Olive brown fat clay (CH)				

Sample Diameter (in.)	2.416
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	216.28
Weight of Ring (g)	63.53
Height after consol. (in.)	1.0720
Before Test	
Wt.Wet Sample+Cont. (g)	321.88
Wt.of Dry Sample+Cont. (g)	283.38
Weight of Container (g)	38.78
Initial Moisture Content (%)	15.7
Initial Dry Density (pcf)	109.7
Initial Saturation (%)	79
Initial Vertical Reading (in.)	0.2947
After Test	
Wt.of Wet Sample+Cont. (g)	266.25
Wt. of Dry Sample+Cont. (g)	231.71
Weight of Container (g)	38.95
Final Moisture Content (%)	26.73
Final Dry Density (pcf)	100.2
Final Saturation (%)	106
Final Vertical Reading (in.)	0.3650
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

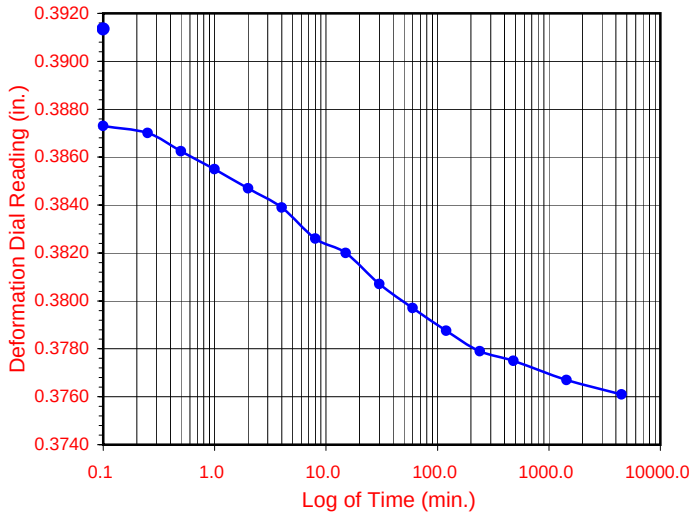


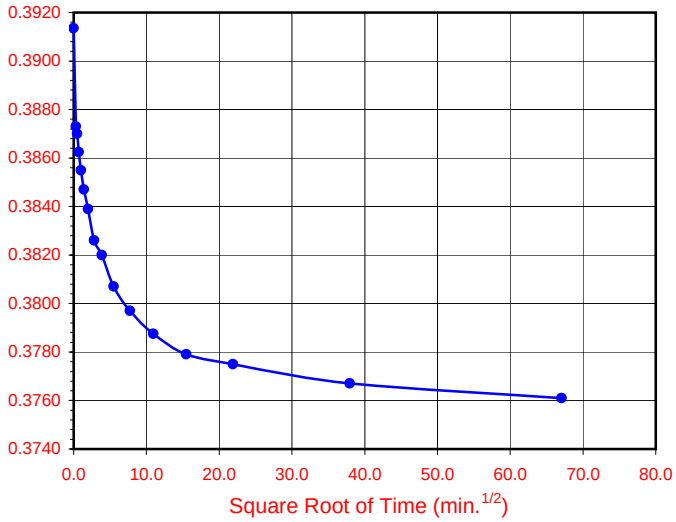
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.2947	1.0000	0.00	0.00	0.537	0.00
0.10	0.3962	1.1015	0.00	-10.15	0.693	-10.15
0.25	0.3964	1.1017	0.03	-10.17	0.694	-10.20
0.50	0.3962	1.1015	0.06	-10.15	0.694	-10.21
1.00	0.3914	1.0967	0.10	-9.66	0.687	-9.76
2.00	0.3761	1.0814	0.16	-8.14	0.665	-8.30
4.00	0.3549	1.0602	0.26	-6.02	0.634	-6.28
8.00	0.3266	1.0319	0.43	-3.18	0.593	-3.61
16.00	0.2989	1.0042	0.63	-0.42	0.553	-1.05
4.00	0.3165	1.0218	0.39	-2.18	0.576	-2.57
1.00	0.3428	1.0481	0.25	-4.81	0.615	-5.06
0.25	0.3650	1.0703	0.17	-7.03	0.648	-7.20

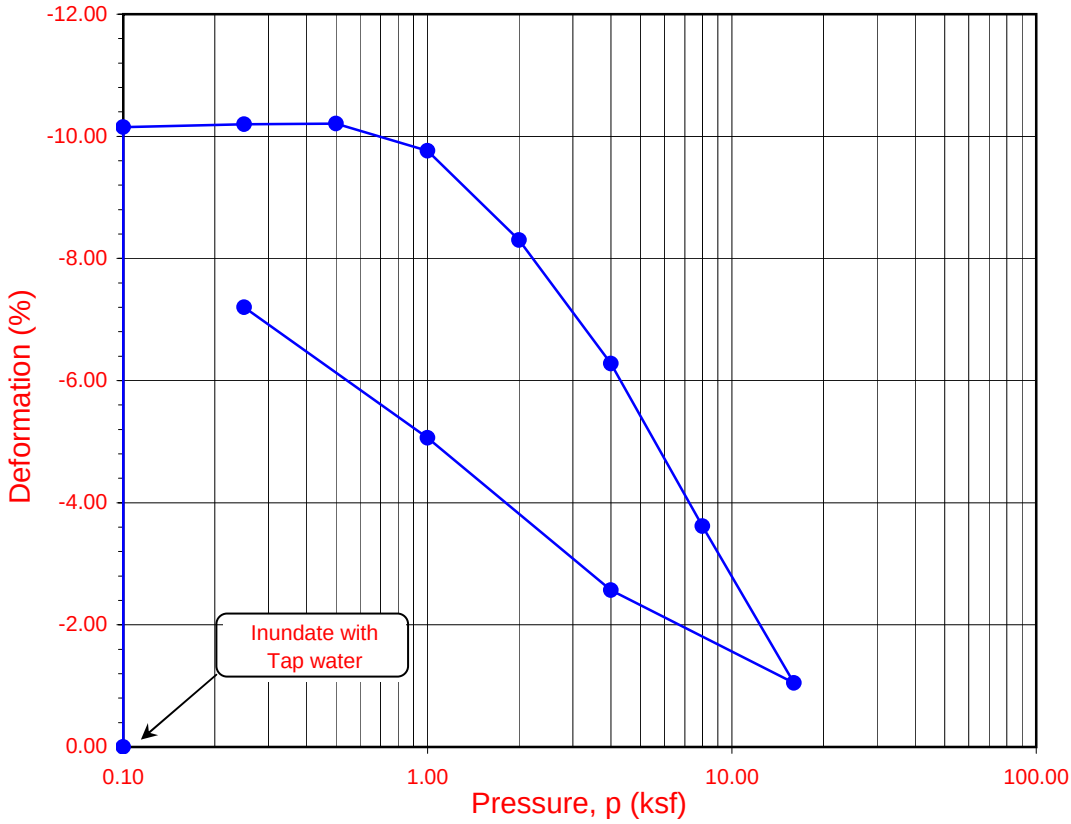
Time Readings @ 2.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
7/28/08	10:00:00	0.0	0.0	0.3914
7/28/08	10:00:06	0.1	0.3	0.3873
7/28/08	10:00:15	0.2	0.5	0.3870
7/28/08	10:00:30	0.5	0.7	0.3863
7/28/08	10:01:00	1.0	1.0	0.3855
7/28/08	10:02:00	2.0	1.4	0.3847
7/28/08	10:04:00	4.0	2.0	0.3839
7/28/08	10:08:00	8.0	2.8	0.3826
7/28/08	10:15:00	15.0	3.9	0.3820
7/28/08	10:30:00	30.0	5.5	0.3807
7/28/08	11:00:00	60.0	7.7	0.3797
7/28/08	12:00:00	120.0	11.0	0.3788
7/28/08	14:00:00	240.0	15.5	0.3779
7/28/08	18:00:00	480.0	21.9	0.3775
7/29/08	10:00:00	1440.0	37.9	0.3767
7/31/08	13:00:00	4500.0	67.1	0.3761

Time Readings @ 2.0 ksf







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-08-002	**D-3**	**15.0**	**15.7**	**26.7**	**109.7**	**100.2**	**0.537**	**0.648**	**79**	**100**

Soil Identification: Olive brown fat clay (CH)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

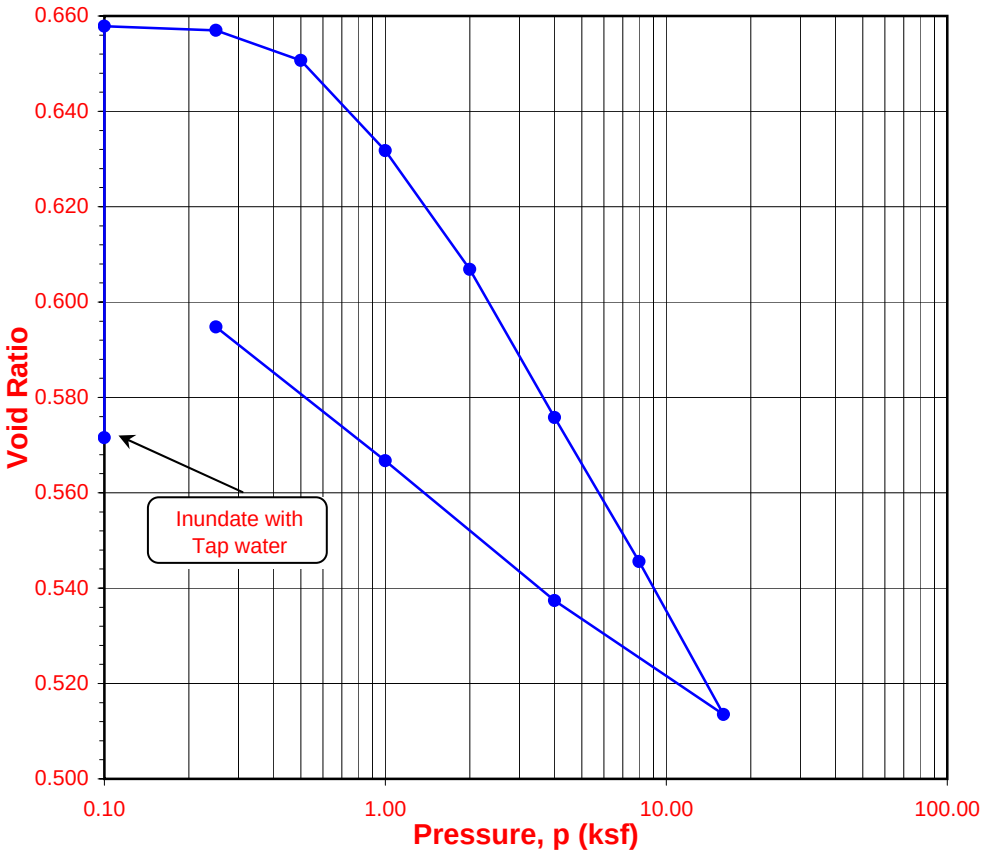
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

(ASTM D 2435)

Leighton

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/24/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Boring No.:	A-08-008	Depth (ft.):	5.0		
Sample No.:	D-1	Sample Type:	Drive		
Soil Identification:	Brown lean clay (CL)				

Sample Diameter (in.)	2.416
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	219.39
Weight of Ring (g)	62.00
Height after consol. (in.)	1.0146
Before Test	
Wt.Wet Sample+Cont. (g)	180.47
Wt.of Dry Sample+Cont. (g)	155.09
Weight of Container (g)	39.50
Initial Moisture Content (%)	22.0
Initial Dry Density (pcf)	107.2
Initial Saturation (%)	104
Initial Vertical Reading (in.)	0.3229
After Test	
Wt.of Wet Sample+Cont. (g)	262.47
Wt. of Dry Sample+Cont. (g)	229.04
Weight of Container (g)	39.04
Final Moisture Content (%)	26.12
Final Dry Density (pcf)	104.8
Final Saturation (%)	116
Final Vertical Reading (in.)	0.3349
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

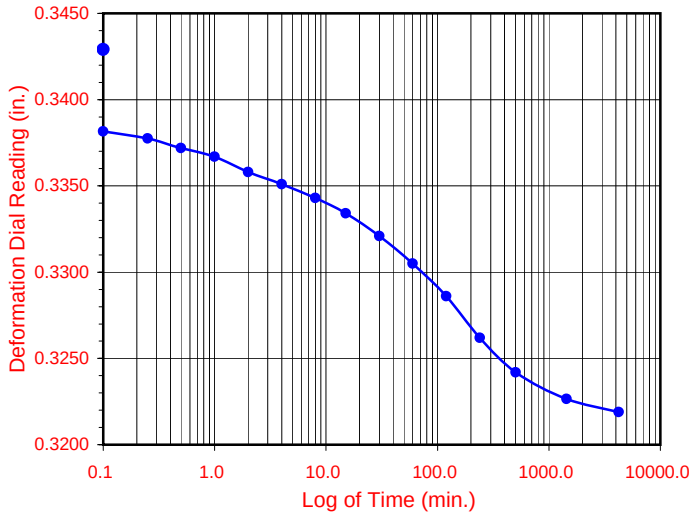


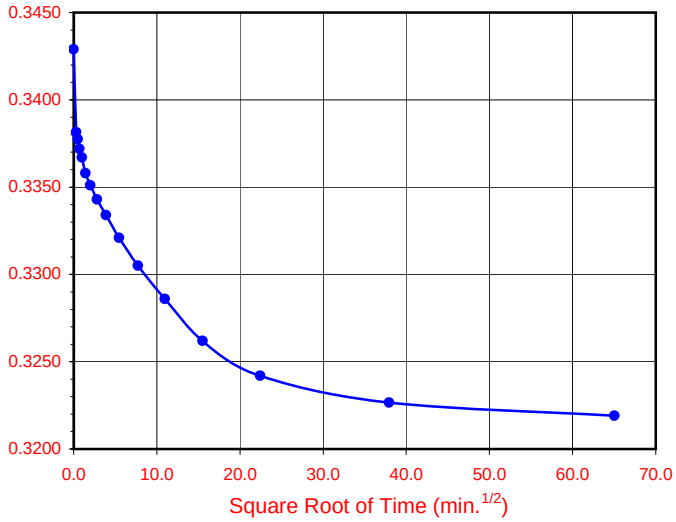
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deforma-tion (%)
0.10	0.3228	0.9999	0.00	0.02	0.572	0.02
0.10	0.3777	1.0548	0.00	-5.47	0.658	-5.47
0.25	0.3764	1.0535	0.07	-5.35	0.657	-5.42
0.50	0.3721	1.0492	0.10	-4.92	0.651	-5.02
1.00	0.3596	1.0367	0.15	-3.66	0.632	-3.81
2.00	0.3429	1.0200	0.23	-2.00	0.607	-2.23
4.00	0.3219	0.9990	0.35	0.10	0.576	-0.25
8.00	0.3010	0.9781	0.52	2.19	0.546	1.67
16.00	0.2782	0.9553	0.76	4.47	0.513	3.71
4.00	0.2959	0.9730	0.51	2.70	0.537	2.19
1.00	0.3162	0.9933	0.35	0.68	0.567	0.33
0.25	0.3349	1.0120	0.26	-1.20	0.595	-1.46

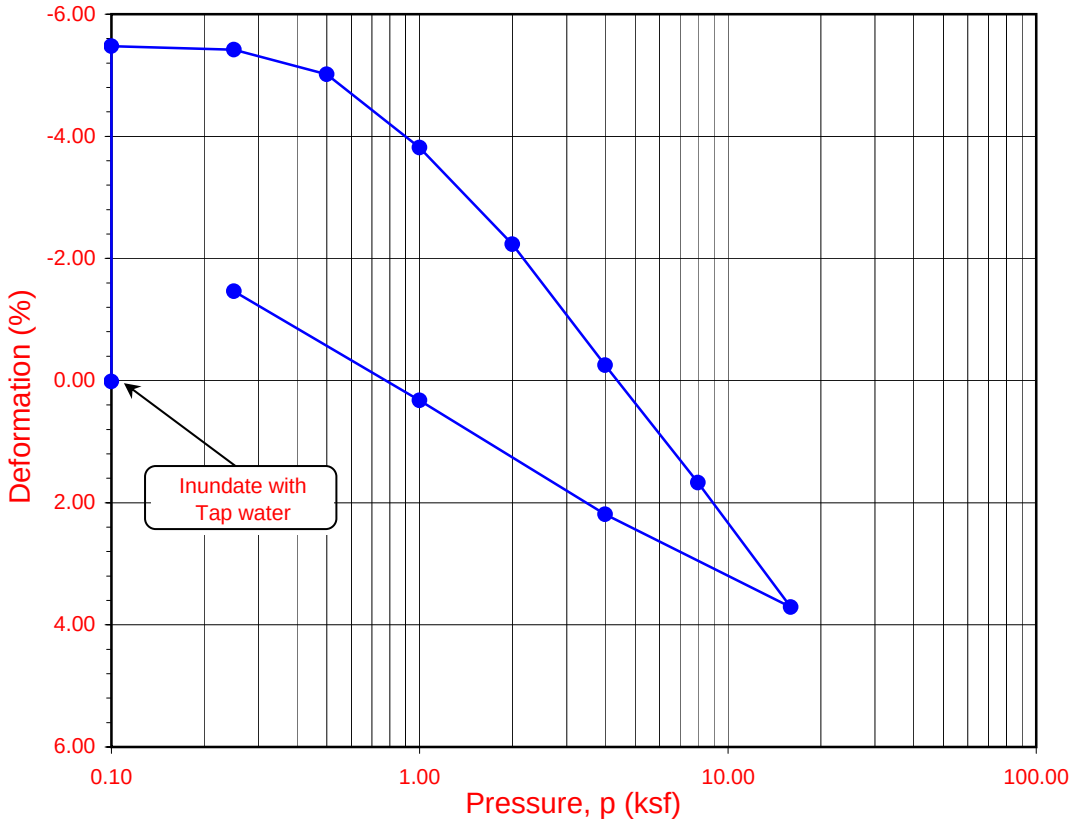
Time Readings @ 4.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
7/31/08	13:00:00	0.0	0.0	0.3429
7/31/08	13:00:06	0.1	0.3	0.3382
7/31/08	13:00:15	0.2	0.5	0.3378
7/31/08	13:00:30	0.5	0.7	0.3372
7/31/08	13:01:00	1.0	1.0	0.3367
7/31/08	13:02:00	2.0	1.4	0.3358
7/31/08	13:04:00	4.0	2.0	0.3351
7/31/08	13:08:00	8.0	2.8	0.3343
7/31/08	13:15:00	15.0	3.9	0.3334
7/31/08	13:30:00	30.0	5.5	0.3321
7/31/08	14:00:00	60.0	7.7	0.3305
7/31/08	15:00:00	120.0	11.0	0.3286
7/31/08	17:00:00	240.0	15.5	0.3262
7/31/08	21:24:00	504.0	22.4	0.3242
8/1/08	13:00:00	1440.0	37.9	0.3227
8/3/08	11:30:00	4230.0	65.0	0.3219

Time Readings @ 4.0 ksf







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-08-008	**D-1**	**5.0**	**22.0**	**26.1**	**107.2**	**104.8**	**0.572**	**0.595**	**100**	**100**

Soil Identification: Brown lean clay (CL)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

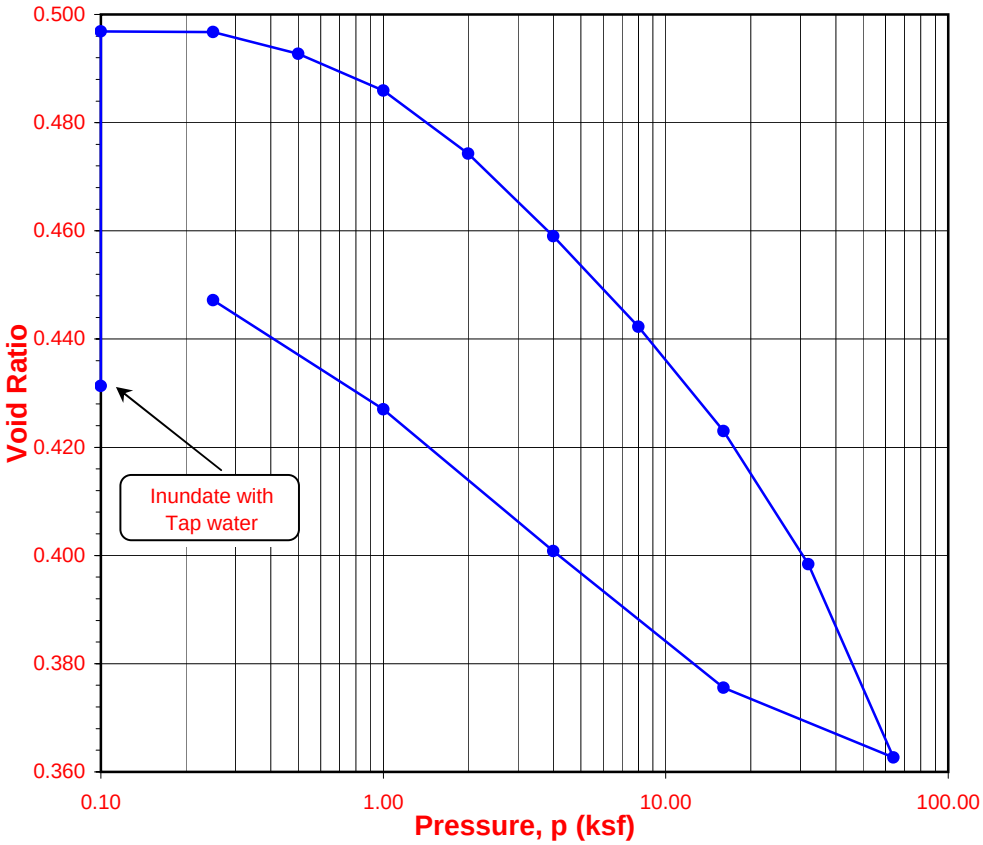
Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

(ASTM D 2435)

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/28/08
Boring No.:	A-08-012	Depth (ft.):	35.0		
Sample No.:	D-7	Sample Type:	Drive		
Soil Identification:	Yellowish brown lean clay (CL)				

Sample Diameter (in.)	2.416
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	218.90
Weight of Ring (g)	54.44
Height after consol. (in.)	1.0048
Before Test	
Wt.Wet Sample+Cont. (g)	187.01
Wt.of Dry Sample+Cont. (g)	165.71
Weight of Container (g)	38.71
Initial Moisture Content (%)	16.8
Initial Dry Density (pcf)	117.0
Initial Saturation (%)	103
Initial Vertical Reading (in.)	0.2459
After Test	
Wt.of Wet Sample+Cont. (g)	259.19
Wt. of Dry Sample+Cont. (g)	233.39
Weight of Container (g)	38.99
Final Moisture Content (%)	18.43
Final Dry Density (pcf)	115.7
Final Saturation (%)	109
Final Vertical Reading (in.)	0.2464
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

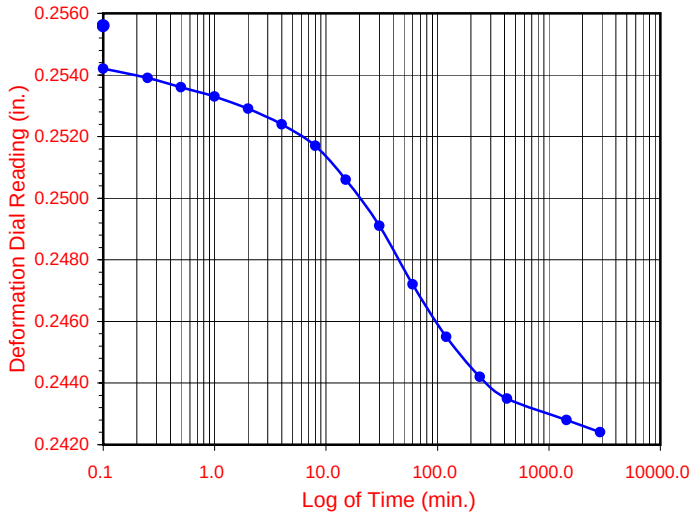


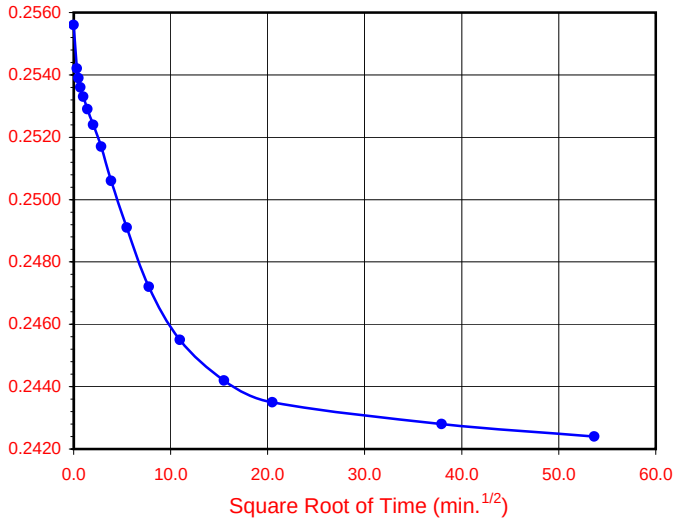
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deforma-tion (%)
0.10	0.2397	0.9938	0.00	0.62	0.431	0.62
0.10	0.2852	1.0393	0.00	-3.93	0.497	-3.93
0.25	0.2847	1.0388	0.04	-3.88	0.497	-3.92
0.50	0.2815	1.0356	0.08	-3.56	0.493	-3.64
1.00	0.2763	1.0304	0.13	-3.04	0.486	-3.17
2.00	0.2675	1.0216	0.20	-2.16	0.474	-2.36
4.00	0.2556	1.0097	0.33	-0.97	0.459	-1.30
8.00	0.2424	0.9965	0.49	0.35	0.442	-0.14
16.00	0.2272	0.9813	0.67	1.87	0.423	1.20
32.00	0.2076	0.9617	0.92	3.83	0.398	2.91
64.00	0.1792	0.9333	1.28	6.67	0.363	5.39
16.00	0.1922	0.9463	0.88	5.38	0.376	4.50
4.00	0.2120	0.9661	0.65	3.39	0.401	2.74
1.00	0.2316	0.9857	0.51	1.43	0.427	0.92
0.25	0.2464	1.0005	0.43	-0.05	0.447	-0.48

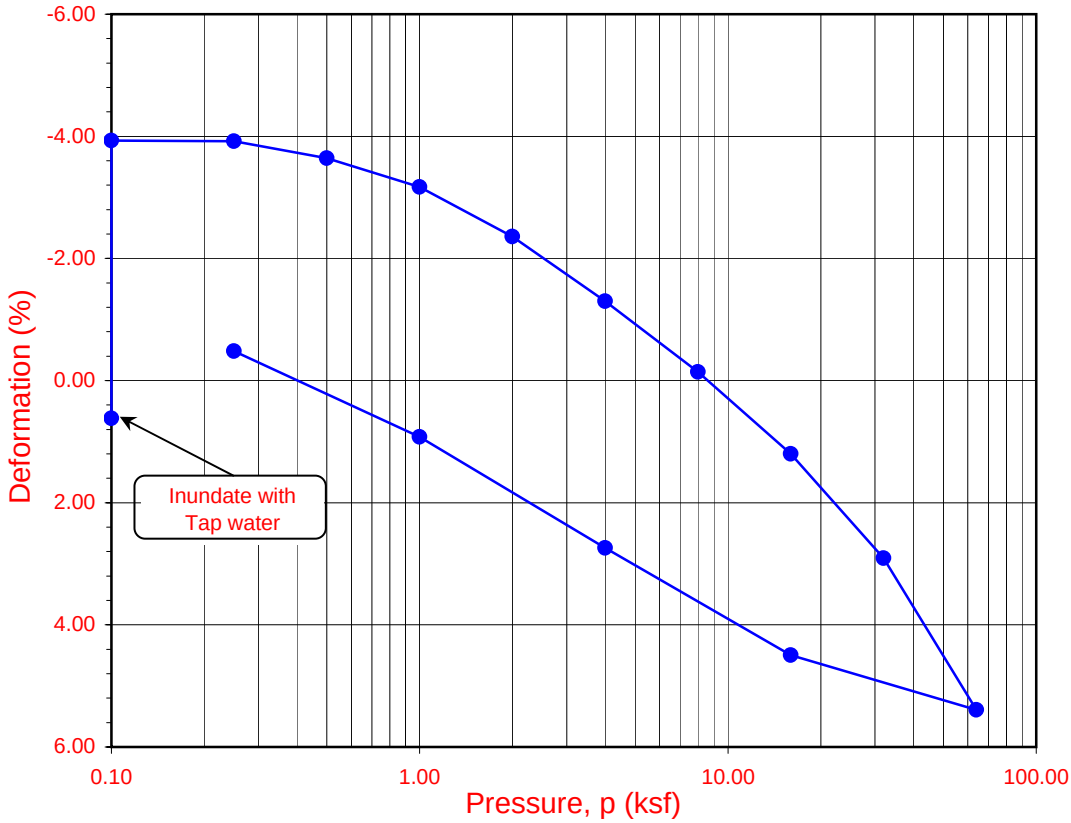
Time Readings @ 8 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
8/19/08	8:23:00	0.0	0.0	0.2556
8/19/08	8:23:06	0.1	0.3	0.2542
8/19/08	8:23:15	0.2	0.5	0.2539
8/19/08	8:23:30	0.5	0.7	0.2536
8/19/08	8:24:00	1.0	1.0	0.2533
8/19/08	8:25:00	2.0	1.4	0.2529
8/19/08	8:27:00	4.0	2.0	0.2524
8/19/08	8:31:00	8.0	2.8	0.2517
8/19/08	8:38:00	15.0	3.9	0.2506
8/19/08	8:53:00	30.0	5.5	0.2491
8/19/08	9:23:00	60.0	7.7	0.2472
8/19/08	10:23:00	120.0	11.0	0.2455
8/19/08	12:23:00	240.0	15.5	0.2442
8/19/08	15:23:00	420.0	20.5	0.2435
8/20/08	8:23:00	1440.0	37.9	0.2428
8/21/08	8:23:00	2880.0	53.7	0.2424

Time Readings @ 8 ksf







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-08-012	**D-7**	**35.0**	**16.8**	**18.4**	**117.0**	**115.7**	**0.440**	**0.447**	**100**	**100**

Soil Identification: Yellowish brown lean clay (CL)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

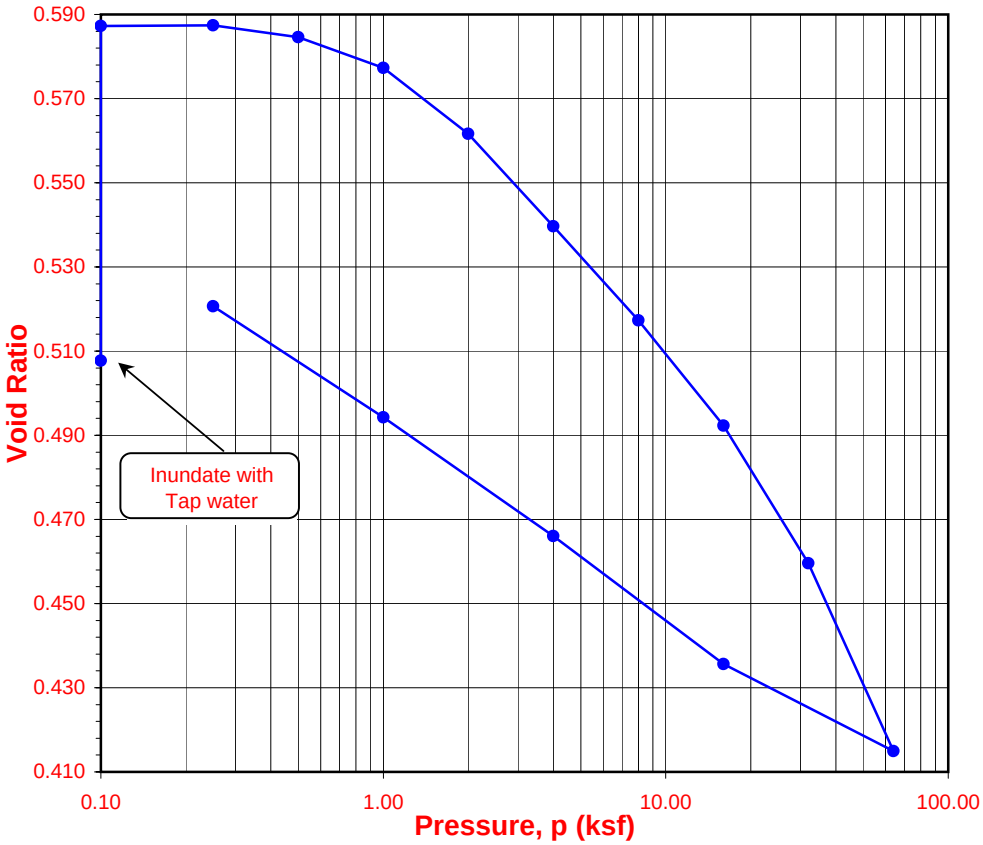
Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

(ASTM D 2435)

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/28/08
Boring No.:	A-08-013	Depth (ft.):	35.0		
Sample No.:	D-7	Sample Type:	Drive		
Soil Identification:	Olive brown fat clay (CH)				

Sample Diameter (in.)	2.416
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	222.14
Weight of Ring (g)	61.97
Height after consol. (in.)	1.0086
Before Test	
Wt.Wet Sample+Cont. (g)	200.78
Wt.of Dry Sample+Cont. (g)	175.01
Weight of Container (g)	39.72
Initial Moisture Content (%)	19.0
Initial Dry Density (pcf)	111.8
Initial Saturation (%)	101
Initial Vertical Reading (in.)	0.2323
After Test	
Wt.of Wet Sample+Cont. (g)	263.54
Wt. of Dry Sample+Cont. (g)	235.28
Weight of Container (g)	39.14
Final Moisture Content (%)	21.06
Final Dry Density (pcf)	110.5
Final Saturation (%)	108
Final Vertical Reading (in.)	0.2372
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

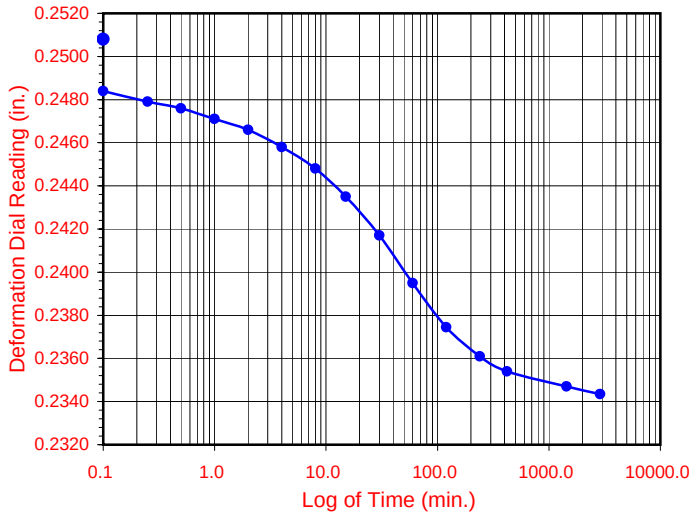


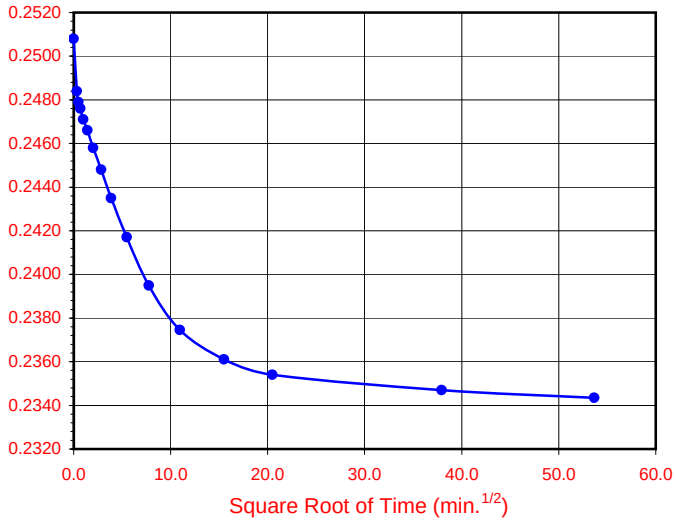
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deforma-tion (%)
0.10	0.2323	1.0000	0.00	0.00	0.508	0.00
0.10	0.2851	1.0528	0.00	-5.28	0.587	-5.28
0.25	0.2850	1.0527	0.02	-5.27	0.587	-5.29
0.50	0.2829	1.0506	0.04	-5.06	0.585	-5.10
1.00	0.2777	1.0454	0.08	-4.54	0.577	-4.62
2.00	0.2667	1.0344	0.14	-3.44	0.562	-3.58
4.00	0.2508	1.0185	0.27	-1.85	0.540	-2.12
8.00	0.2344	1.0021	0.43	-0.21	0.517	-0.64
16.00	0.2156	0.9833	0.65	1.67	0.492	1.02
32.00	0.1915	0.9592	0.89	4.08	0.460	3.19
64.00	0.1586	0.9263	1.22	7.37	0.415	6.15
16.00	0.1757	0.9434	0.88	5.66	0.436	4.78
4.00	0.1988	0.9665	0.59	3.35	0.466	2.76
1.00	0.2190	0.9867	0.44	1.33	0.494	0.89
0.25	0.2372	1.0049	0.37	-0.49	0.521	-0.86

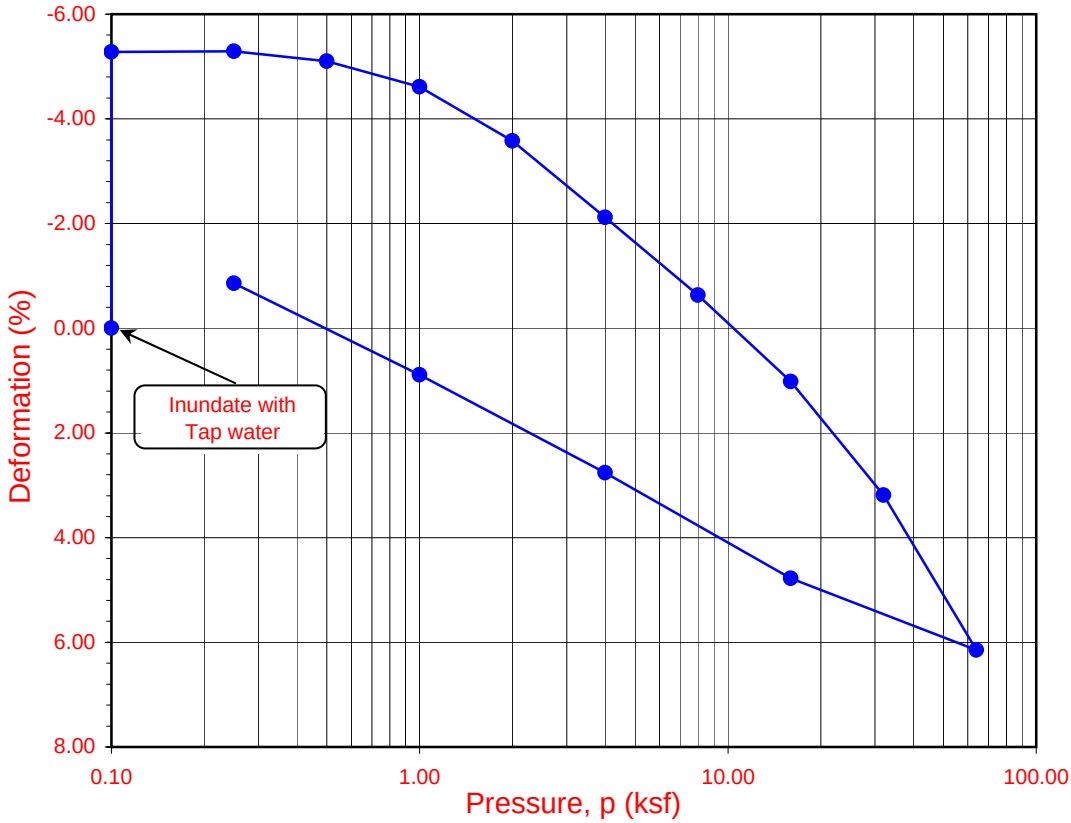
Time Readings @ 8 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
8/19/08	8:20:00	0.0	0.0	0.2508
8/19/08	8:20:06	0.1	0.3	0.2484
8/19/08	8:20:15	0.2	0.5	0.2479
8/19/08	8:20:30	0.5	0.7	0.2476
8/19/08	8:21:00	1.0	1.0	0.2471
8/19/08	8:22:00	2.0	1.4	0.2466
8/19/08	8:24:00	4.0	2.0	0.2458
8/19/08	8:28:00	8.0	2.8	0.2448
8/19/08	8:35:00	15.0	3.9	0.2435
8/19/08	8:50:00	30.0	5.5	0.2417
8/19/08	9:20:00	60.0	7.7	0.2395
8/19/08	10:20:00	120.0	11.0	0.2375
8/19/08	12:20:00	240.0	15.5	0.2361
8/19/08	15:20:00	420.0	20.5	0.2354
8/20/08	8:20:00	1440.0	37.9	0.2347
8/21/08	8:20:00	2880.0	53.7	0.2344

Time Readings @ 8 ksf







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-08-013	**D-7**	**35.0**	**19.0**	**21.1**	**111.8**	**110.5**	**0.508**	**0.521**	**100**	**100**

Soil Identification: Olive brown fat clay (CH)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

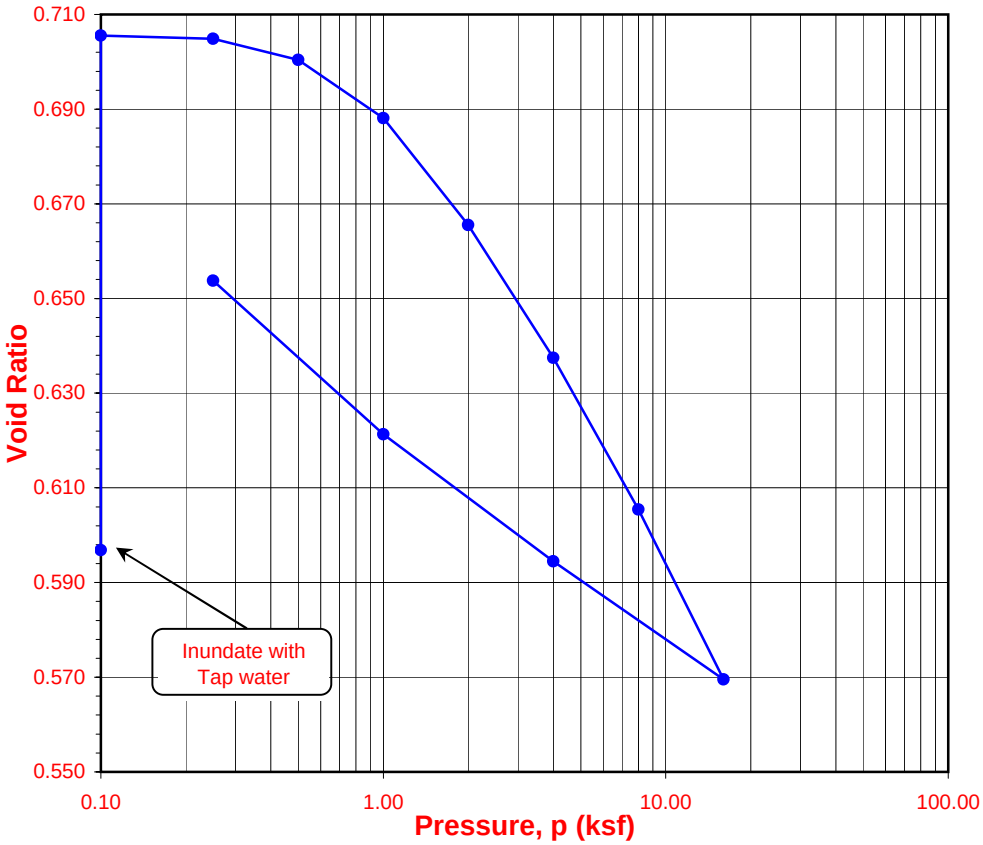
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

(ASTM D 2435)

Leighton

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/07/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/20/08
Boring No.:	A-08-015	Depth (ft.):	25.0		
Sample No.:	D-5	Sample Type:	Drive		
Soil Identification:	Brown fat clay (CH)				

Sample Diameter (in.)	2.416
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	219.00
Weight of Ring (g)	63.53
Height after consol. (in.)	1.0349
Before Test	
Wt.Wet Sample+Cont. (g)	321.41
Wt.of Dry Sample+Cont. (g)	269.64
Weight of Container (g)	39.29
Initial Moisture Content (%)	22.5
Initial Dry Density (pcf)	105.5
Initial Saturation (%)	101
Initial Vertical Reading (in.)	0.2662
After Test	
Wt.of Wet Sample+Cont. (g)	263.59
Wt. of Dry Sample+Cont. (g)	229.11
Weight of Container (g)	39.95
Final Moisture Content (%)	27.45
Final Dry Density (pcf)	100.9
Final Saturation (%)	110
Final Vertical Reading (in.)	0.2989
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

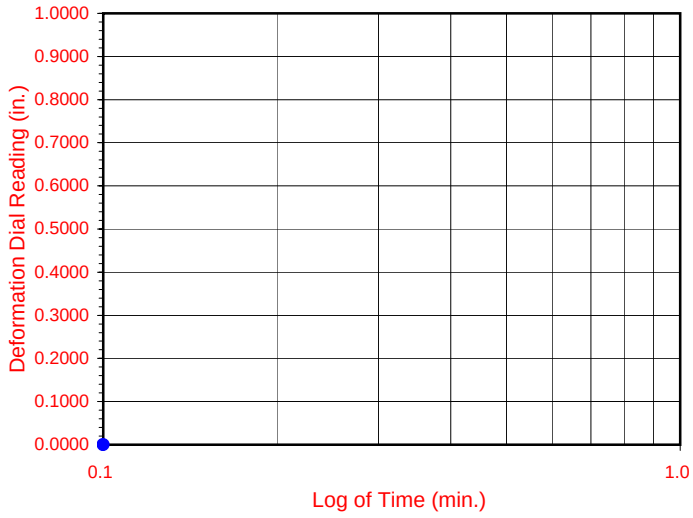


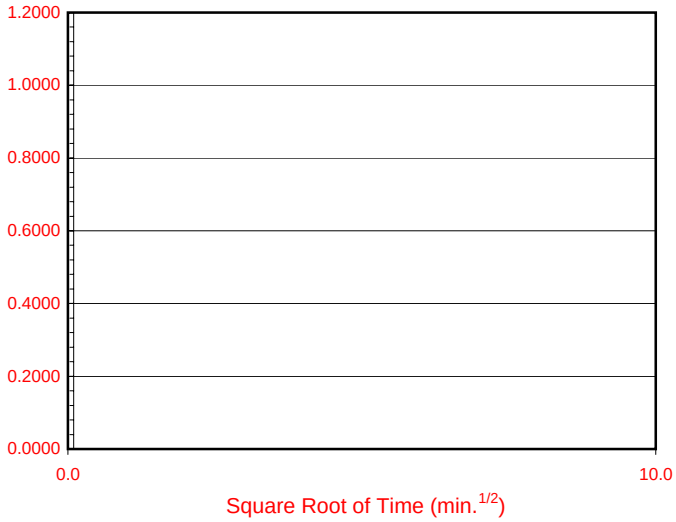
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deforma-tion (%)
0.10	0.2655	0.9993	0.00	0.07	0.597	0.07
0.10	0.3335	1.0673	0.00	-6.73	0.706	-6.73
0.25	0.3327	1.0665	0.04	-6.65	0.705	-6.69
0.50	0.3296	1.0634	0.07	-6.34	0.700	-6.41
1.00	0.3217	1.0555	0.09	-5.55	0.688	-5.64
2.00	0.3069	1.0407	0.16	-4.07	0.665	-4.23
4.00	0.2882	1.0220	0.27	-2.20	0.637	-2.47
8.00	0.2664	1.0002	0.45	-0.02	0.605	-0.47
16.00	0.2416	0.9754	0.68	2.46	0.570	1.78
4.00	0.2596	0.9934	0.44	0.66	0.594	0.22
1.00	0.2778	1.0116	0.30	-1.16	0.621	-1.46
0.25	0.2989	1.0327	0.22	-3.27	0.654	-3.49

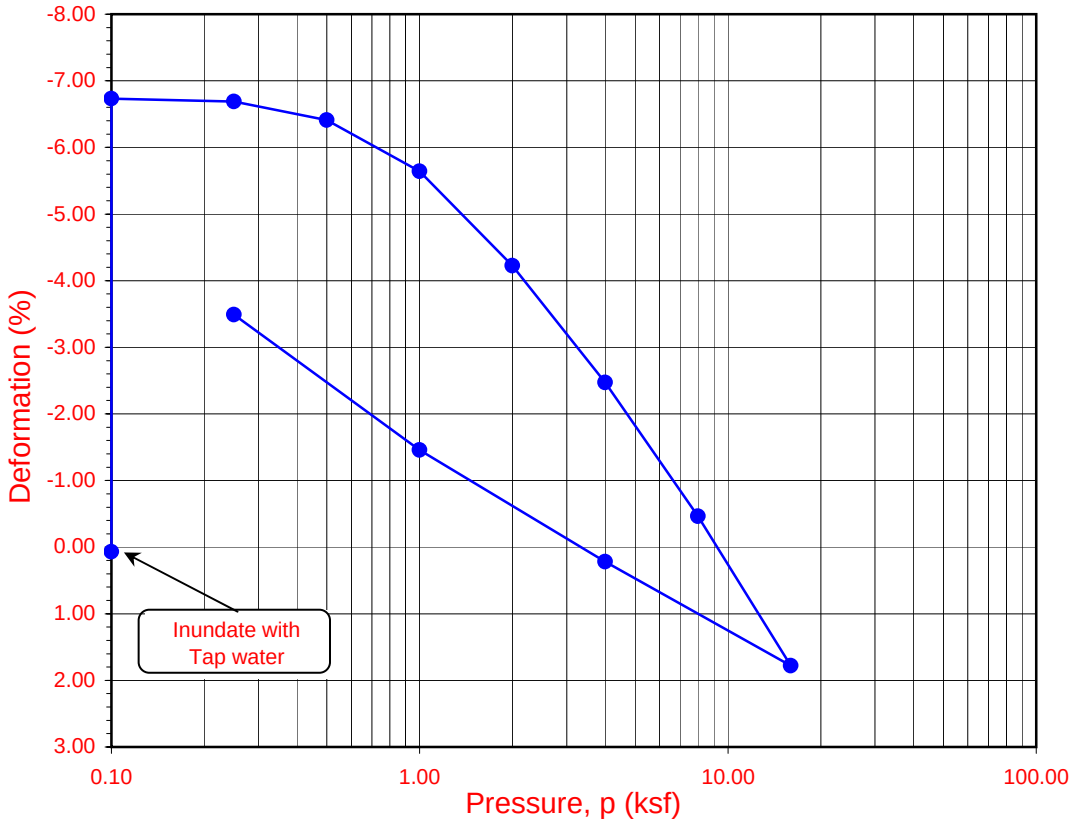
No Time Readings

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
A-08-015	**D-5**	**25.0**	**22.5**	**27.4**	**105.5**	**100.9**	**0.598**	**0.654**	**100**	**100**

Soil Identification: Brown fat clay (CH)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

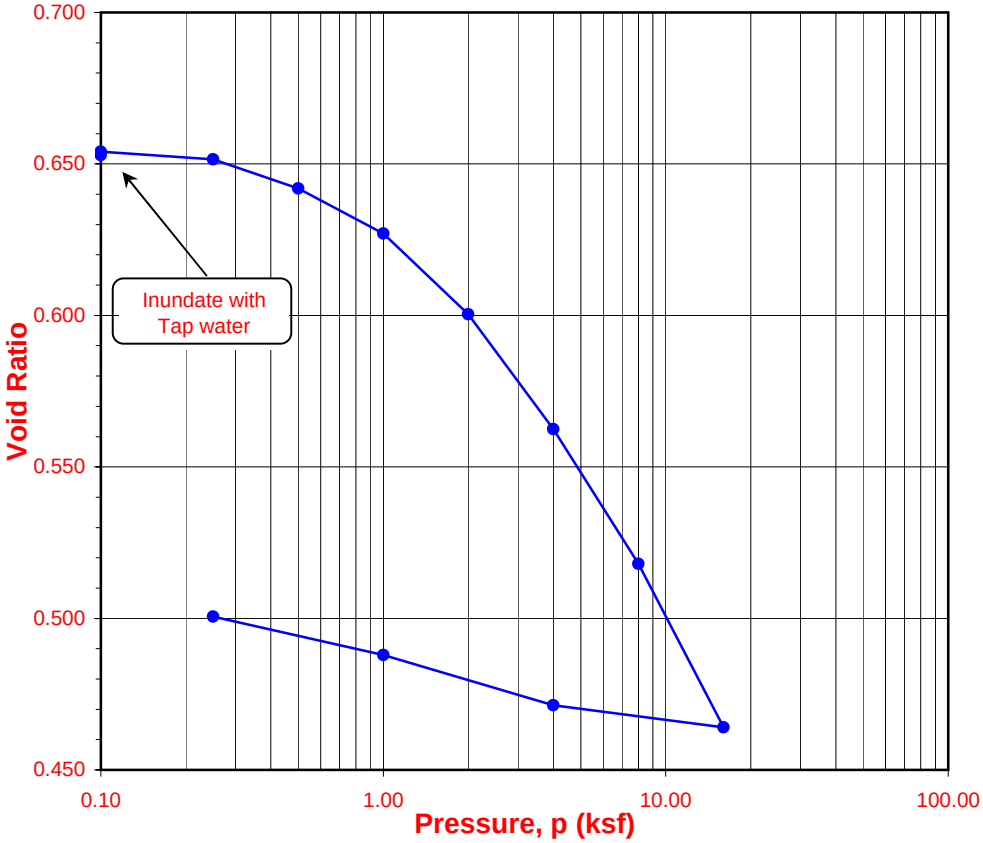
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

(ASTM D 2435)

Leighton

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/17/08
Project No.:	370900.02.GE.0S	Checked By:	J. Ward	Date:	09/30/08
Boring No.:	A-08-026	Depth (ft.):	60.0		
Sample No.:	D-12	Sample Type:	Drive		
Soil Identification:	Brown lean clay (CL)				

Sample Diameter (in.)	2.416
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	195.34
Weight of Ring (g)	43.00
Height after consol. (in.)	0.9044
Before Test	
Wt.Wet Sample+Cont. (g)	112.50
Wt.of Dry Sample+Cont. (g)	97.83
Weight of Container (g)	38.21
Initial Moisture Content (%)	24.6
Initial Dry Density (pcf)	101.6
Initial Saturation (%)	101
Initial Vertical Reading (in.)	0.2182
After Test	
Wt.of Wet Sample+Cont. (g)	227.62
Wt. of Dry Sample+Cont. (g)	203.17
Weight of Container (g)	38.81
Final Moisture Content (%)	20.15
Final Dry Density (pcf)	111.5
Final Saturation (%)	106
Final Vertical Reading (in.)	0.1196
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

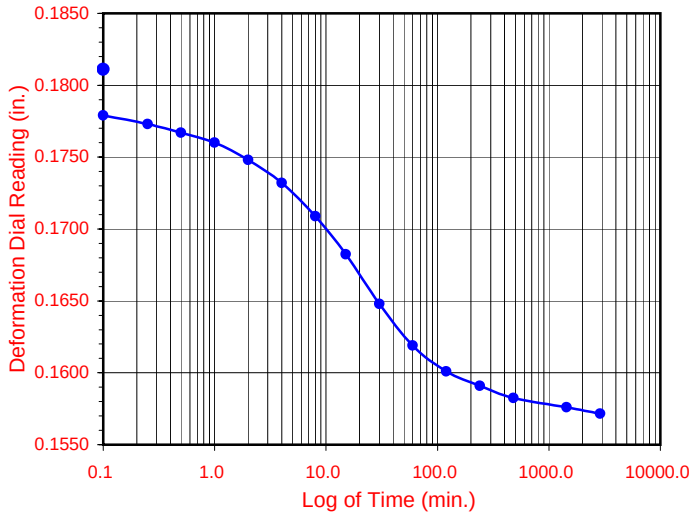


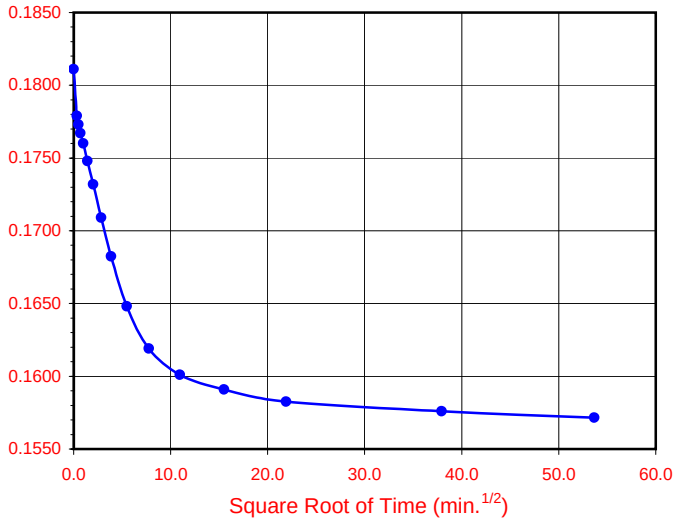
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.2144	0.9962	0.00	0.38	0.653	0.38
0.10	0.2151	0.9969	0.00	0.31	0.654	0.31
0.25	0.2133	0.9951	0.03	0.49	0.652	0.46
0.50	0.2072	0.9890	0.06	1.10	0.642	1.04
1.00	0.1977	0.9795	0.11	2.05	0.627	1.94
2.00	0.1811	0.9629	0.17	3.71	0.600	3.54
4.00	0.1570	0.9388	0.29	6.12	0.562	5.83
8.00	0.1285	0.9103	0.46	8.97	0.518	8.51
16.00	0.0935	0.8753	0.71	12.47	0.464	11.76
4.00	0.1001	0.8819	0.49	11.81	0.471	11.32
1.00	0.1114	0.8932	0.36	10.69	0.488	10.33
0.25	0.1196	0.9014	0.30	9.86	0.501	9.56

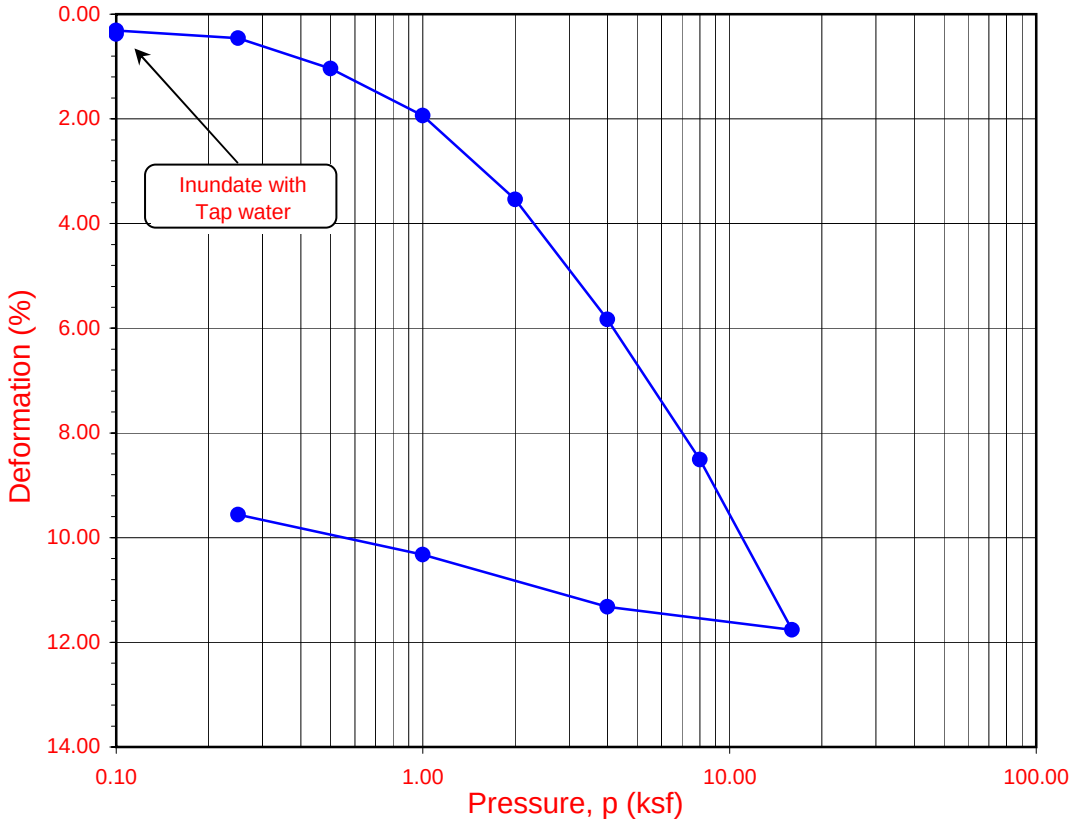
Time Readings @ 4.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
9/22/08	9:00:00	0.0	0.0	0.1811
9/22/08	9:00:06	0.1	0.3	0.1779
9/22/08	9:00:15	0.2	0.5	0.1773
9/22/08	9:00:30	0.5	0.7	0.1767
9/22/08	9:01:00	1.0	1.0	0.1760
9/22/08	9:02:00	2.0	1.4	0.1748
9/22/08	9:04:00	4.0	2.0	0.1732
9/22/08	9:08:00	8.0	2.8	0.1709
9/22/08	9:15:00	15.0	3.9	0.1683
9/22/08	9:30:00	30.0	5.5	0.1648
9/22/08	10:00:00	60.0	7.7	0.1619
9/22/08	11:00:00	120.0	11.0	0.1601
9/22/08	13:00:00	240.0	15.5	0.1591
9/22/08	17:00:00	480.0	21.9	0.1583
9/23/08	9:00:00	1440.0	37.9	0.1576
9/24/08	9:00:00	2880.0	53.7	0.1572
9/24/08	12:30:00	3090.0	55.6	0.1570

Time Readings @ 4.0 ksf







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-08-026	**D-12**	**60.0**	**24.6**	**20.1**	**101.6**	**111.5**	**0.659**	**0.501**	**100**	**100**

Soil Identification: Brown lean clay (CL)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

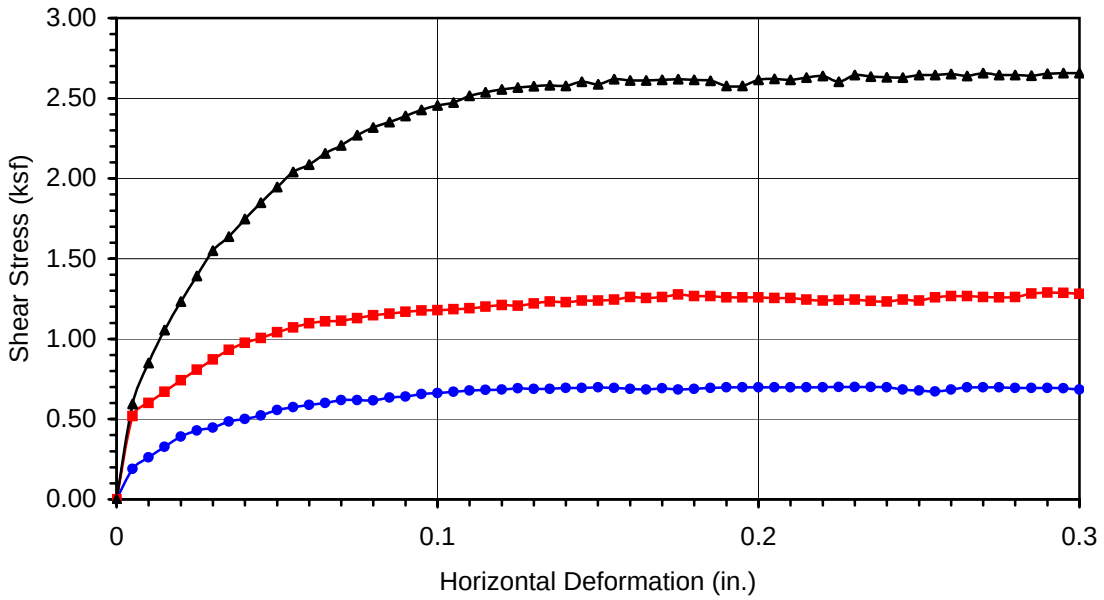
DIRECT SHEAR TEST

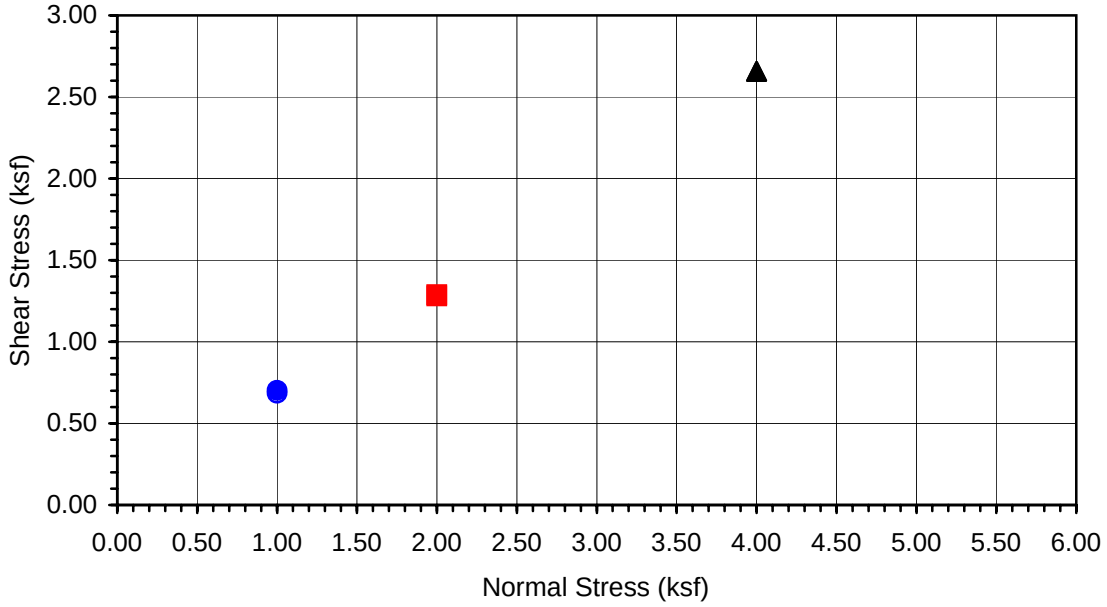
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/04/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Boring No.:	A-08-001	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Brown sandy lean clay s(CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	174.76	175.76	182.24
Weight of Ring(gm):	43.02	42.87	43.32
Before Shearing			
Weight of Wet Sample+Cont.(gm):	169.73	169.73	169.73
Weight of Dry Sample+Cont.(gm):	164.33	164.33	164.33
Weight of Container(gm):	39.57	39.57	39.57
Vertical Rdg.(in): Initial	0.0000	0.2443	0.2600
Vertical Rdg.(in): Final	-0.0493	0.3144	0.3454
After Shearing			
Weight of Wet Sample+Cont.(gm):	184.09	183.55	188.71
Weight of Dry Sample+Cont.(gm):	164.03	163.39	169.46
Weight of Container(gm):	39.91	39.20	39.18
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-001**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Brown sandy lean clay s(CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.701	■ 1.289	▲ 2.656
Shear Stress @ End of Test (ksf)	○ 0.685	□ 1.280	△ 2.656
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	4.33	4.33	4.33
Dry Density (pcf)	105.0	105.9	110.7
Saturation (%)	19.3	19.8	22.4
Soil Height Before Shearing (in.)	0.9507	0.9299	0.9146
Final Moisture Content (%)	16.2	16.2	14.8

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

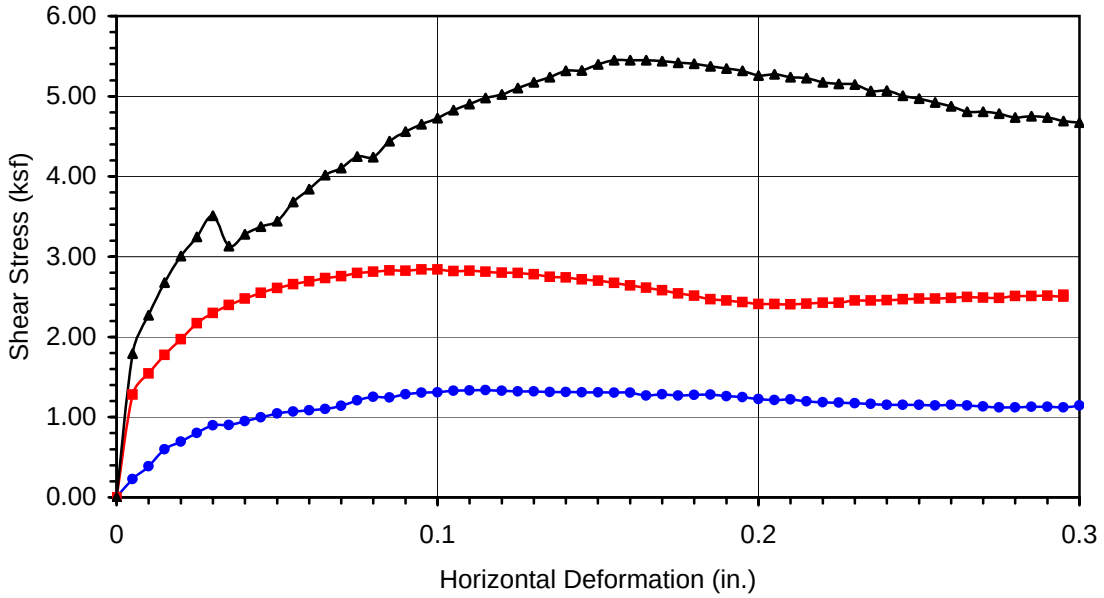
DIRECT SHEAR TEST

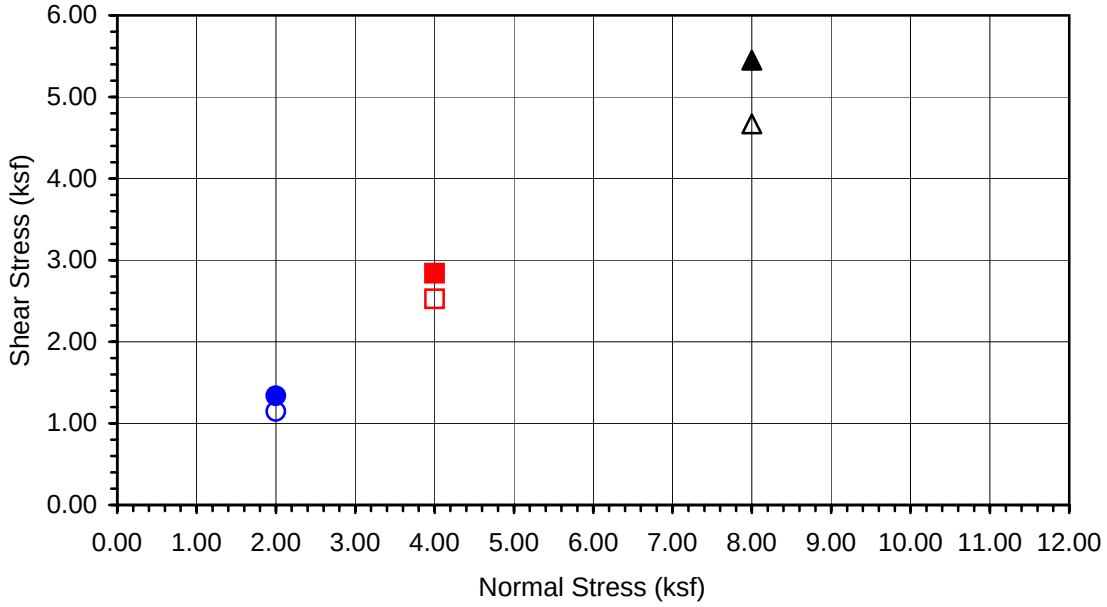
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/04/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Boring No.:	A-08-001	Sample Type:	Drive		
Sample No.:	D-5	Depth (ft.):	25.0		

Soil Identification: Yellowish brown poorly graded sand with silt (SP-SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	165.70	167.62	168.33
Weight of Ring(gm):	43.05	43.02	43.49
Before Shearing			
Weight of Wet Sample+Cont.(gm):	225.77	225.77	225.77
Weight of Dry Sample+Cont.(gm):	222.30	222.30	222.30
Weight of Container(gm):	39.05	39.05	39.05
Vertical Rdg.(in): Initial	0.0000	0.2680	0.2542
Vertical Rdg.(in): Final	-0.0224	0.3045	0.2950
After Shearing			
Weight of Wet Sample+Cont.(gm):	178.24	182.25	181.12
Weight of Dry Sample+Cont.(gm):	151.83	155.68	156.21
Weight of Container(gm):	38.74	39.20	39.47
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-001**
Sample No.	**D-5**
Depth (ft)	**25**

Sample Type:

Drive

Soil Identification:
Yellowish brown poorly graded sand with silt (SP-SM)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.336	■ 2.839	▲ 5.451
Shear Stress @ End of Test (ksf)	○ 1.144	□ 2.524	△ 4.672
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	1.89	1.89	1.89
Dry Density (pcf)	100.1	101.7	101.9
Saturation (%)	7.5	7.8	7.8
Soil Height Before Shearing (in.)	0.9776	0.9635	0.9592
Final Moisture Content (%)	23.4	22.8	21.3

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

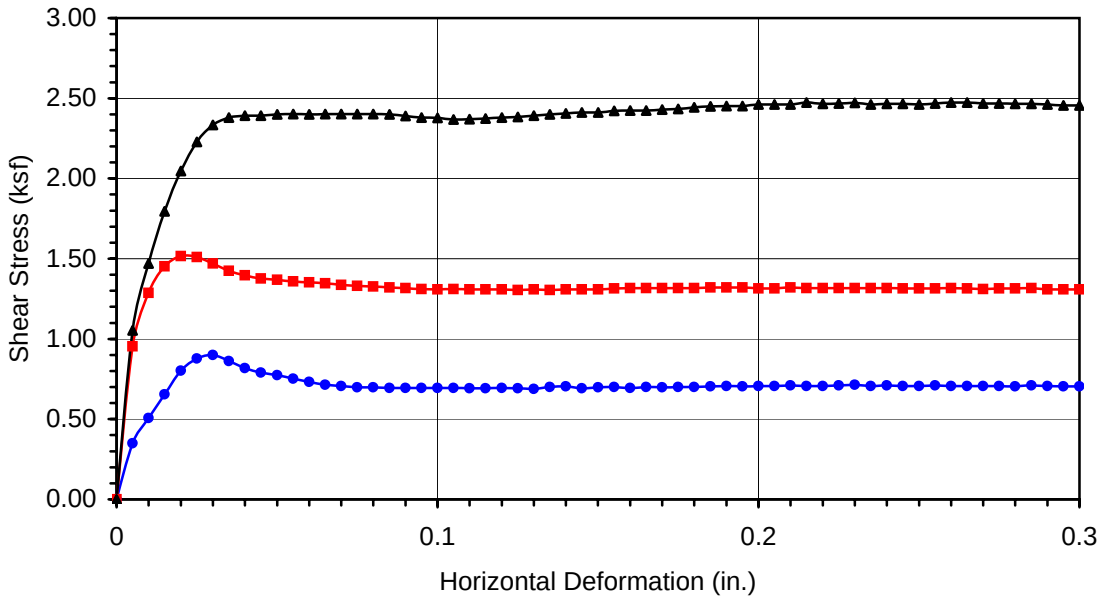
DIRECT SHEAR TEST

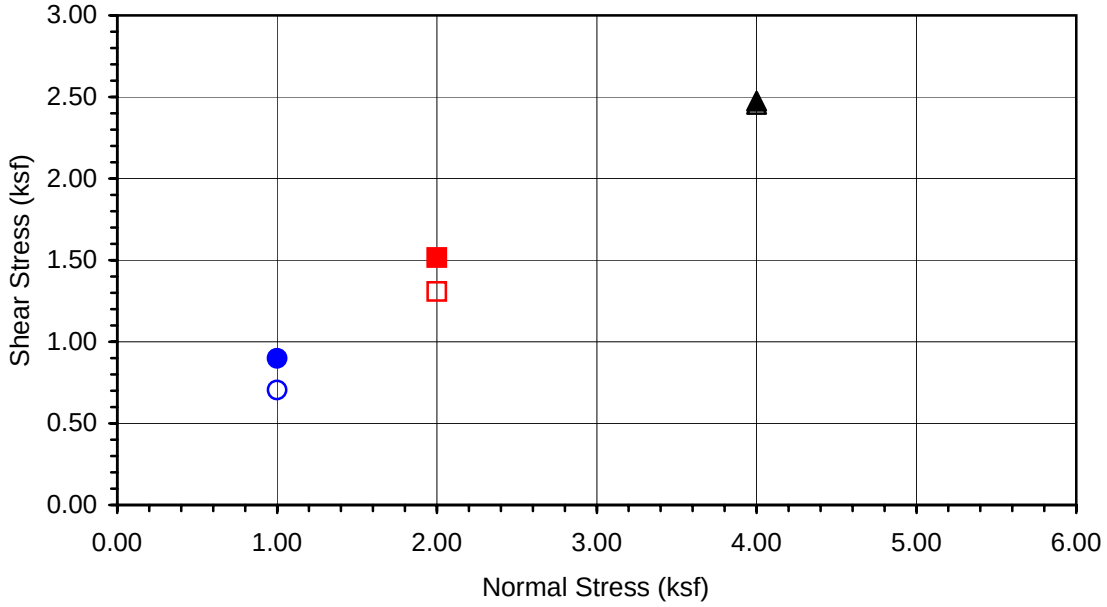
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/07/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Boring No.:	A-08-002	Sample Type:	Remolded to 95% Max. Dens. @ Opt. MC		
Sample No.:	BAG-1	Depth (ft.):	2-7		

Soil Identification: Dark grayish brown sandy lean clay s(CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	198.53	198.51	198.49
Weight of Ring(gm):	44.24	44.22	44.20
Before Shearing			
Weight of Wet Sample+Cont.(gm):	225.48	225.48	225.48
Weight of Dry Sample+Cont.(gm):	205.49	205.49	205.49
Weight of Container(gm):	38.89	38.89	38.89
Vertical Rdg.(in): Initial	0.2694	0.2672	0.0000
Vertical Rdg.(in): Final	0.2659	0.2690	-0.0092
After Shearing			
Weight of Wet Sample+Cont.(gm):	201.19	199.00	198.14
Weight of Dry Sample+Cont.(gm):	176.00	174.92	174.74
Weight of Container(gm):	39.50	39.03	38.51
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-002**
Sample No.	**BAG-1**
Depth (ft)	**2-7**

Sample Type:
Remolded to 95% Max. Dens. @ Opt. MC

Soil Identification:
Dark grayish brown sandy lean clay s(CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.899	■ 1.515	▲ 2.474
Shear Stress @ End of Test (ksf)	○ 0.704	□ 1.308	△ 2.455
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.00	12.00	12.00
Dry Density (pcf)	114.6	114.6	114.6
Saturation (%)	68.7	68.7	68.7
Soil Height Before Shearing (in.)	1.0035	0.9982	0.9908
Final Moisture Content (%)	18.5	17.7	17.2

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

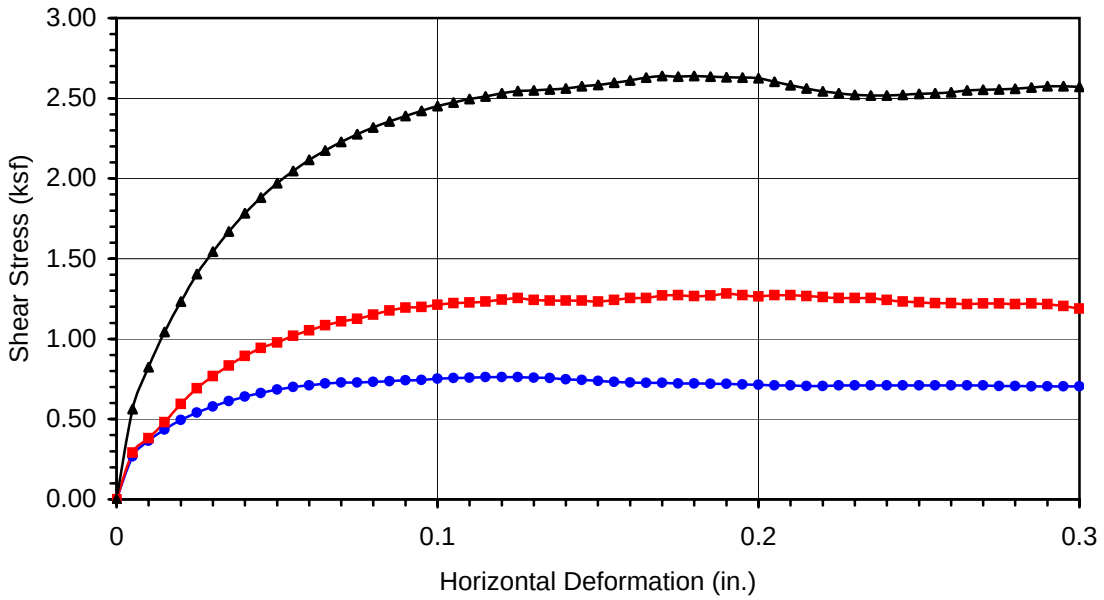
DIRECT SHEAR TEST

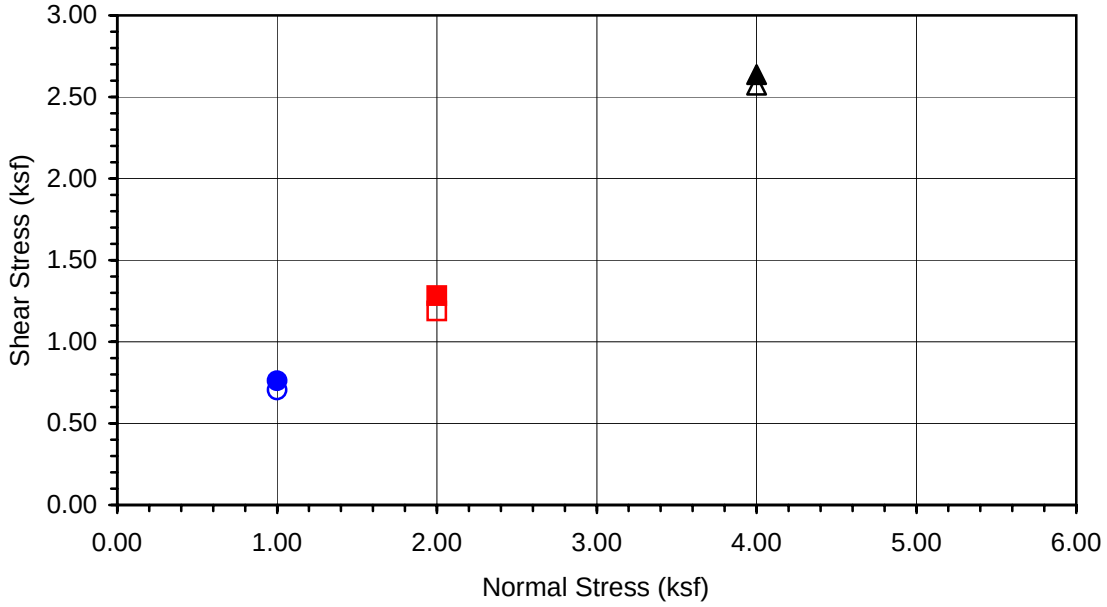
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/04/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Boring No.:	A-08-003	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Yellowish brown sandy silty clay s(CL-ML)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	165.06	165.30	167.91
Weight of Ring(gm):	42.81	43.31	43.26
Before Shearing			
Weight of Wet Sample+Cont.(gm):	158.39	158.39	158.39
Weight of Dry Sample+Cont.(gm):	149.58	149.58	149.58
Weight of Container(gm):	38.89	38.89	38.89
Vertical Rdg.(in): Initial	0.0000	0.2612	0.2717
Vertical Rdg.(in): Final	-0.0092	0.2844	0.3057
After Shearing			
Weight of Wet Sample+Cont.(gm):	181.35	177.78	179.92
Weight of Dry Sample+Cont.(gm):	149.43	146.57	151.77
Weight of Container(gm):	38.90	39.37	39.11
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-003**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Yellowish brown sandy silty clay s(CL-ML)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.761	■ 1.283	▲ 2.638
Shear Stress @ End of Test (ksf)	○ 0.704	□ 1.188	△ 2.572
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	7.96	7.96	7.96
Dry Density (pcf)	94.2	94.0	96.0
Saturation (%)	27.2	27.1	28.4
Soil Height Before Shearing (in.)	0.9908	0.9768	0.9660
Final Moisture Content (%)	28.9	29.1	25.0

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/05/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Boring No.:	A-08-004	Sample Type:	Remolded to 95% Max. Dens. @ Opt. MC		
Sample No.:	BAG-1	Depth (ft.):	2-7		

Soil Identification: Light olive brown poorly graded sand with silt and gravel (SP-SM)g

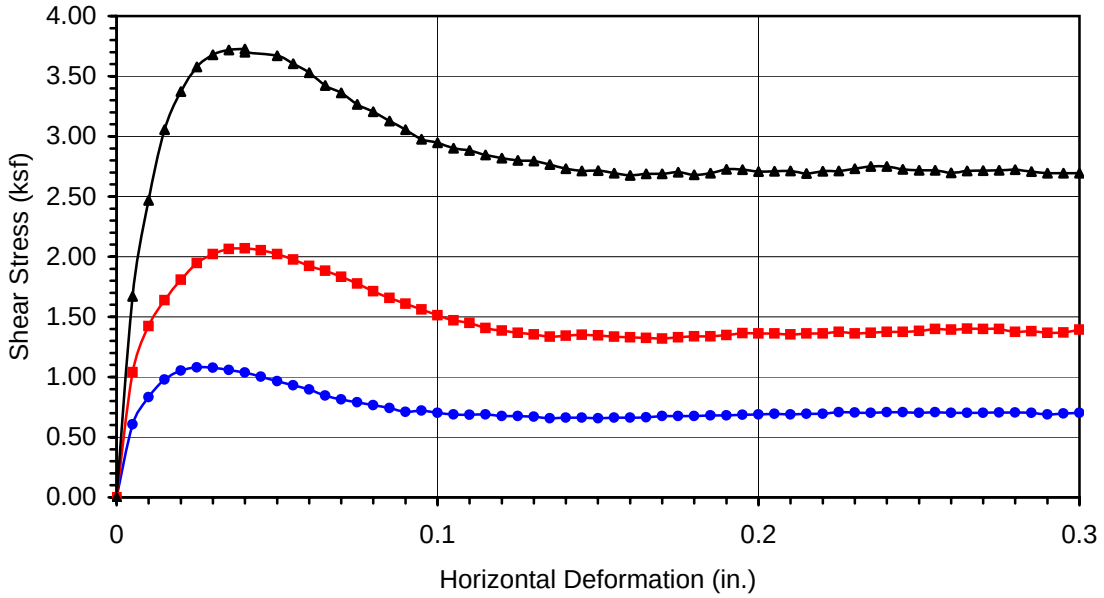
Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	193.30	192.87	192.80
Weight of Ring(gm):	43.53	43.10	43.03

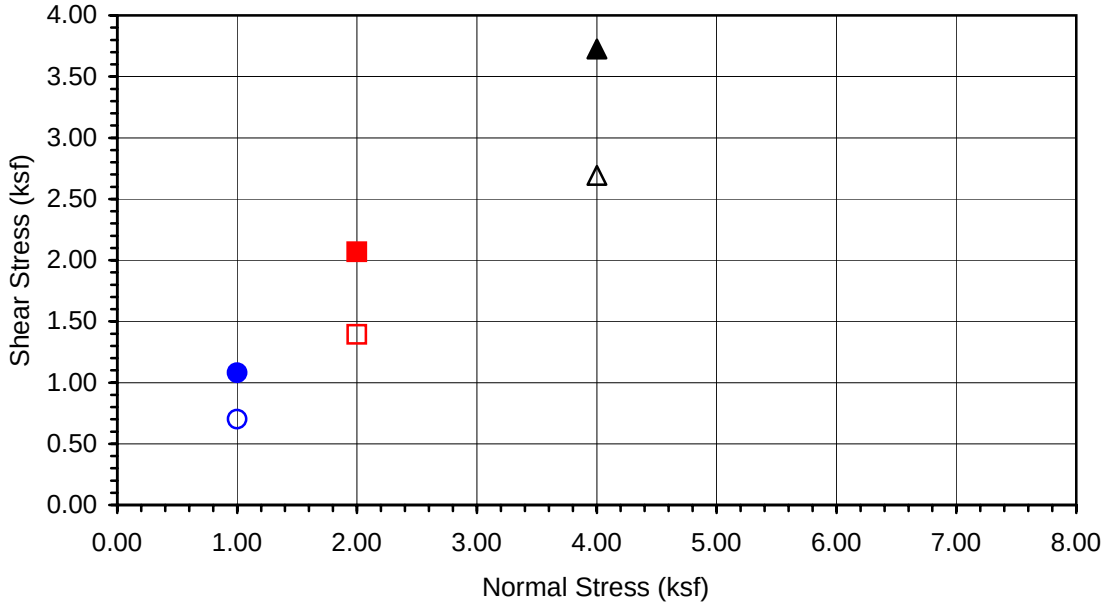
Before Shearing

Weight of Wet Sample+Cont.(gm):	209.68	209.68	209.68
Weight of Dry Sample+Cont.(gm):	192.00	192.00	192.00
Weight of Container(gm):	38.35	38.35	38.35
Vertical Rdg.(in): Initial	0.1211	0.1406	0.1376
Vertical Rdg.(in): Final	0.1351	0.1524	0.1576

After Shearing

Weight of Wet Sample+Cont.(gm):	191.59	191.40	188.86
Weight of Dry Sample+Cont.(gm):	170.71	171.03	166.74
Weight of Container(gm):	39.87	38.70	38.93
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-004**
Sample No.	**BAG-1**
Depth (ft)	**2-7**

Sample Type:
Remolded to 95% Max. Dens. @ Opt. MC

Soil Identification:
Light olive brown poorly graded sand with silt and gravel (SP-SM)g

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.081	■ 2.069	▲ 3.725
Shear Stress @ End of Test (ksf)	○ 0.701	□ 1.393	△ 2.694
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.51	11.51	11.51
Dry Density (pcf)	111.7	111.7	111.7
Saturation (%)	61.0	61.0	61.0
Soil Height Before Shearing (in.)	0.9860	0.9882	0.9800
Final Moisture Content (%)	16.0	15.4	17.3

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

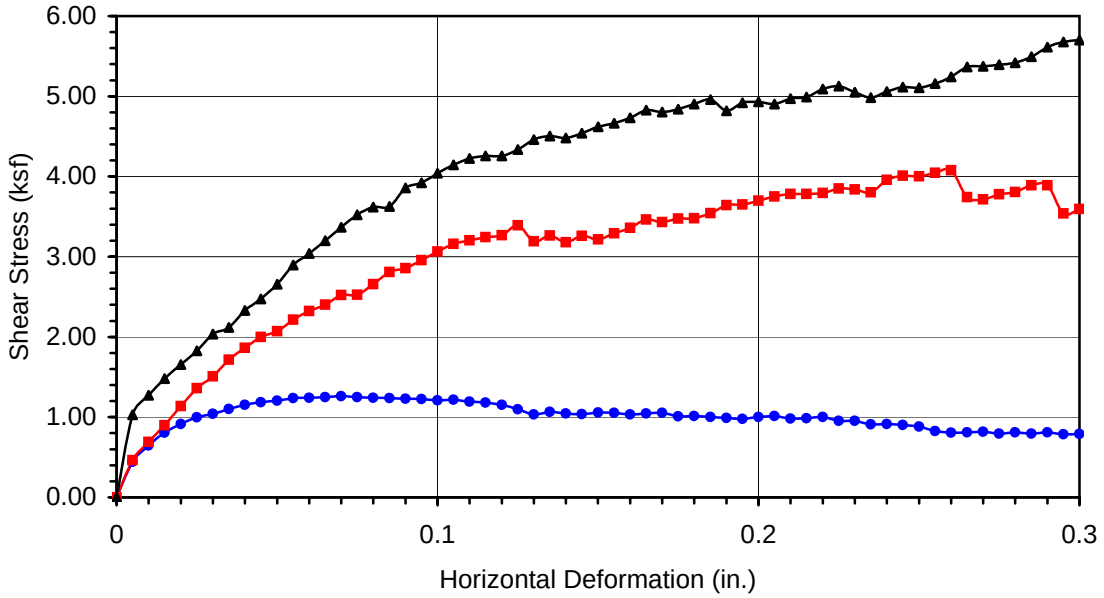
DIRECT SHEAR TEST

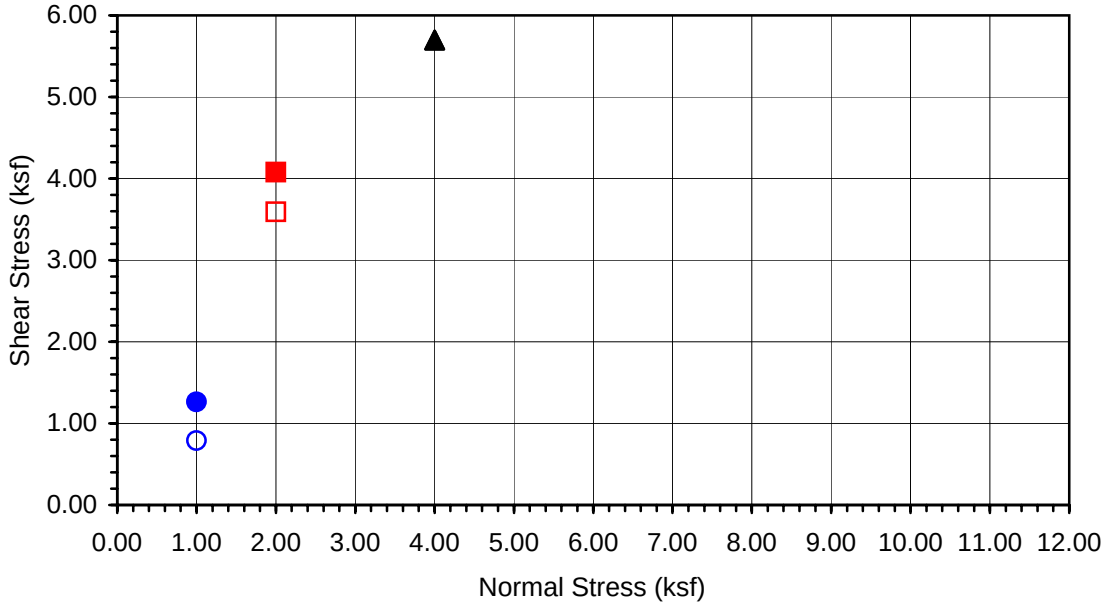
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/24/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Boring No.:	A-08-004	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Yellowish brown well-graded sand with silt and gravel (SW-SM)g

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	180.19	190.55	184.53
Weight of Ring(gm):	43.04	43.30	43.22
Before Shearing			
Weight of Wet Sample+Cont.(gm):	420.27	420.27	420.27
Weight of Dry Sample+Cont.(gm):	402.90	402.90	402.90
Weight of Container(gm):	39.83	39.83	39.83
Vertical Rdg.(in): Initial	0.0000	0.2877	0.2537
Vertical Rdg.(in): Final	-0.0157	0.3090	0.3024
After Shearing			
Weight of Wet Sample+Cont.(gm):	190.09	192.46	187.82
Weight of Dry Sample+Cont.(gm):	166.94	174.60	167.57
Weight of Container(gm):	39.36	38.89	39.01
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-004**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Yellowish brown well-graded sand with silt and gravel (SW-SM)g

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.261	■ 4.077	▲ 5.700
Shear Stress @ End of Test (ksf)	○ 0.789	□ 3.593	△ 5.700
Deformation Rate (in./min.)	0.0050	0.0050	0.0050
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	4.78	4.78	4.78
Dry Density (pcf)	108.9	116.9	112.2
Saturation (%)	23.6	29.2	25.7
Soil Height Before Shearing (in.)	0.9843	0.9787	0.9513
Final Moisture Content (%)	18.1	13.2	15.8

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

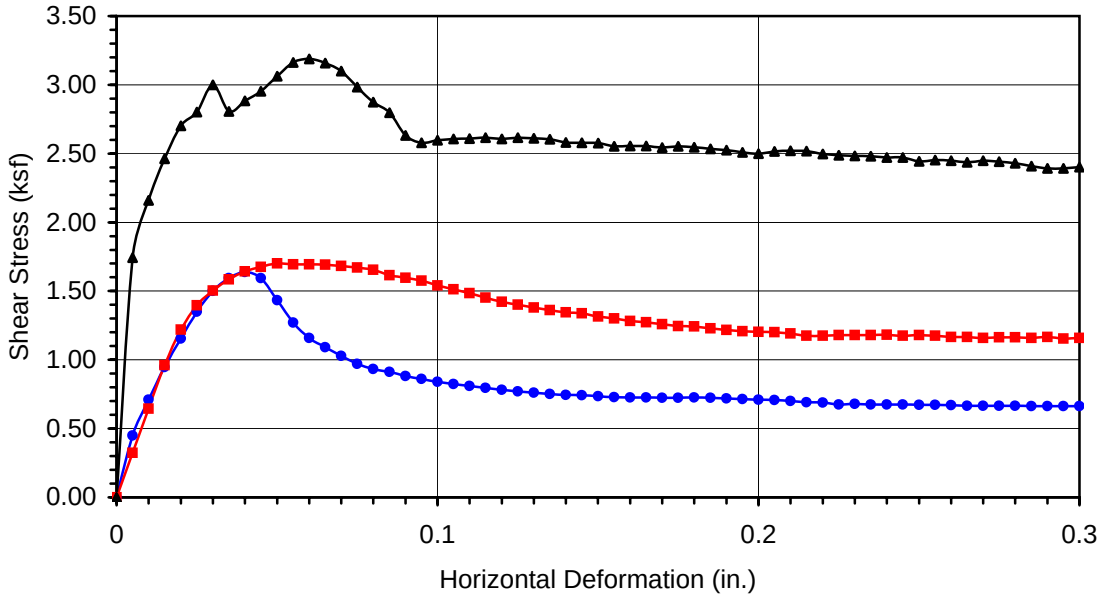
DIRECT SHEAR TEST

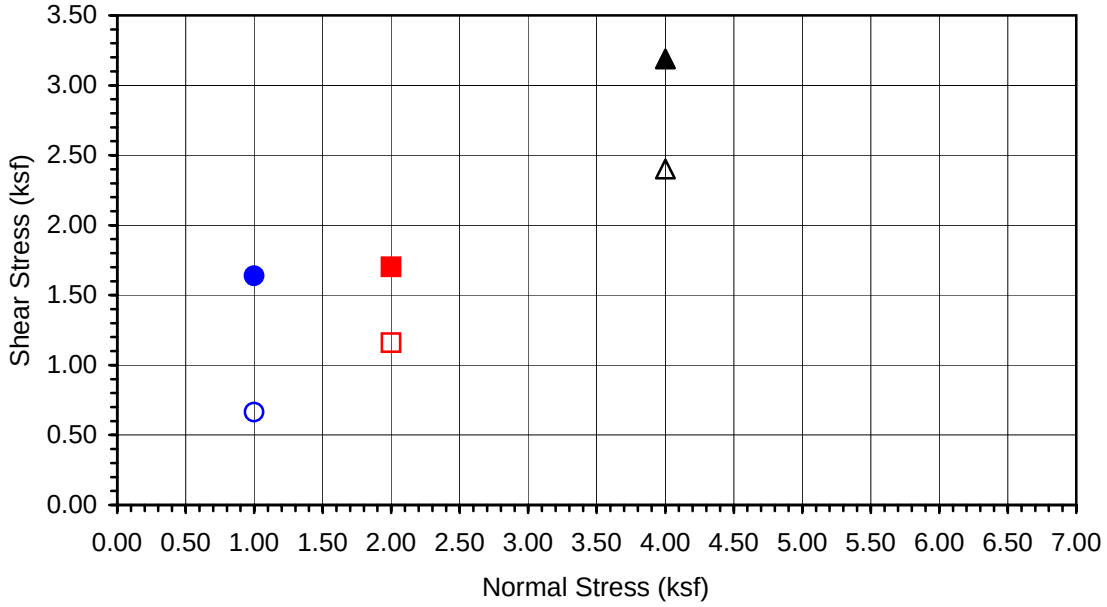
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/24/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Boring No.:	A-08-004	Sample Type:	Drive		
Sample No.:	D-5	Depth (ft.):	25.0		

Soil Identification: Yellowish brown lean clay with sand (CL)s

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	195.59	196.31	198.14
Weight of Ring(gm):	43.47	43.38	43.78
Before Shearing			
Weight of Wet Sample+Cont.(gm):	192.40	192.40	192.40
Weight of Dry Sample+Cont.(gm):	168.88	168.88	168.88
Weight of Container(gm):	39.31	39.31	39.31
Vertical Rdg.(in): Initial	0.0000	0.2476	0.2663
Vertical Rdg.(in): Final	-0.0019	0.2566	0.2928
After Shearing			
Weight of Wet Sample+Cont.(gm):	193.58	194.25	196.48
Weight of Dry Sample+Cont.(gm):	159.95	160.06	167.37
Weight of Container(gm):	38.96	38.77	39.36
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-004**
Sample No.	**D-5**
Depth (ft)	**25**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay with sand (CL)s

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.638	■ 1.701	▲ 3.188
Shear Stress @ End of Test (ksf)	○ 0.663	□ 1.160	△ 2.402
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	18.15	18.15	18.15
Dry Density (pcf)	107.1	107.6	108.7
Saturation (%)	85.4	86.6	88.9
Soil Height Before Shearing (in.)	0.9981	0.9910	0.9735
Final Moisture Content (%)	27.8	28.2	22.7

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

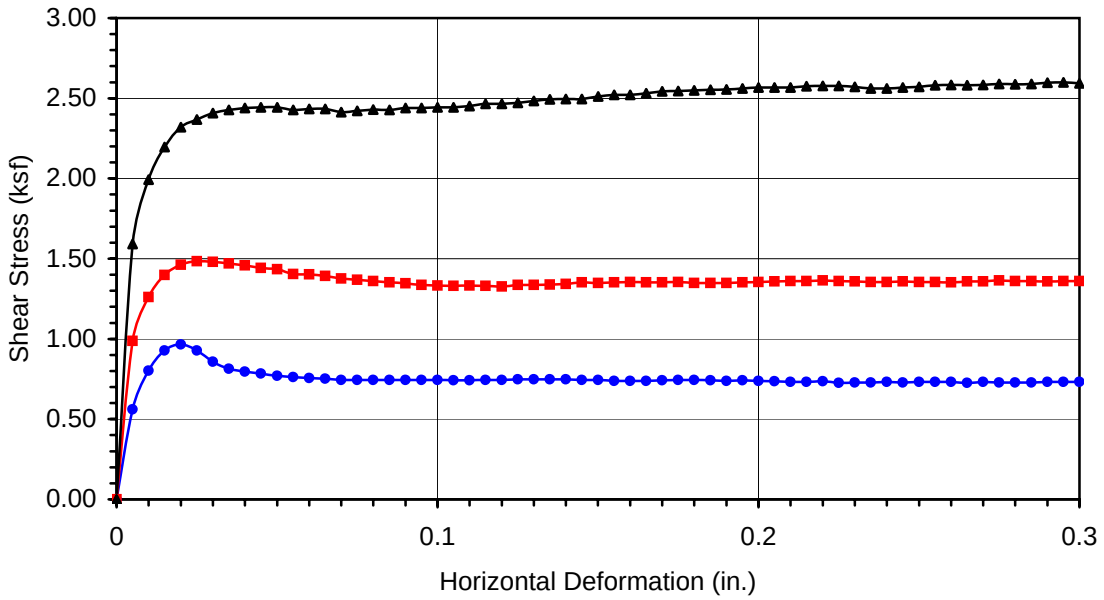
DIRECT SHEAR TEST

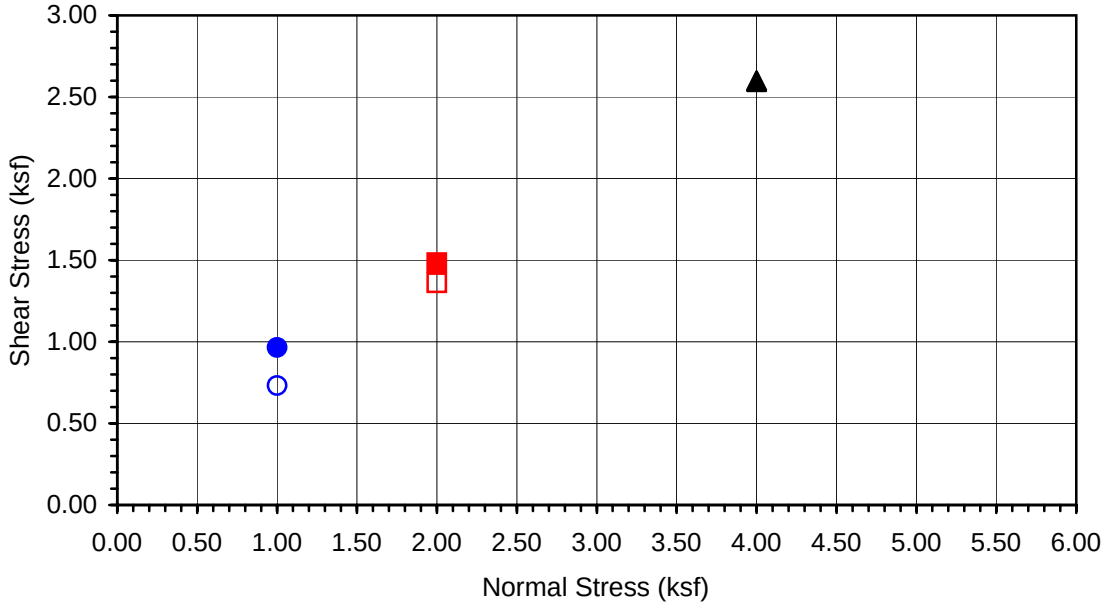
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/02/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-005	Sample Type:	Remolded to 95% Max. Dens @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	0-7		

Soil Identification: Olive yellow sandy lean clay s(CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	191.66	192.02	191.94
Weight of Ring(gm):	43.09	43.45	43.37
Before Shearing			
Weight of Wet Sample+Cont.(gm):	222.18	222.18	222.18
Weight of Dry Sample+Cont.(gm):	200.42	200.42	200.42
Weight of Container(gm):	39.23	39.23	39.23
Vertical Rdg.(in): Initial	0.0060	0.2635	0.2738
Vertical Rdg.(in): Final	0.0082	0.2662	0.2854
After Shearing			
Weight of Wet Sample+Cont.(gm):	196.29	196.07	194.15
Weight of Dry Sample+Cont.(gm):	168.40	168.96	168.03
Weight of Container(gm):	39.19	39.32	38.14
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-005**
Sample No.	**Bag-1**
Depth (ft)	**0-7**

Sample Type:
Remolded to 95% Max. Dens @ Opt. MC

Soil Identification:
Olive yellow sandy lean clay s(CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.965	■ 1.484	▲ 2.600
Shear Stress @ End of Test (ksf)	○ 0.732	□ 1.361	△ 2.594
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	13.50	13.50	13.50
Dry Density (pcf)	108.9	108.9	108.9
Saturation (%)	66.5	66.5	66.5
Soil Height Before Shearing (in.)	0.9978	0.9973	0.9884
Final Moisture Content (%)	21.6	20.9	20.1

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

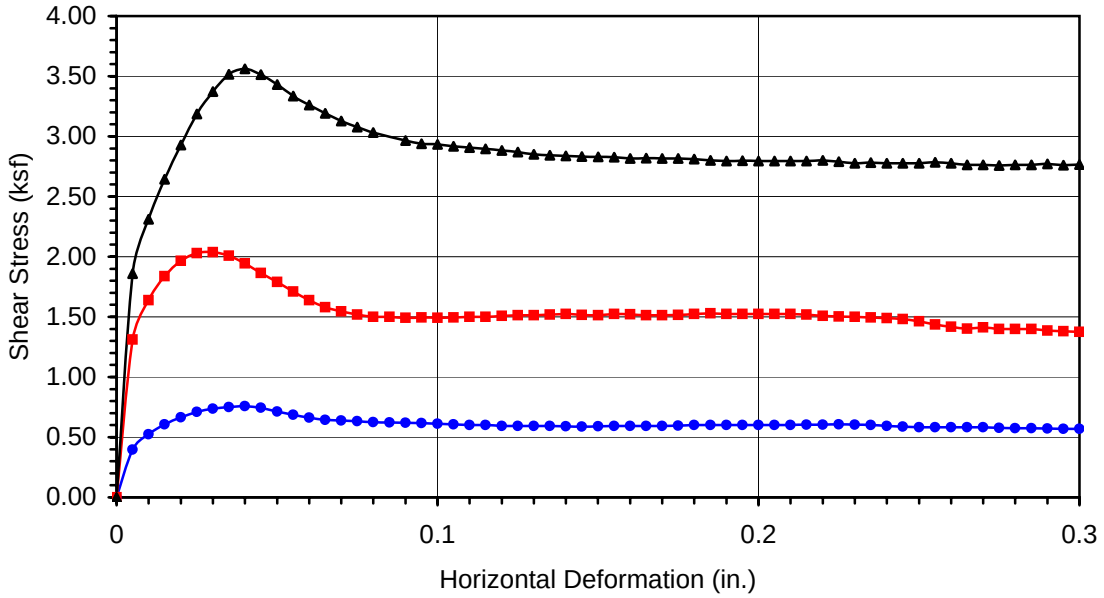
DIRECT SHEAR TEST

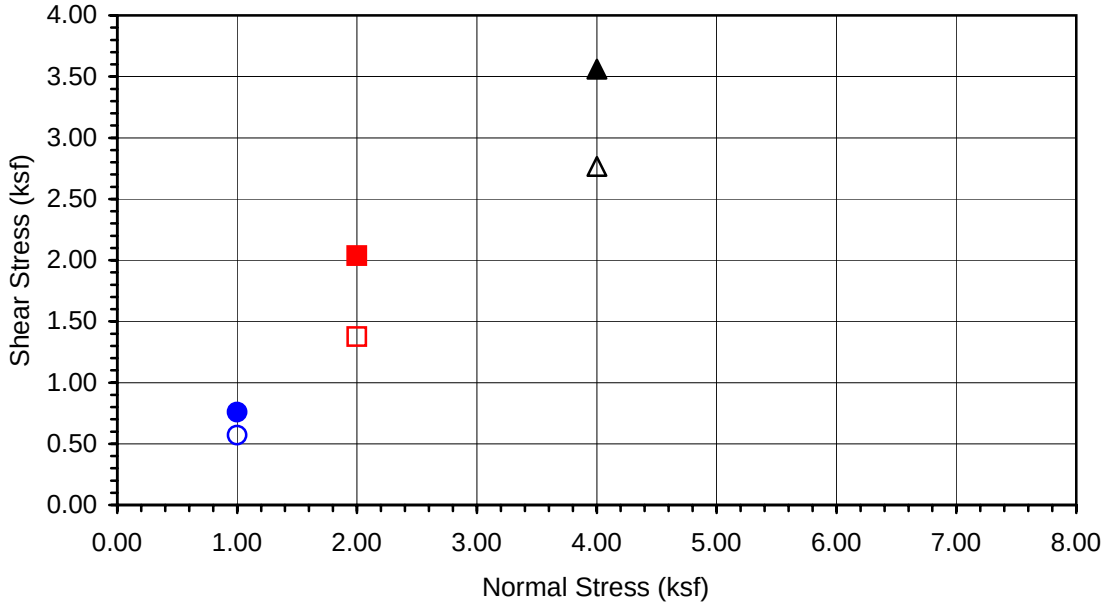
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/04/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/08/08
Boring No.:	A-08-005	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Yellowish brown sandy silt s(ML)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	180.69	184.89	188.98
Weight of Ring(gm):	43.34	43.18	43.43
Before Shearing			
Weight of Wet Sample+Cont.(gm):	157.50	157.50	157.50
Weight of Dry Sample+Cont.(gm):	148.54	148.54	148.54
Weight of Container(gm):	39.33	39.33	39.33
Vertical Rdg.(in): Initial	0.0000	0.2769	0.2715
Vertical Rdg.(in): Final	0.0054	0.2807	0.2834
After Shearing			
Weight of Wet Sample+Cont.(gm):	183.23	197.24	199.34
Weight of Dry Sample+Cont.(gm):	154.42	170.26	172.94
Weight of Container(gm):	39.16	39.31	38.67
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-005**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Yellowish brown sandy silt s(ML)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.758	■ 2.037	▲ 3.562
Shear Stress @ End of Test (ksf)	○ 0.569	□ 1.374	△ 2.767
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	8.20	8.20	8.20
Dry Density (pcf)	105.6	108.9	111.9
Saturation (%)	37.1	40.5	43.7
Soil Height Before Shearing (in.)	1.0054	0.9962	0.9881
Final Moisture Content (%)	25.0	20.6	19.7

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

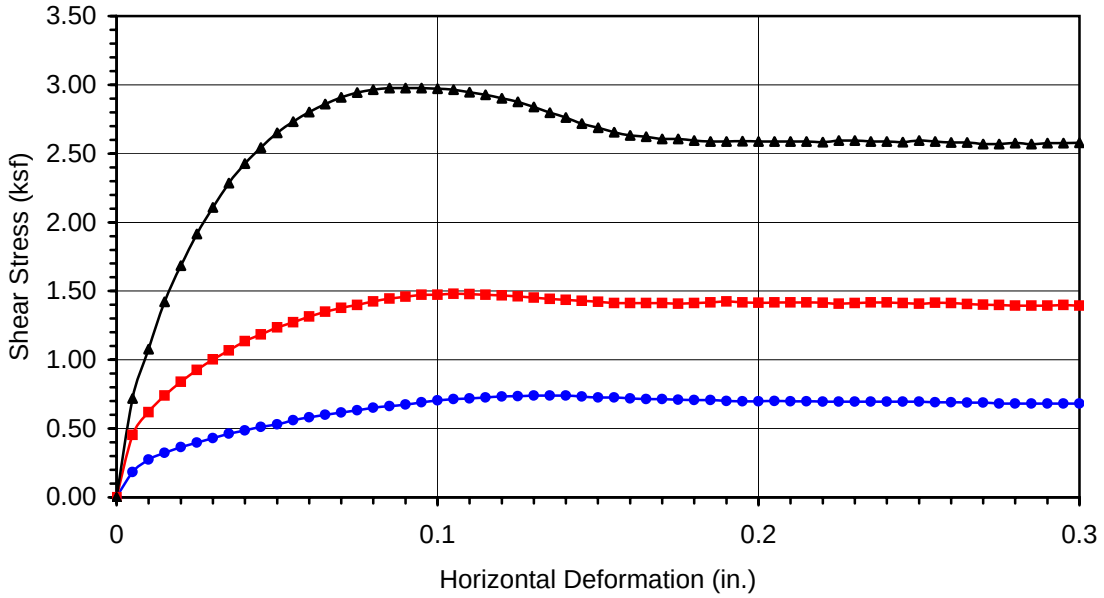
DIRECT SHEAR TEST

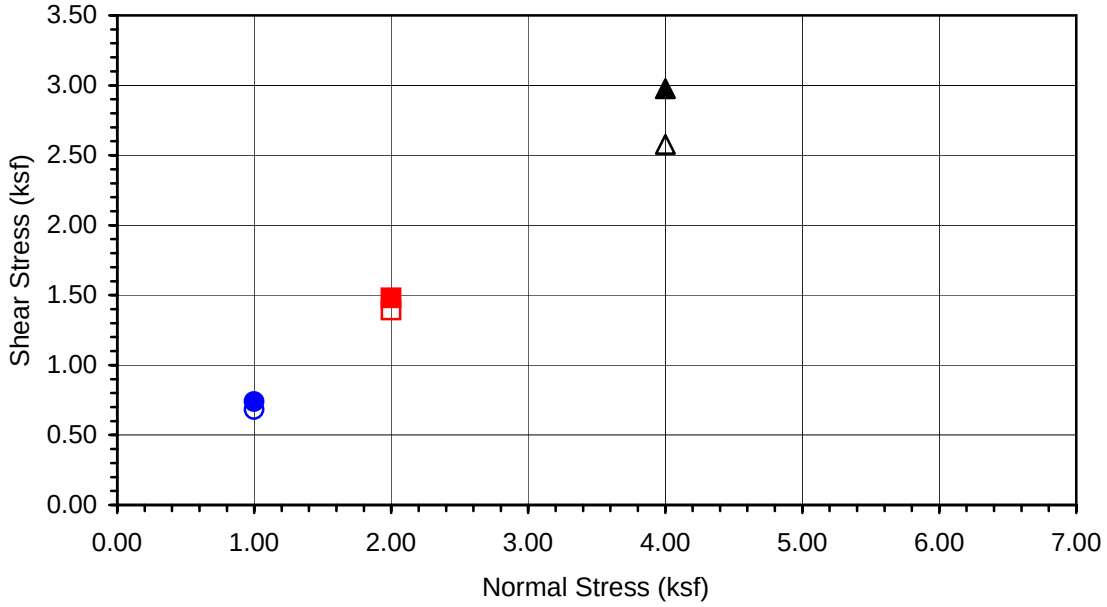
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/13/08
Boring No.:	A-08-005	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Yellowish brown silty fine sand (SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	174.80	176.39	181.66
Weight of Ring(gm):	43.36	43.50	43.59
Before Shearing			
Weight of Wet Sample+Cont.(gm):	189.73	189.73	189.73
Weight of Dry Sample+Cont.(gm):	177.61	177.61	177.61
Weight of Container(gm):	38.95	38.95	38.95
Vertical Rdg.(in): Initial	0.0000	0.2890	0.2677
Vertical Rdg.(in): Final	-0.0065	0.3032	0.2971
After Shearing			
Weight of Wet Sample+Cont.(gm):	178.49	181.56	184.40
Weight of Dry Sample+Cont.(gm):	154.91	158.16	160.76
Weight of Container(gm):	39.16	38.50	39.16
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-005**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Yellowish brown silty fine sand (SM)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.739	■ 1.481	▲ 2.977
Shear Stress @ End of Test (ksf)	○ 0.682	□ 1.393	△ 2.578
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	8.74	8.74	8.74
Dry Density (pcf)	100.5	101.6	105.6
Saturation (%)	34.9	35.8	39.6
Soil Height Before Shearing (in.)	0.9935	0.9858	0.9706
Final Moisture Content (%)	20.4	19.6	19.4

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

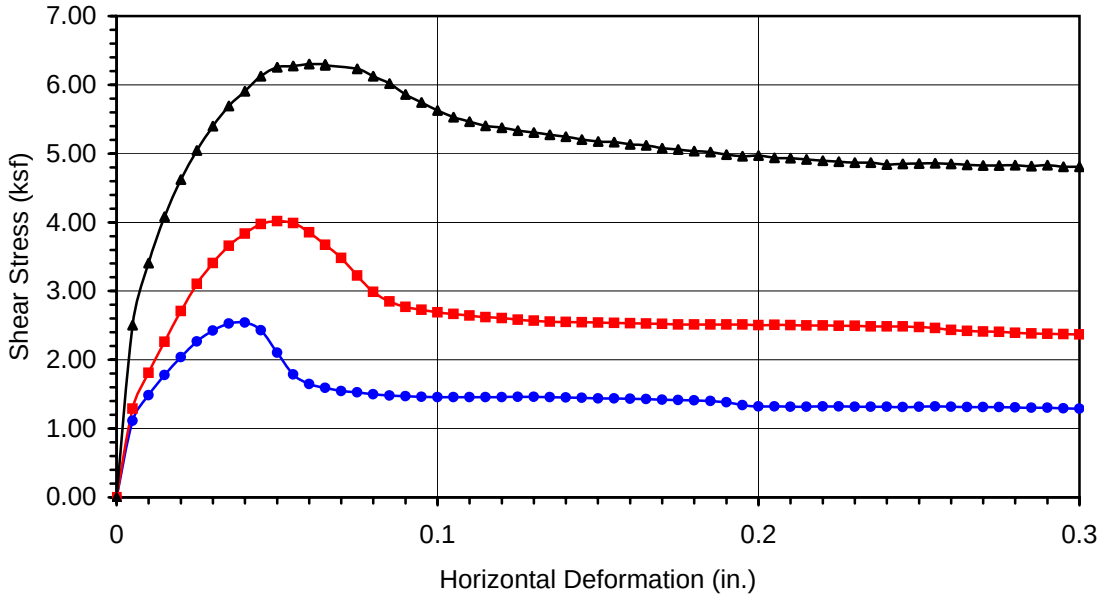
DIRECT SHEAR TEST

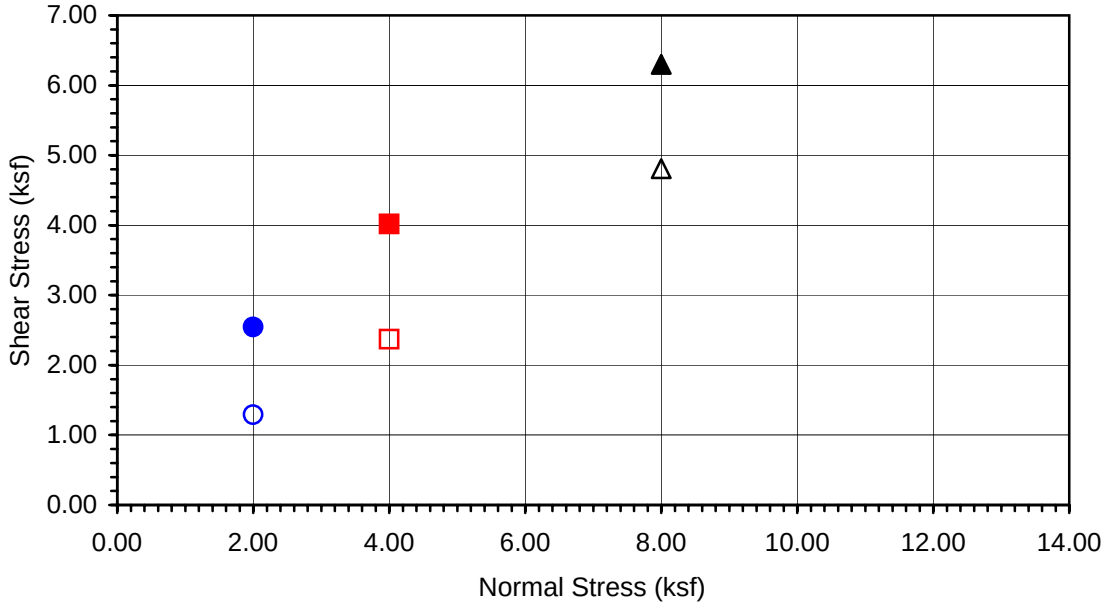
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	G. Bathala	Date:	08/06/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Boring No.:	A-08-005	Sample Type:	Drive		
Sample No.:	D-5	Depth (ft.):	25.0		

Soil Identification: Yellowish brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	203.43	205.06	206.13
Weight of Ring(gm):	43.57	43.34	43.09
Before Shearing			
Weight of Wet Sample+Cont.(gm):	216.77	216.77	216.77
Weight of Dry Sample+Cont.(gm):	191.66	191.66	191.66
Weight of Container(gm):	39.33	39.33	39.33
Vertical Rdg.(in): Initial	0.0000	0.2359	0.2416
Vertical Rdg.(in): Final	-0.0046	0.2432	0.2596
After Shearing			
Weight of Wet Sample+Cont.(gm):	201.32	201.97	202.67
Weight of Dry Sample+Cont.(gm):	174.79	175.99	178.94
Weight of Container(gm):	39.40	39.29	39.56
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-005**
Sample No.	**D-5**
Depth (ft)	**25**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay (CL)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 2.543	■ 4.015	▲ 6.300
Shear Stress @ End of Test (ksf)	○ 1.289	□ 2.370	△ 4.807
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.48	16.48	16.48
Dry Density (pcf)	114.1	115.5	116.4
Saturation (%)	93.3	96.8	99.3
Soil Height Before Shearing (in.)	0.9954	0.9927	0.9820
Final Moisture Content (%)	19.6	19.0	17.0

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

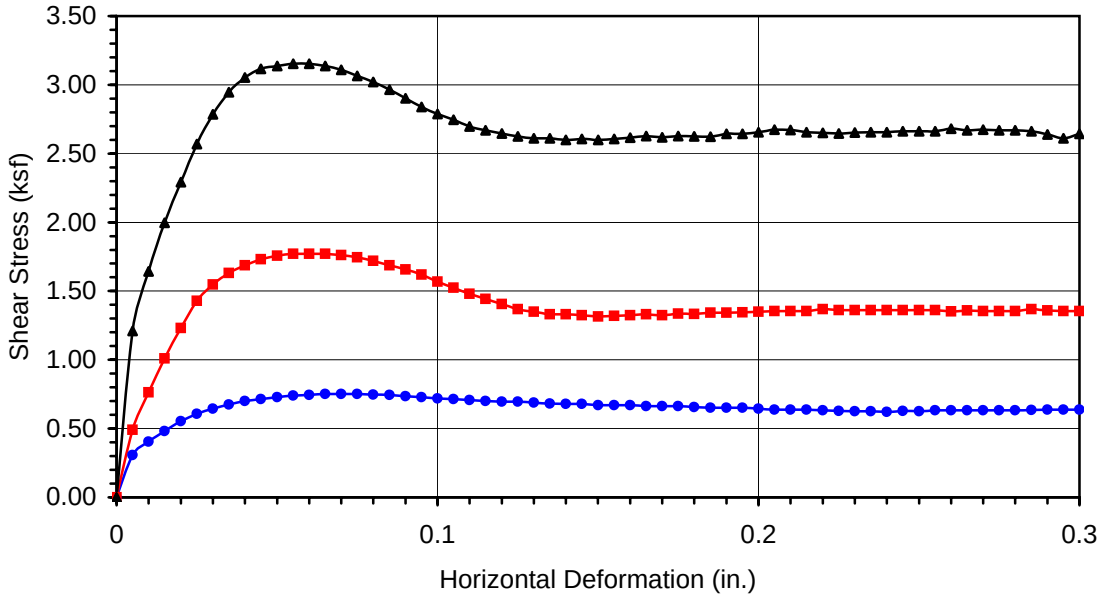
DIRECT SHEAR TEST

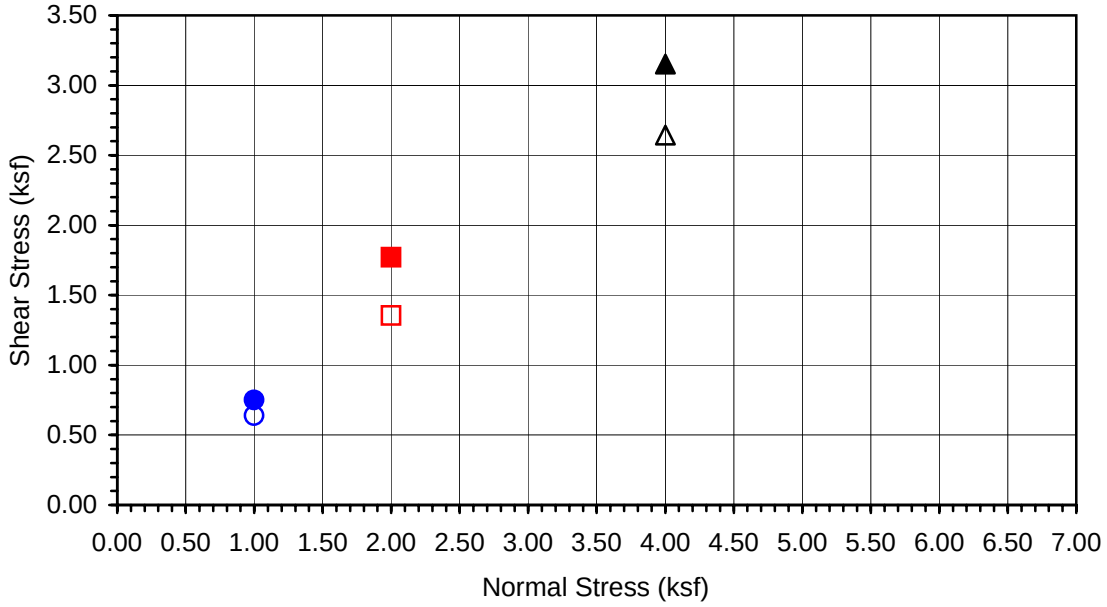
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Boring No.:	A-08-007	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Yellowish brown silty fine sand (SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	163.62	168.54	166.68
Weight of Ring(gm):	43.28	43.21	43.05
Before Shearing			
Weight of Wet Sample+Cont.(gm):	213.30	213.30	213.30
Weight of Dry Sample+Cont.(gm):	207.96	207.96	207.96
Weight of Container(gm):	38.92	38.92	38.92
Vertical Rdg.(in): Initial	0.2624	0.2762	0.0000
Vertical Rdg.(in): Final	0.2679	0.2890	-0.0177
After Shearing			
Weight of Wet Sample+Cont.(gm):	176.29	182.99	184.44
Weight of Dry Sample+Cont.(gm):	149.18	155.35	156.01
Weight of Container(gm):	39.12	38.92	39.23
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-007**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Yellowish brown silty fine sand (SM)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.751	■ 1.770	▲ 3.153
Shear Stress @ End of Test (ksf)	○ 0.638	□ 1.355	△ 2.644
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	3.16	3.16	3.16
Dry Density (pcf)	97.0	101.0	99.7
Saturation (%)	11.6	12.8	12.3
Soil Height Before Shearing (in.)	0.9945	0.9872	0.9823
Final Moisture Content (%)	24.6	23.7	24.3

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

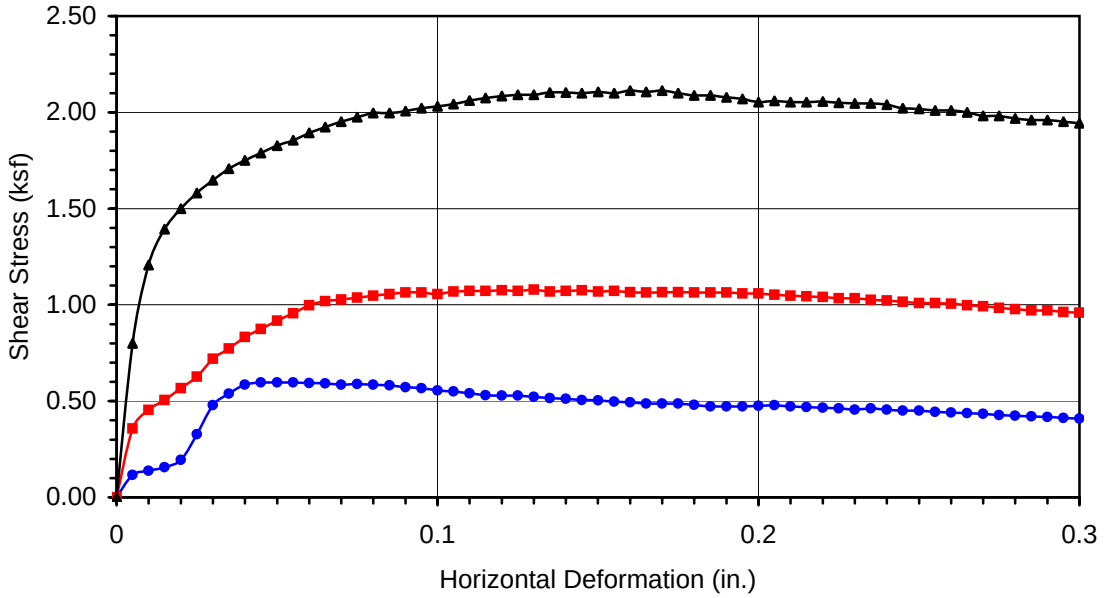
DIRECT SHEAR TEST

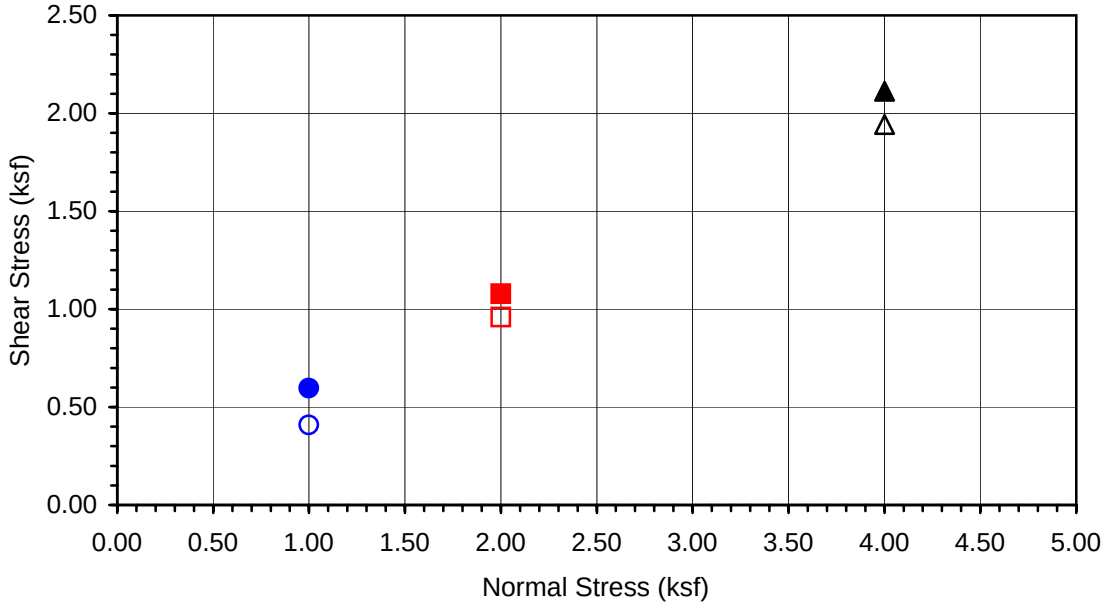
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/21/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/27/08
Boring No.:	A-08-008	Sample Type:	Remolded to 95% Max. Dens @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	0-7		

Soil Identification: Yellowish brown lean clay with sand (CL)s

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	189.78	189.35	190.78
Weight of Ring(gm):	43.16	42.73	44.16
Before Shearing			
Weight of Wet Sample+Cont.(gm):	311.11	311.11	311.11
Weight of Dry Sample+Cont.(gm):	278.73	278.73	278.73
Weight of Container(gm):	38.84	38.84	38.84
Vertical Rdg.(in): Initial	0.0000	0.2617	0.2539
Vertical Rdg.(in): Final	0.0399	0.2398	0.2509
After Shearing			
Weight of Wet Sample+Cont.(gm):	199.77	199.76	212.11
Weight of Dry Sample+Cont.(gm):	167.39	168.37	182.82
Weight of Container(gm):	39.21	39.36	54.32
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-008**
Sample No.	**Bag-1**
Depth (ft)	**0-7**

Sample Type:
Remolded to 95% Max. Dens @ Opt. MC

Soil Identification:
Yellowish brown lean clay with sand (CL)s

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.597	■ 1.078	▲ 2.113
Shear Stress @ End of Test (ksf)	○ 0.409	□ 0.959	△ 1.943
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	13.50	13.50	13.50
Dry Density (pcf)	107.4	107.4	107.4
Saturation (%)	64.1	64.1	64.1
Soil Height Before Shearing (in.)	1.0399	1.0219	1.0030
Final Moisture Content (%)	25.3	24.3	22.8

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

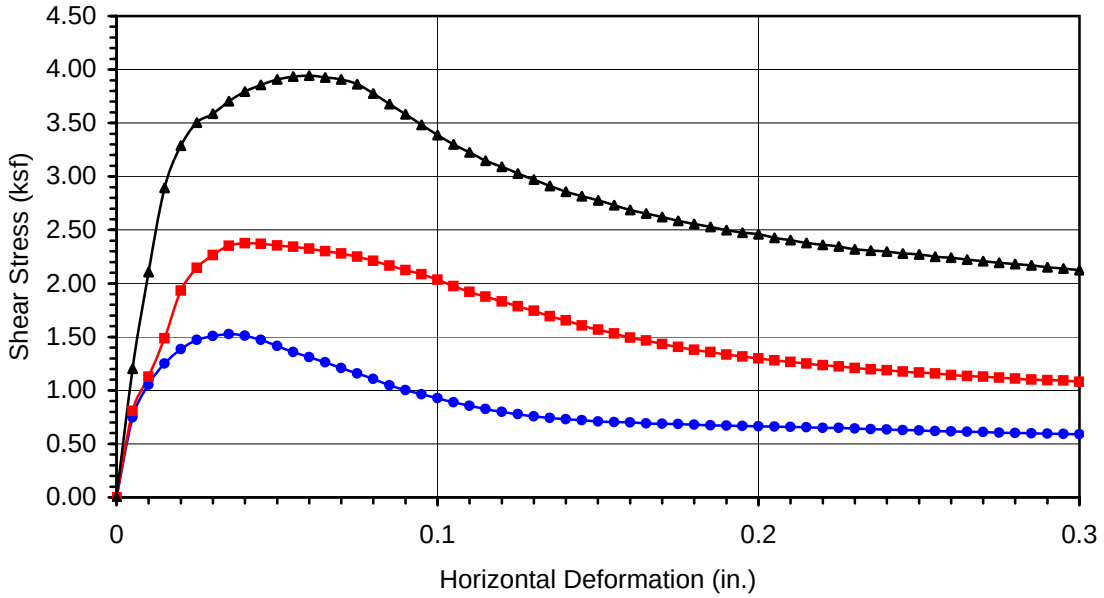
DIRECT SHEAR TEST

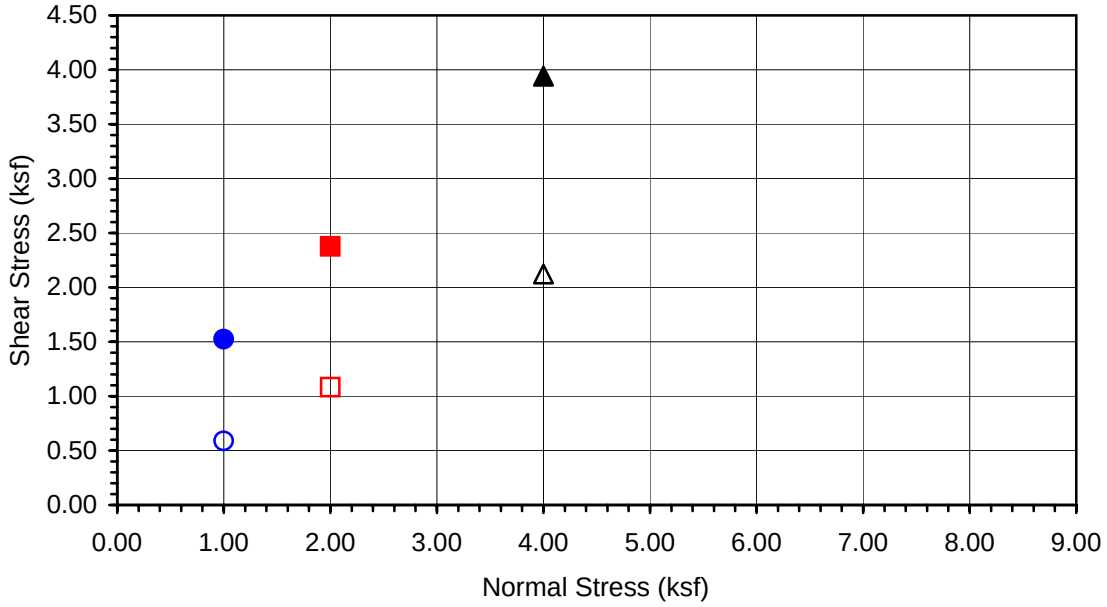
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/24/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Boring No.:	A-08-008	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	202.95	203.71	204.24
Weight of Ring(gm):	43.56	43.23	43.59
Before Shearing			
Weight of Wet Sample+Cont.(gm):	180.47	180.47	180.47
Weight of Dry Sample+Cont.(gm):	155.09	155.09	155.09
Weight of Container(gm):	39.50	39.50	39.50
Vertical Rdg.(in): Initial	0.0000	0.2386	0.2362
Vertical Rdg.(in): Final	0.0137	0.2288	0.2421
After Shearing			
Weight of Wet Sample+Cont.(gm):	203.22	203.77	202.39
Weight of Dry Sample+Cont.(gm):	168.36	168.81	168.88
Weight of Container(gm):	39.09	39.16	39.19
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-008**
Sample No.	**D-1**
Depth (ft)	**5**
Sample Type: Drive	
Soil Identification: Brown lean clay (CL)	

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.525	■ 2.377	▲ 3.942
Shear Stress @ End of Test (ksf)	○ 0.588	□ 1.081	△ 2.125
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	21.96	21.96	21.96
Dry Density (pcf)	108.7	109.4	109.6
Saturation (%)	107.6	109.7	110.1
Soil Height Before Shearing (in.)	1.0137	1.0098	0.9941
Final Moisture Content (%)	27.0	27.0	25.8

Leighton

DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

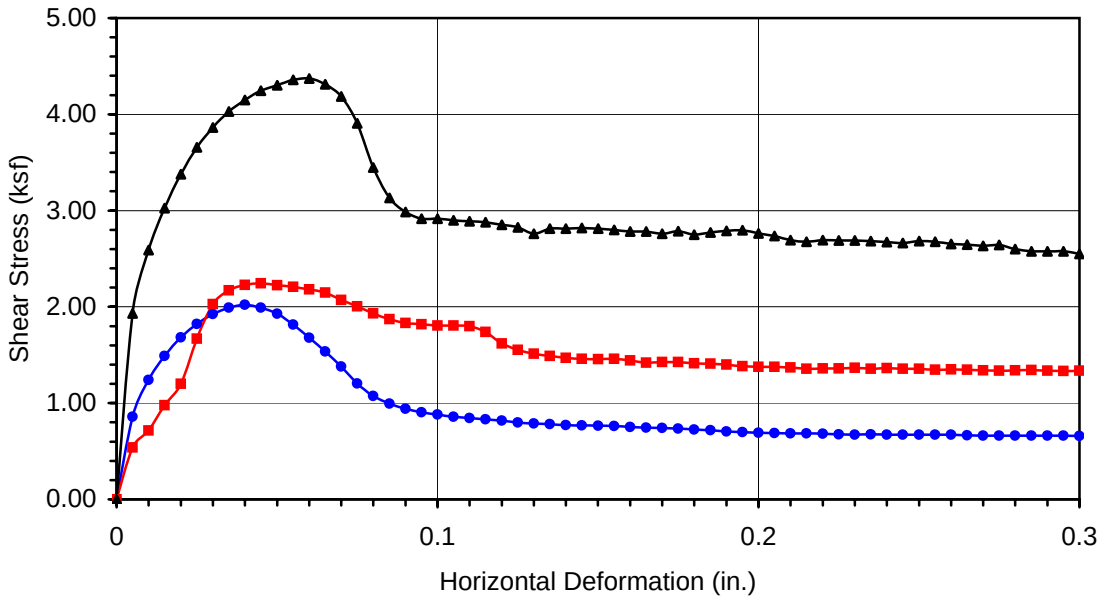
DIRECT SHEAR TEST

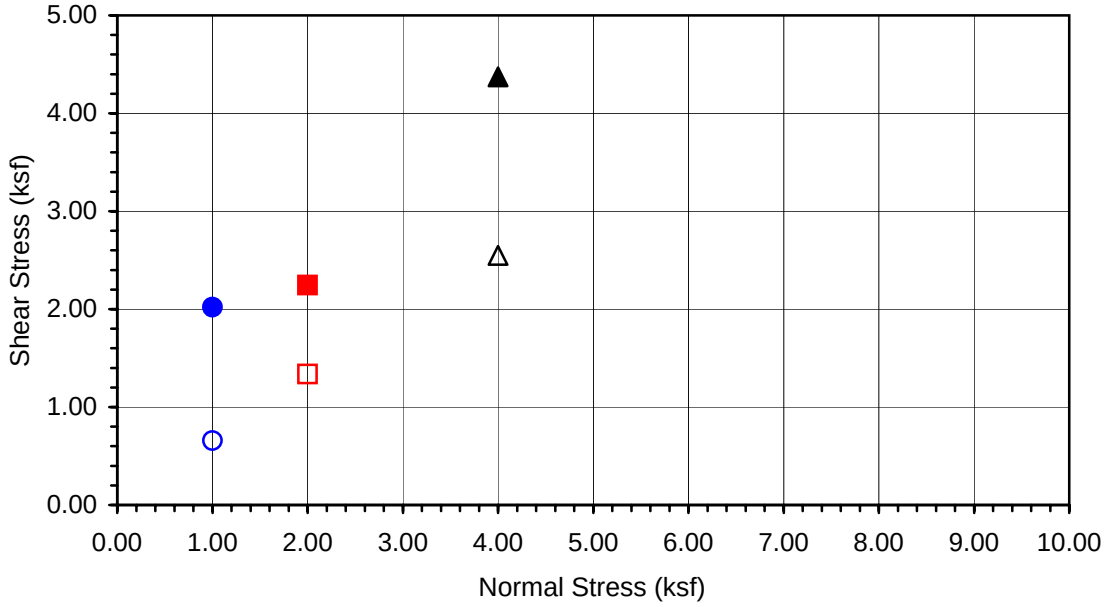
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/28/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/31/08
Boring No.:	A-08-008	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Yellowish brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	209.22	209.50	211.80
Weight of Ring(gm):	43.24	43.40	43.44
Before Shearing			
Weight of Wet Sample+Cont.(gm):	207.17	207.17	207.17
Weight of Dry Sample+Cont.(gm):	186.42	186.42	186.42
Weight of Container(gm):	39.10	39.10	39.10
Vertical Rdg.(in): Initial	0.0000	0.2491	0.2815
Vertical Rdg.(in): Final	0.0043	0.2497	0.2892
After Shearing			
Weight of Wet Sample+Cont.(gm):	208.22	207.90	208.00
Weight of Dry Sample+Cont.(gm):	183.38	183.34	183.87
Weight of Container(gm):	38.79	38.80	38.32
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-008**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay (CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 2.021	■ 2.245	▲ 4.373
Shear Stress @ End of Test (ksf)	○ 0.657	□ 1.336	△ 2.550
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	14.08	14.08	14.08
Dry Density (pcf)	121.0	121.1	122.7
Saturation (%)	96.7	97.0	101.8
Soil Height Before Shearing (in.)	1.0043	0.9994	0.9923
Final Moisture Content (%)	17.2	17.0	16.6

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

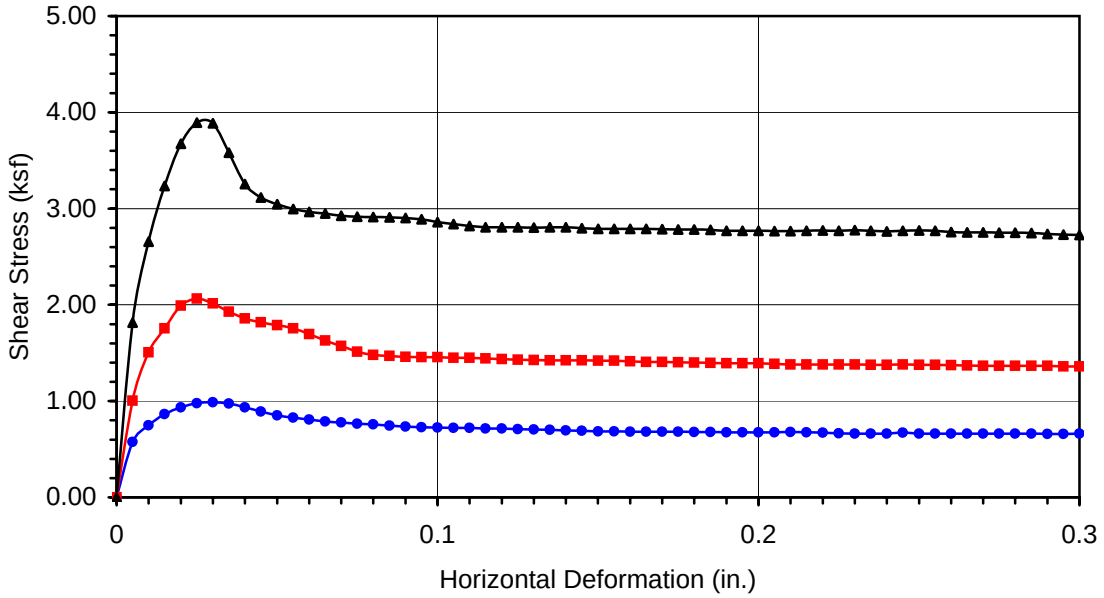
DIRECT SHEAR TEST

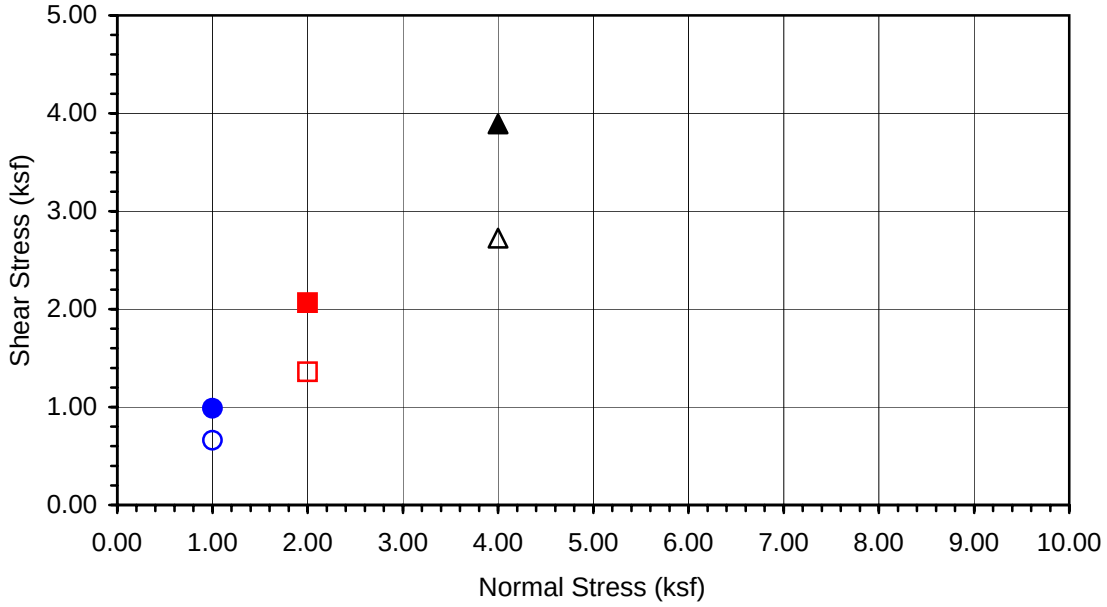
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	G. Bathala	Date:	08/07/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Boring No.:	A-08-009	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Yellowish brown silty, clayey sand (SC-SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	180.44	187.96	193.20
Weight of Ring(gm):	43.34	43.31	43.66
Before Shearing			
Weight of Wet Sample+Cont.(gm):	155.98	155.98	155.98
Weight of Dry Sample+Cont.(gm):	148.34	148.34	148.34
Weight of Container(gm):	39.15	39.15	39.15
Vertical Rdg.(in): Initial	0.0000	0.2854	0.2759
Vertical Rdg.(in): Final	-0.0035	0.2902	0.2852
After Shearing			
Weight of Wet Sample+Cont.(gm):	190.48	199.04	201.03
Weight of Dry Sample+Cont.(gm):	165.03	172.06	176.92
Weight of Container(gm):	39.45	39.85	39.00
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-009**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Yellowish brown silty, clayey sand (SC-SM)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.987	■ 2.065	▲ 3.892
Shear Stress @ End of Test (ksf)	○ 0.660	□ 1.361	△ 2.726
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	7.00	7.00	7.00
Dry Density (pcf)	106.6	112.4	116.2
Saturation (%)	32.5	37.8	42.0
Soil Height Before Shearing (in.)	0.9965	0.9952	0.9907
Final Moisture Content (%)	20.3	20.4	17.5

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

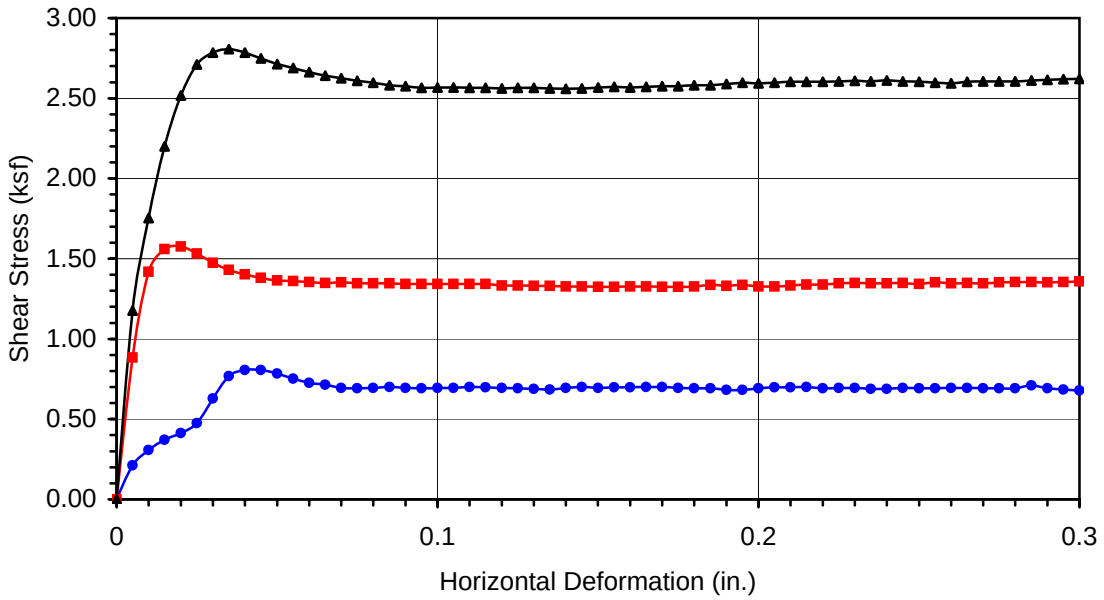
DIRECT SHEAR TEST

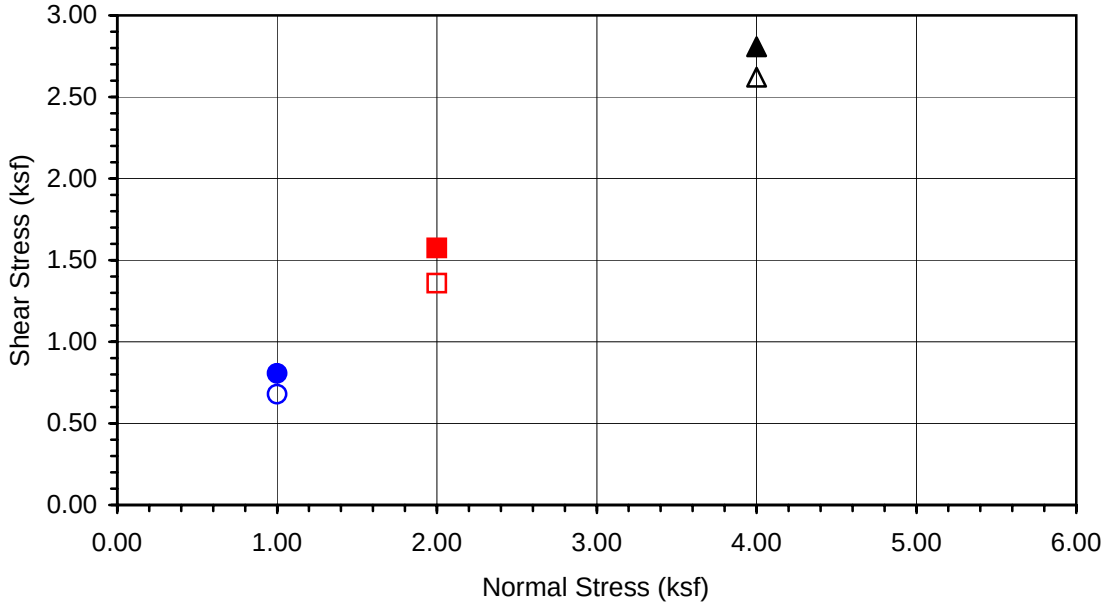
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/07/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Boring No.:	A-08-010	Sample Type:	Remolded to 95% Max. Dens. @ Opt. MC		
Sample No.:	BAG-1	Depth (ft.):	0-7		

Soil Identification: Yellowish brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	198.02	197.88	197.95
Weight of Ring(gm):	43.27	43.13	43.20
Before Shearing			
Weight of Wet Sample+Cont.(gm):	241.33	241.33	241.33
Weight of Dry Sample+Cont.(gm):	222.10	222.10	222.10
Weight of Container(gm):	38.94	38.94	38.94
Vertical Rdg.(in): Initial	0.0000	0.2676	0.2654
Vertical Rdg.(in): Final	0.0054	0.2693	0.2727
After Shearing			
Weight of Wet Sample+Cont.(gm):	200.50	199.87	200.53
Weight of Dry Sample+Cont.(gm):	176.93	176.45	177.49
Weight of Container(gm):	38.87	38.35	39.49
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-010**
Sample No.	**BAG-1**
Depth (ft)	**0-7**

Sample Type:
Remolded to 95% Max. Dens. @ Opt. MC

Soil Identification:
Yellowish brown clayey sand (SC)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.805	■ 1.575	▲ 2.807
Shear Stress @ End of Test (ksf)	○ 0.679	□ 1.358	△ 2.622
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	10.50	10.50	10.50
Dry Density (pcf)	116.5	116.5	116.5
Saturation (%)	63.4	63.4	63.4
Soil Height Before Shearing (in.)	1.0054	0.9983	0.9927
Final Moisture Content (%)	17.1	17.0	16.7

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/24/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Boring No.:	A-08-010	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Yellowish brown lean clay (CL)

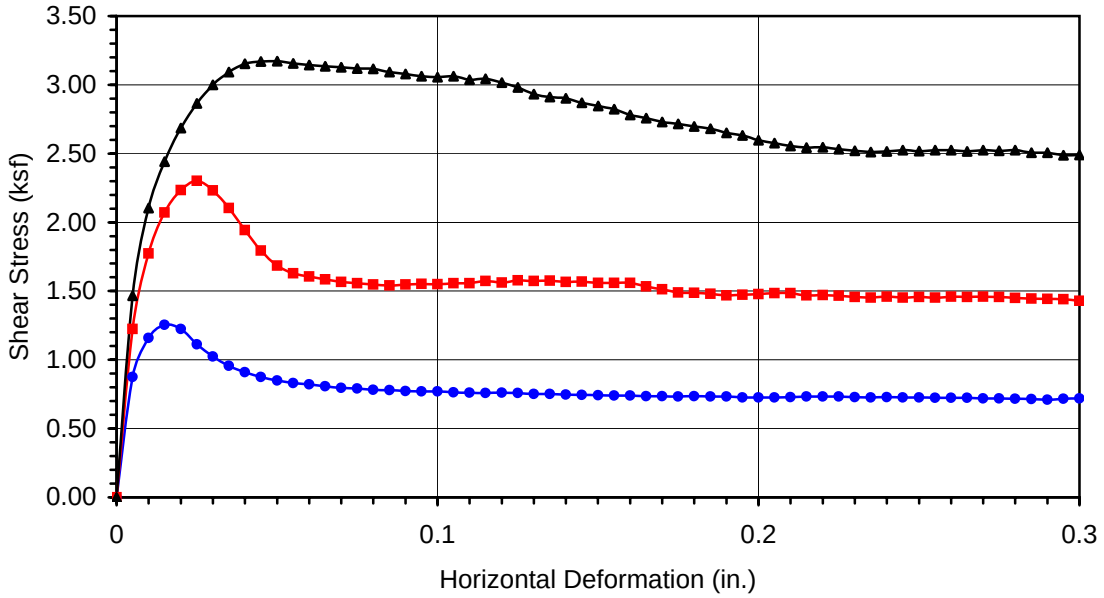
Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	207.91	212.55	214.58
Weight of Ring(gm):	43.32	43.26	43.14

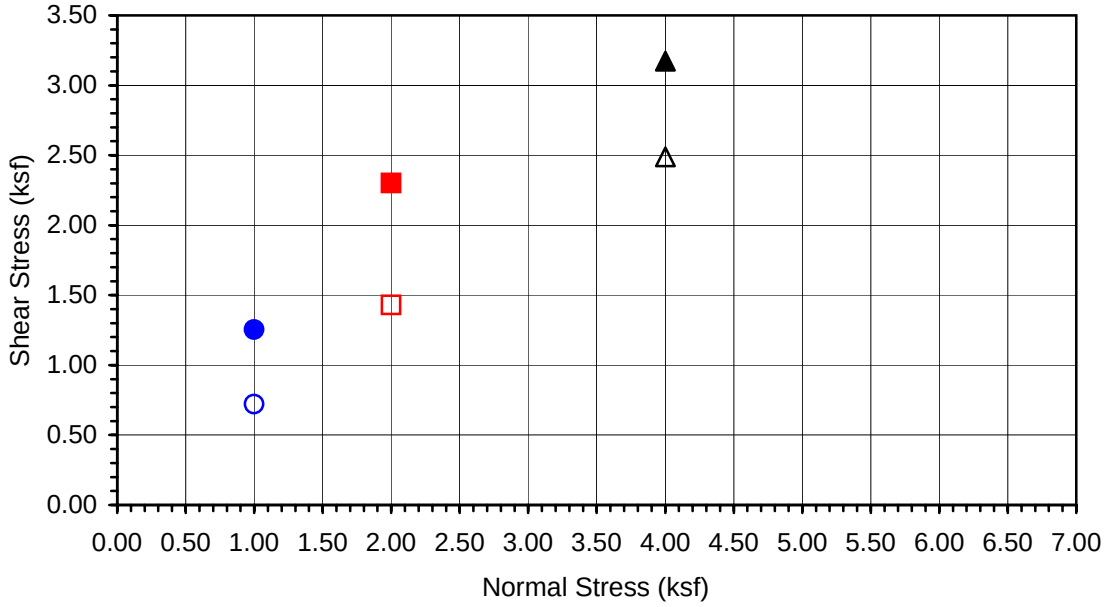
Before Shearing

Weight of Wet Sample+Cont.(gm):	175.10	175.10	175.10
Weight of Dry Sample+Cont.(gm):	160.00	160.00	160.00
Weight of Container(gm):	38.27	38.27	38.27
Vertical Rdg.(in): Initial	0.0000	0.2663	0.2663
Vertical Rdg.(in): Final	-0.0005	0.2721	0.2764

After Shearing

Weight of Wet Sample+Cont.(gm):	208.69	213.29	214.50
Weight of Dry Sample+Cont.(gm):	184.52	189.02	191.02
Weight of Container(gm):	38.40	39.44	39.71
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-010**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay (CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.254	■ 2.301	▲ 3.172
Shear Stress @ End of Test (ksf)	○ 0.720	□ 1.430	△ 2.490
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.40	12.40	12.40
Dry Density (pcf)	121.8	125.3	126.8
Saturation (%)	87.2	96.9	101.8
Soil Height Before Shearing (in.)	0.9995	0.9942	0.9899
Final Moisture Content (%)	16.5	16.2	15.5

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

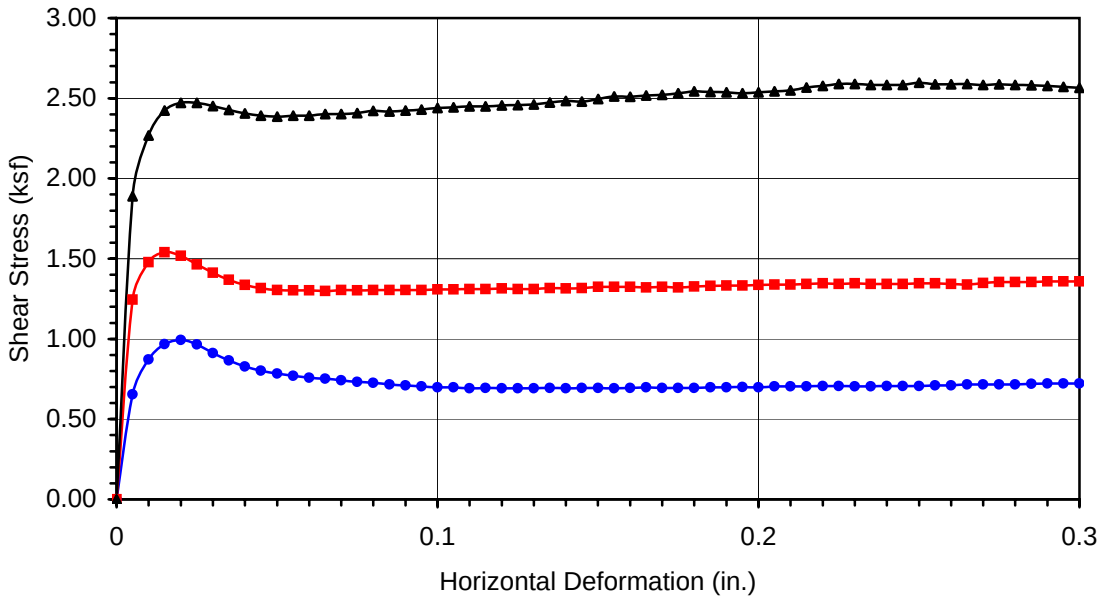
DIRECT SHEAR TEST

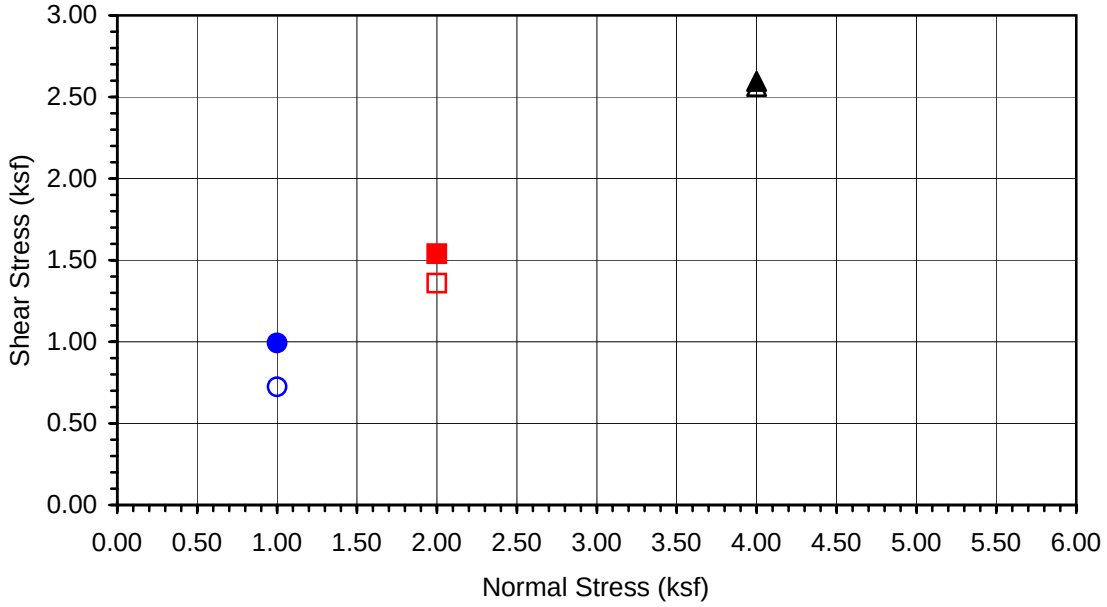
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/02/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-011	Sample Type:	Remolded to 95% Max. Dens @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	0-7		

Soil Identification: Yellowish brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	195.63	195.59	196.25
Weight of Ring(gm):	42.84	42.80	43.46
Before Shearing			
Weight of Wet Sample+Cont.(gm):	206.06	206.06	206.06
Weight of Dry Sample+Cont.(gm):	190.86	190.86	190.86
Weight of Container(gm):	38.89	38.89	38.89
Vertical Rdg.(in): Initial	0.0000	0.2888	0.2716
Vertical Rdg.(in): Final	0.0007	0.2922	0.2800
After Shearing			
Weight of Wet Sample+Cont.(gm):	197.30	198.56	198.60
Weight of Dry Sample+Cont.(gm):	174.65	176.38	176.50
Weight of Container(gm):	38.44	39.09	39.00
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-011**
Sample No.	**Bag-1**
Depth (ft)	**0-7**

Sample Type:
Remolded to 95% Max. Dens @ Opt. MC

Soil Identification:
Yellowish brown clayey sand (SC)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.993	■ 1.540	▲ 2.597
Shear Stress @ End of Test (ksf)	○ 0.723	□ 1.358	△ 2.565
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	10.00	10.00	10.00
Dry Density (pcf)	115.5	115.5	115.5
Saturation (%)	58.8	58.8	58.8
Soil Height Before Shearing (in.)	1.0007	0.9966	0.9916
Final Moisture Content (%)	16.6	16.2	16.1

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

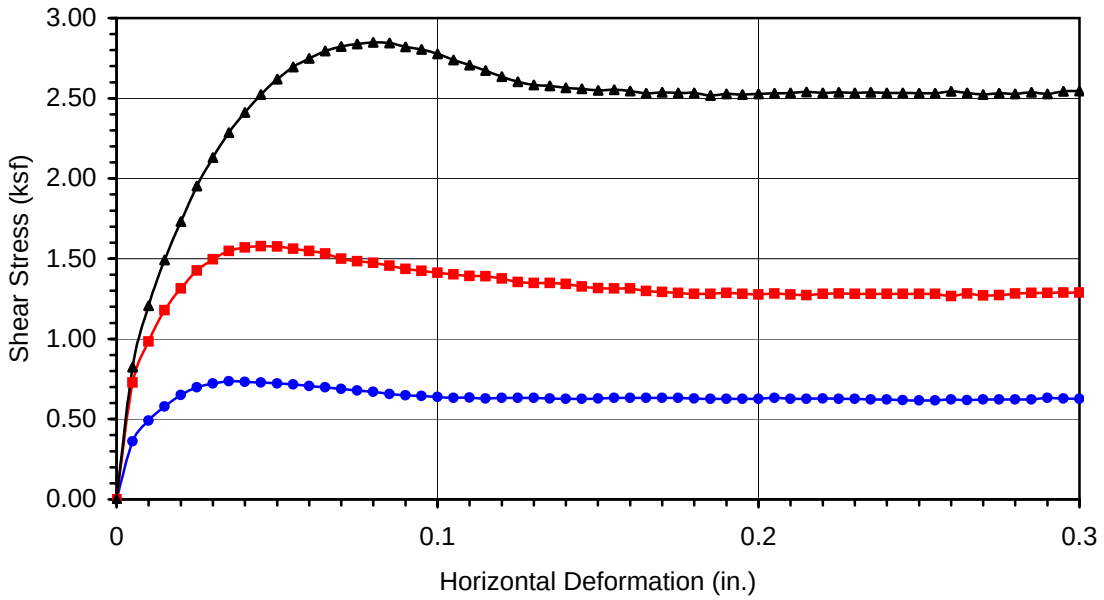
DIRECT SHEAR TEST

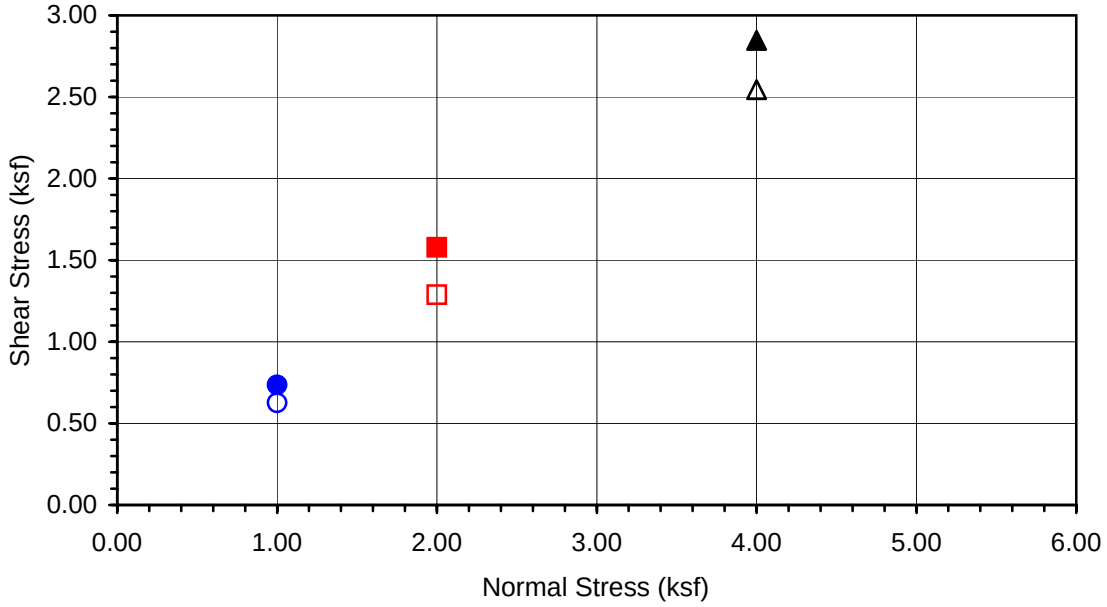
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/05/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/15/08
Boring No.:	A-08-011	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Yellowish brown silty sand (SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	182.31	184.73	187.25
Weight of Ring(gm):	43.20	43.01	43.02
Before Shearing			
Weight of Wet Sample+Cont.(gm):	173.51	173.51	173.51
Weight of Dry Sample+Cont.(gm):	163.90	163.90	163.90
Weight of Container(gm):	39.32	39.32	39.32
Vertical Rdg.(in): Initial	0.0000	0.2585	0.2539
Vertical Rdg.(in): Final	-0.0054	0.2704	0.2749
After Shearing			
Weight of Wet Sample+Cont.(gm):	190.28	191.87	194.37
Weight of Dry Sample+Cont.(gm):	166.86	169.07	172.33
Weight of Container(gm):	38.92	38.93	39.25
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-011**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Yellowish brown silty sand (SM)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.736	■ 1.578	▲ 2.848
Shear Stress @ End of Test (ksf)	○ 0.626	□ 1.289	△ 2.546
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	7.71	7.71	7.71
Dry Density (pcf)	107.4	109.4	111.4
Saturation (%)	36.6	38.5	40.5
Soil Height Before Shearing (in.)	0.9946	0.9881	0.9790
Final Moisture Content (%)	18.3	17.5	16.6

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

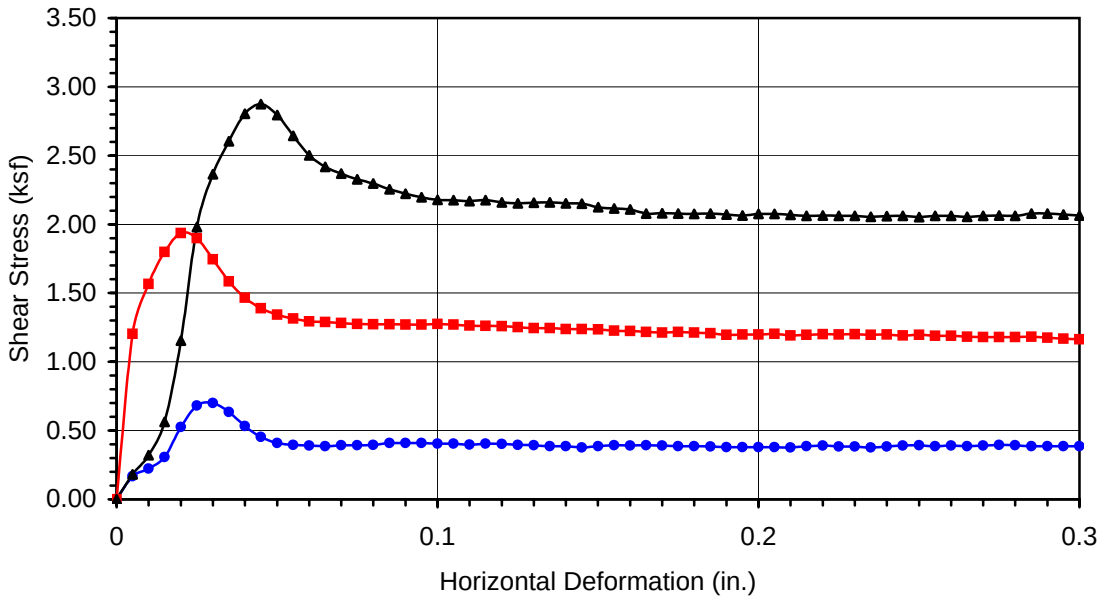
DIRECT SHEAR TEST

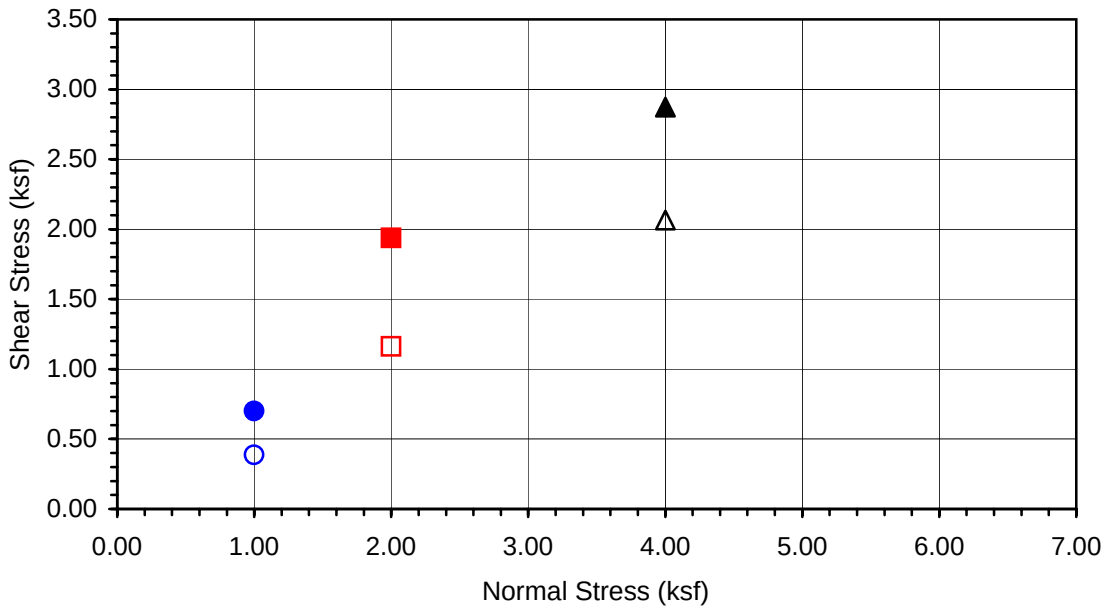
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	G. Bathala	Date:	08/13/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/15/08
Boring No.:	A-08-011	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Yellowish brown silty, clayey sand (SC-SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	202.62	203.39	204.42
Weight of Ring(gm):	43.47	43.09	43.22
Before Shearing			
Weight of Wet Sample+Cont.(gm):	338.98	338.98	338.98
Weight of Dry Sample+Cont.(gm):	311.89	311.89	311.89
Weight of Container(gm):	38.88	38.88	38.88
Vertical Rdg.(in): Initial	0.0000	0.2619	0.2447
Vertical Rdg.(in): Final	-0.0009	0.2670	0.2537
After Shearing			
Weight of Wet Sample+Cont.(gm):	204.92	204.85	205.41
Weight of Dry Sample+Cont.(gm):	184.16	184.20	184.38
Weight of Container(gm):	39.98	39.17	39.28
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-011**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Yellowish brown silty, clayey sand (SC-SM)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.701	■ 1.937	▲ 2.873
Shear Stress @ End of Test (ksf)	○ 0.387	□ 1.163	△ 2.065
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.92	9.92	9.92
Dry Density (pcf)	120.4	121.3	122.0
Saturation (%)	67.0	68.7	70.1
Soil Height Before Shearing (in.)	0.9991	0.9949	0.9910
Final Moisture Content (%)	14.4	14.2	14.5

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/22/08
Project No.:	370900.02.GE.0S	Checked By:	J. Ward	Date:	09/26/08
Boring No.:	A-08-012	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Grayish brown lean clay (CL)

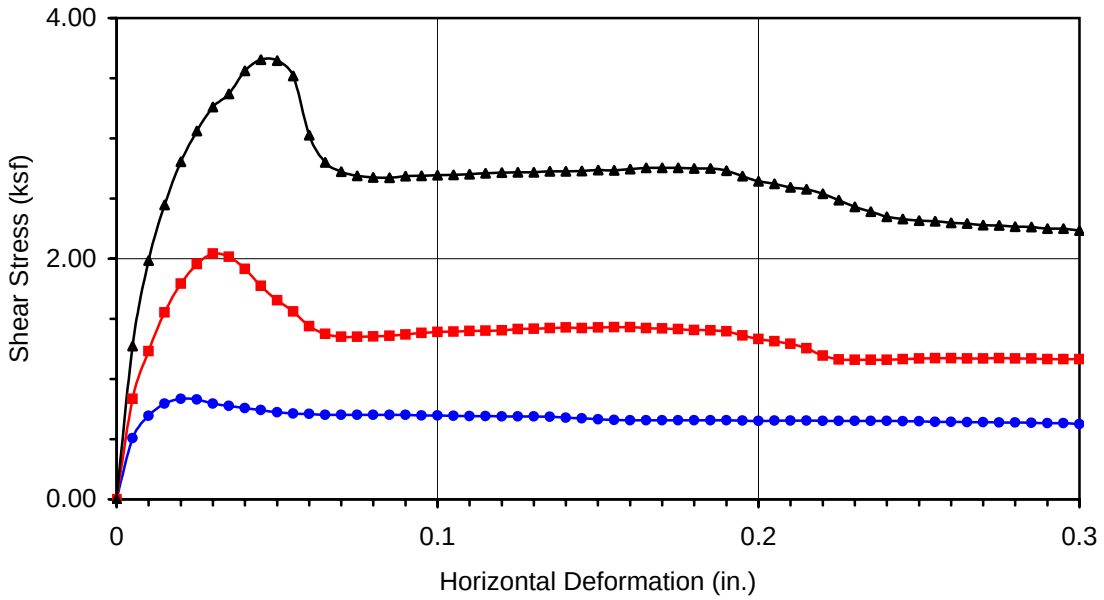
Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	187.88	196.39	202.75
Weight of Ring(gm):	43.38	43.48	43.67

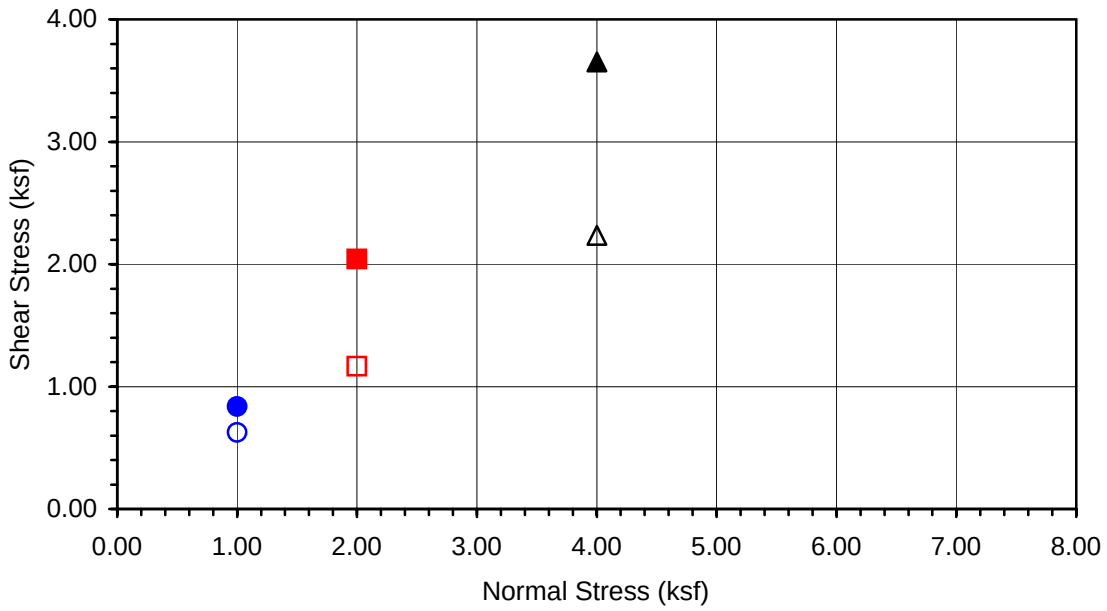
Before Shearing

Weight of Wet Sample+Cont.(gm):	255.15	255.15	255.15
Weight of Dry Sample+Cont.(gm):	230.44	230.44	230.44
Weight of Container(gm):	39.02	39.02	39.02
Vertical Rdg.(in): Initial	0.0000	0.2615	0.2696
Vertical Rdg.(in): Final	0.0149	0.2449	0.2555

After Shearing

Weight of Wet Sample+Cont.(gm):	197.95	203.55	206.80
Weight of Dry Sample+Cont.(gm):	168.10	173.67	178.63
Weight of Container(gm):	39.86	39.38	39.43
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-012**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Grayish brown lean clay (CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.836	■ 2.043	▲ 3.653
Shear Stress @ End of Test (ksf)	○ 0.626	□ 1.166	△ 2.235
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.91	12.91	12.91
Dry Density (pcf)	106.4	112.6	117.2
Saturation (%)	59.7	70.2	79.5
Soil Height Before Shearing (in.)	1.0149	1.0166	1.0141
Final Moisture Content (%)	23.3	22.3	20.2

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

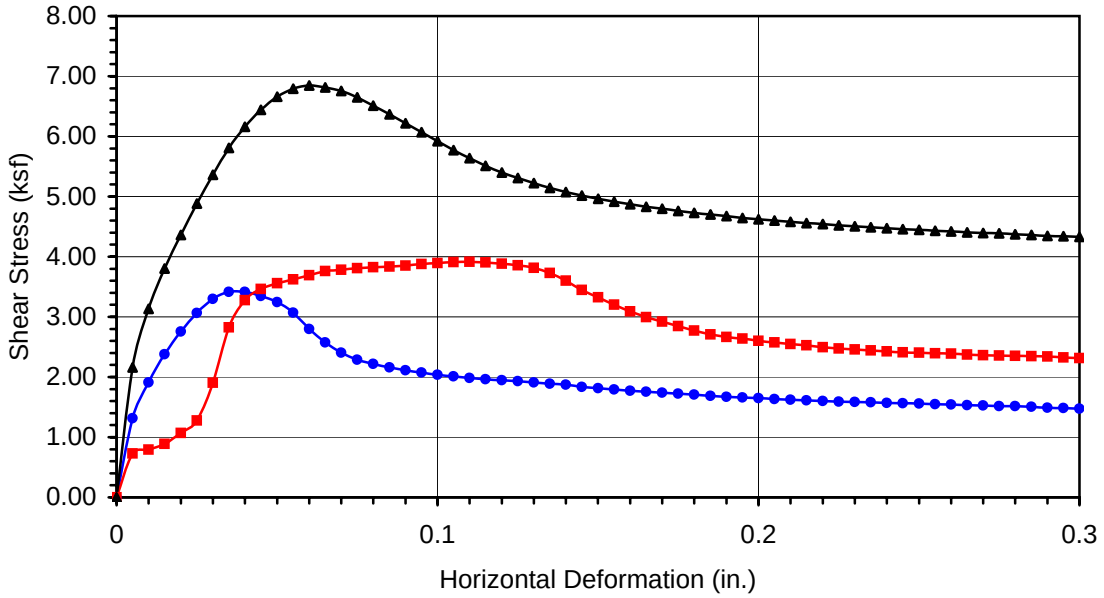
DIRECT SHEAR TEST

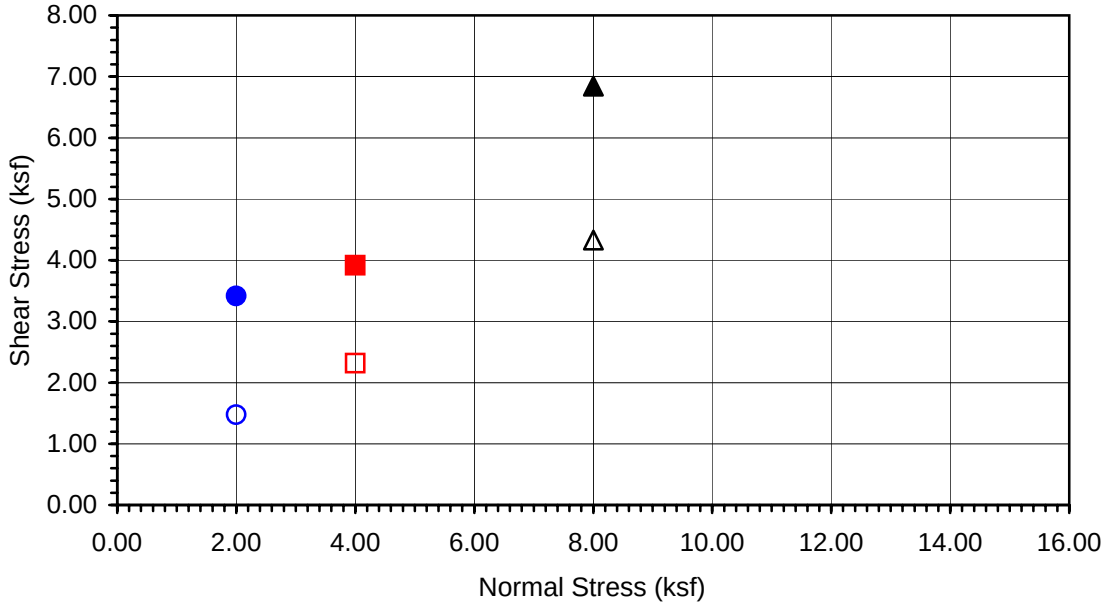
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/14/08
Boring No.:	A-08-012	Sample Type:	Drive		
Sample No.:	D-7	Depth (ft.):	35.0		

Soil Identification: Yellowish brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	207.92	208.67	209.28
Weight of Ring(gm):	43.40	43.43	43.47
Before Shearing			
Weight of Wet Sample+Cont.(gm):	187.01	187.01	187.01
Weight of Dry Sample+Cont.(gm):	165.71	165.71	165.71
Weight of Container(gm):	38.71	38.71	38.71
Vertical Rdg.(in): Initial	0.0000	0.2498	0.2664
Vertical Rdg.(in): Final	0.0055	0.2546	0.2790
After Shearing			
Weight of Wet Sample+Cont.(gm):	205.07	206.28	205.54
Weight of Dry Sample+Cont.(gm):	178.31	179.49	179.65
Weight of Container(gm):	38.76	39.91	39.29
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-012**
Sample No.	**D-7**
Depth (ft)	**35**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay (CL)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 3.414	■ 3.914	▲ 6.844
Shear Stress @ End of Test (ksf)	○ 1.474	□ 2.314	△ 4.332
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.77	16.77	16.77
Dry Density (pcf)	117.2	117.7	118.1
Saturation (%)	103.3	104.8	106.0
Soil Height Before Shearing (in.)	1.0055	0.9952	0.9874
Final Moisture Content (%)	19.2	19.2	18.4

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

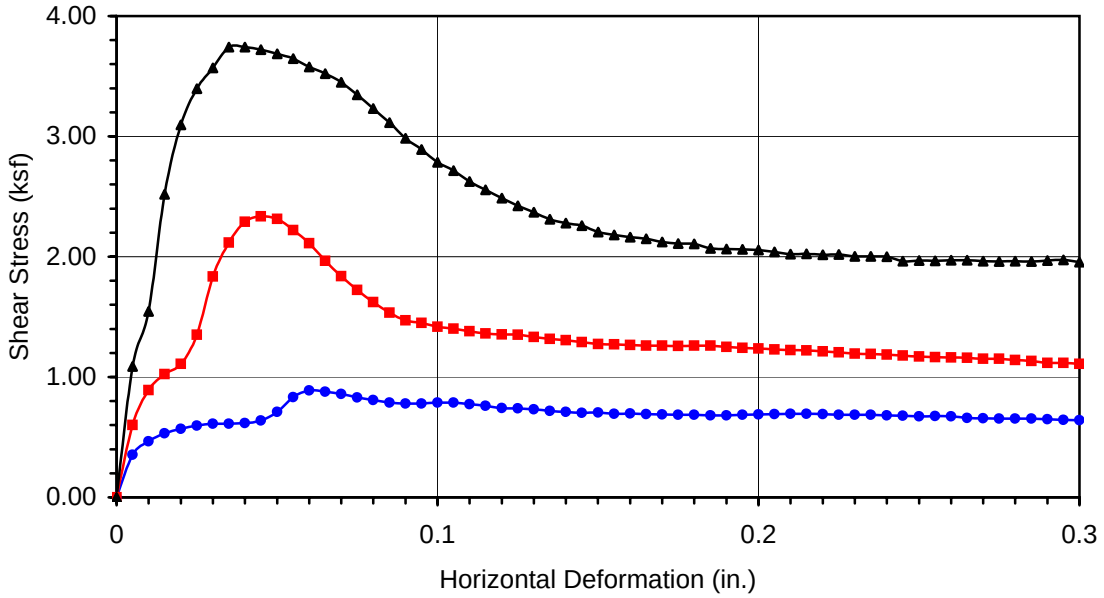
DIRECT SHEAR TEST

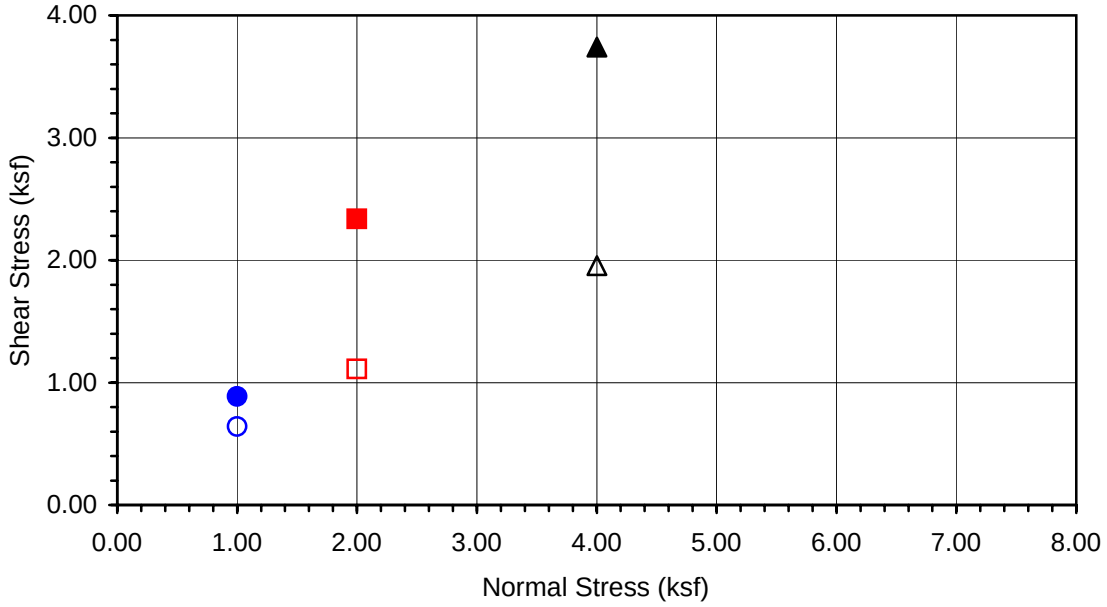
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/22/08
Project No.:	370900.02.GE.0S	Checked By:	J. Ward	Date:	09/26/08
Boring No.:	A-08-013	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Olive gray fat clay with sand (CH)s and caliche

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	191.34	196.64	198.37
Weight of Ring(gm):	43.42	43.47	43.61
Before Shearing			
Weight of Wet Sample+Cont.(gm):	198.08	198.08	198.08
Weight of Dry Sample+Cont.(gm):	167.49	167.49	167.49
Weight of Container(gm):	38.87	38.87	38.87
Vertical Rdg.(in): Initial	0.0000	0.2820	0.2815
Vertical Rdg.(in): Final	0.0269	0.2670	0.2764
After Shearing			
Weight of Wet Sample+Cont.(gm):	196.37	196.87	195.70
Weight of Dry Sample+Cont.(gm):	160.08	162.10	161.32
Weight of Container(gm):	39.21	39.17	38.11
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-013**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Olive gray fat clay with sand (CH)s and caliche

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.887	■ 2.336	▲ 3.741
Shear Stress @ End of Test (ksf)	○ 0.641	□ 1.110	△ 1.955
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	23.78	23.78	23.78
Dry Density (pcf)	99.4	102.9	104.0
Saturation (%)	92.3	100.7	103.4
Soil Height Before Shearing (in.)	1.0269	1.0150	1.0051
Final Moisture Content (%)	30.0	28.3	27.9

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

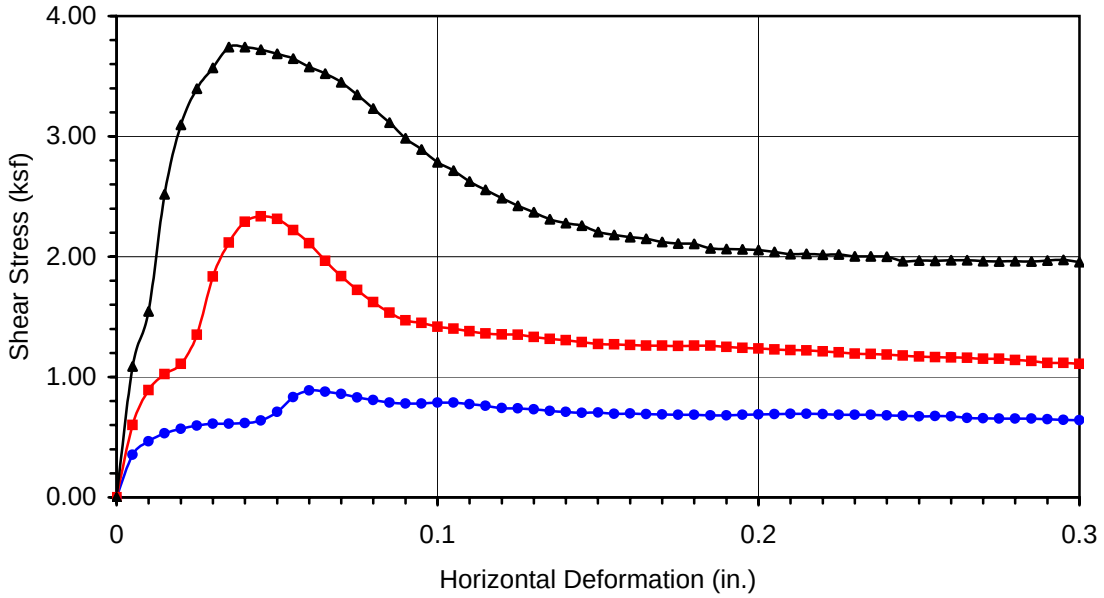
DIRECT SHEAR TEST

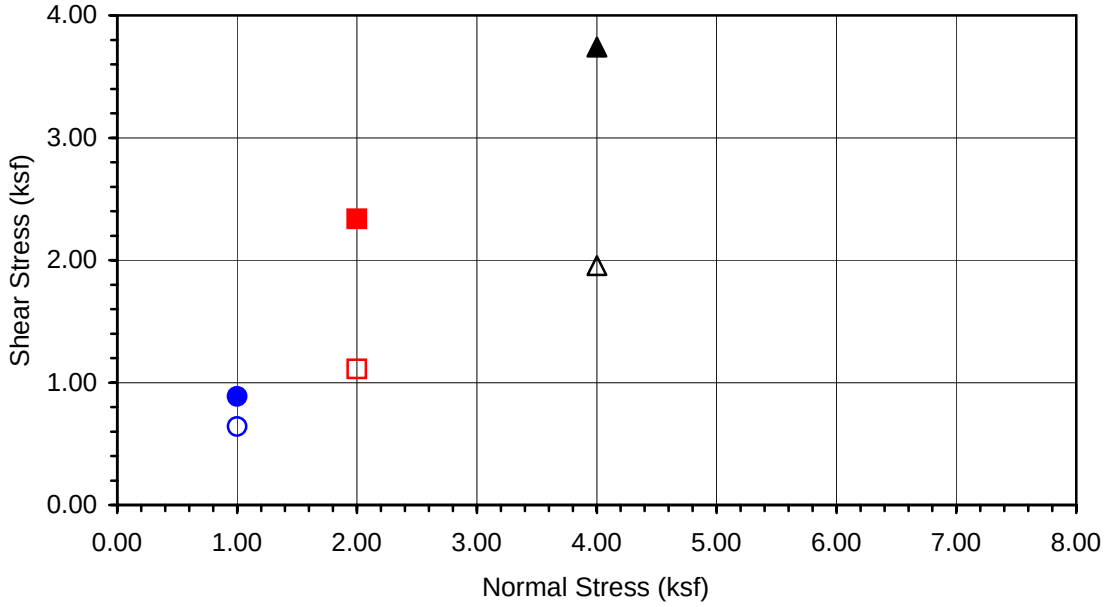
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/22/08
Project No.:	370900.02.GE.0S	Checked By:	J. Ward	Date:	09/26/08
Boring No.:	A-08-013	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Olive gray fat clay with sand (CH)s and caliche

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	191.34	196.64	198.37
Weight of Ring(gm):	43.42	43.47	43.61
Before Shearing			
Weight of Wet Sample+Cont.(gm):	198.08	198.08	198.08
Weight of Dry Sample+Cont.(gm):	167.49	167.49	167.49
Weight of Container(gm):	38.87	38.87	38.87
Vertical Rdg.(in): Initial	0.0000	0.2820	0.2815
Vertical Rdg.(in): Final	0.0269	0.2670	0.2764
After Shearing			
Weight of Wet Sample+Cont.(gm):	196.37	196.87	195.70
Weight of Dry Sample+Cont.(gm):	160.08	162.10	161.32
Weight of Container(gm):	39.21	39.17	38.11
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-013**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Olive gray fat clay with sand (CH)s and caliche

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.887	■ 2.336	▲ 3.741
Shear Stress @ End of Test (ksf)	○ 0.641	□ 1.110	△ 1.955
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	23.78	23.78	23.78
Dry Density (pcf)	99.4	102.9	104.0
Saturation (%)	92.3	100.7	103.4
Soil Height Before Shearing (in.)	1.0269	1.0150	1.0051
Final Moisture Content (%)	30.0	28.3	27.9

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

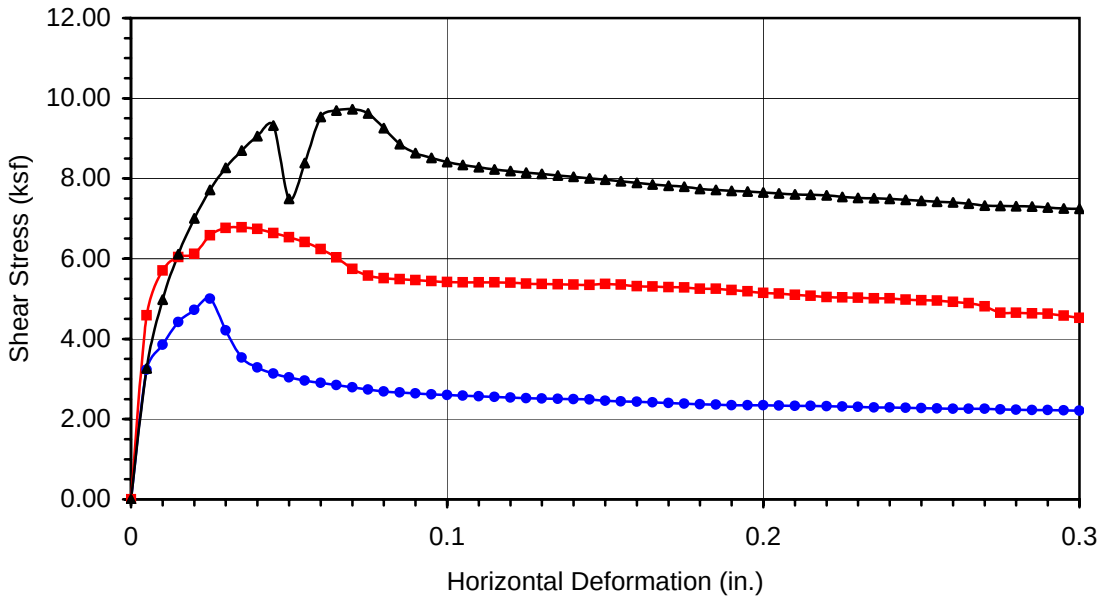
DIRECT SHEAR TEST

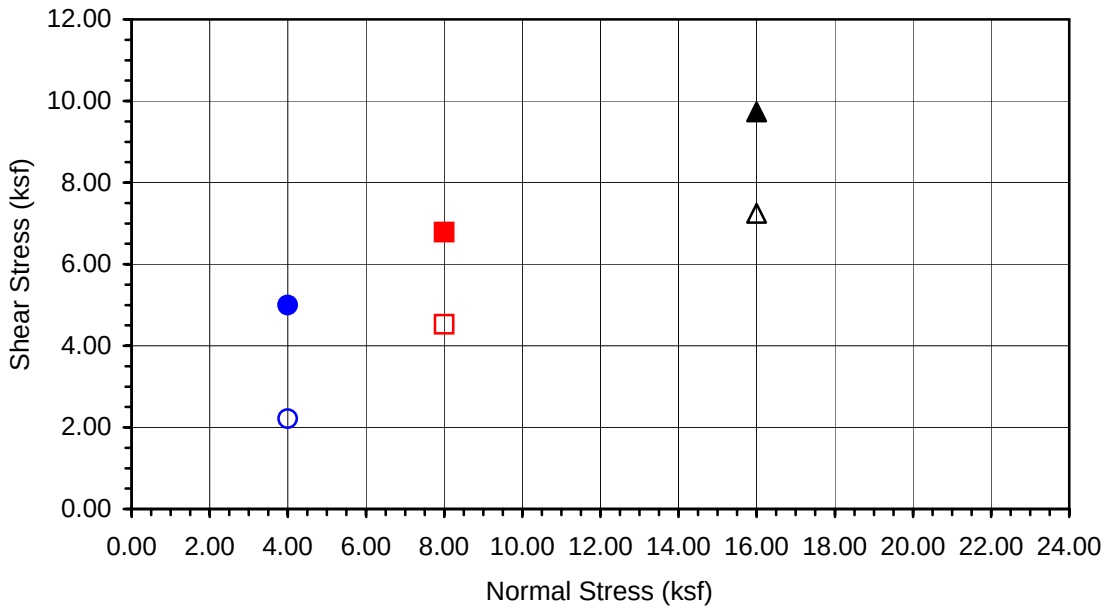
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/22/08
Project No.:	370900.02.GE.0S	Checked By:	J. Ward	Date:	09/26/08
Boring No.:	A-08-013	Sample Type:	Drive		
Sample No.:	D-5	Depth (ft.):	25.0		

Soil Identification: Olive lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	200.33	201.58	202.75
Weight of Ring(gm):	43.07	43.60	43.58
Before Shearing			
Weight of Wet Sample+Cont.(gm):	185.11	185.11	185.11
Weight of Dry Sample+Cont.(gm):	161.95	161.95	161.95
Weight of Container(gm):	39.75	39.75	39.75
Vertical Rdg.(in): Initial	0.2882	0.2853	0.0000
Vertical Rdg.(in): Final	0.2916	0.3013	-0.0333
After Shearing			
Weight of Wet Sample+Cont.(gm):	198.59	198.95	199.34
Weight of Dry Sample+Cont.(gm):	169.75	170.35	172.32
Weight of Container(gm):	39.29	39.33	40.19
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-013**
Sample No.	**D-5**
Depth (ft)	**25**

Sample Type:

Drive

Soil Identification:
Olive lean clay (CL)

Normal Stress (kip/ft²)	4.000	8.000	16.000
Peak Shear Stress (kip/ft²)	● 4.999	■ 6.784	▲ 9.730
Shear Stress @ End of Test (ksf)	○ 2.210	□ 4.524	△ 7.246
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	18.95	18.95	18.95
Dry Density (pcf)	109.9	110.5	111.3
Saturation (%)	96.0	97.3	99.4
Soil Height Before Shearing (in.)	0.9966	0.9840	0.9667
Final Moisture Content (%)	22.1	21.8	20.4

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

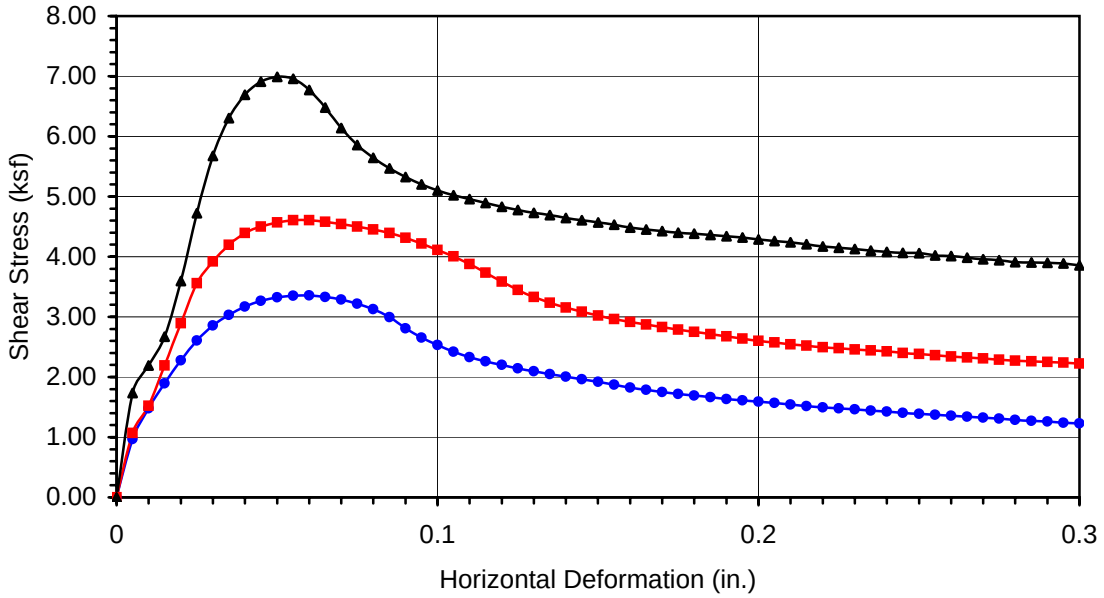
DIRECT SHEAR TEST

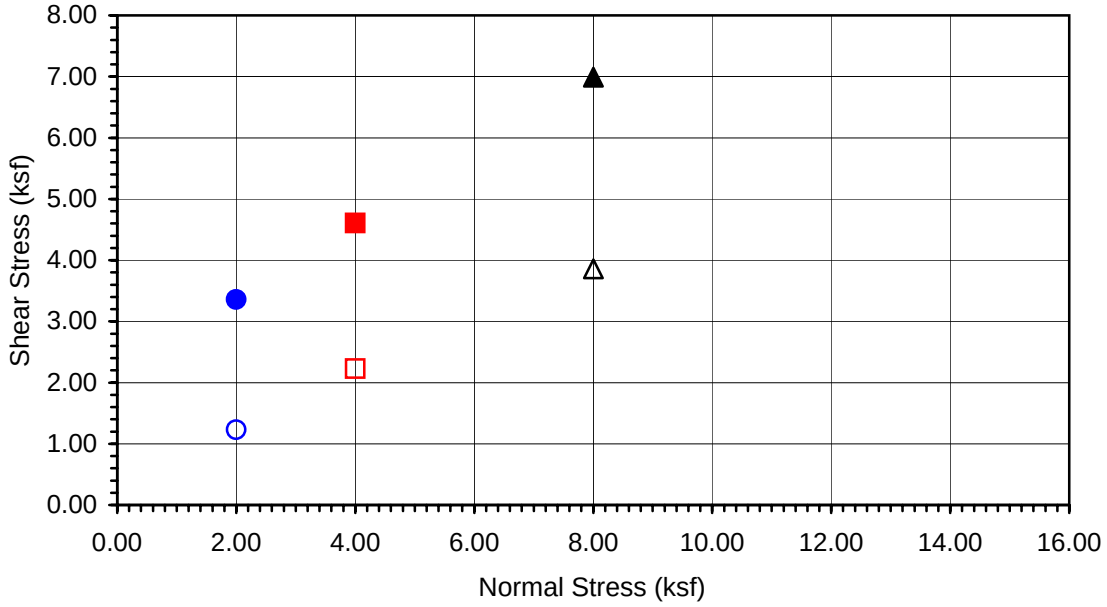
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/28/08
Boring No.:	A-08-013	Sample Type:	Drive		
Sample No.:	D-7	Depth (ft.):	35.0		

Soil Identification: Olive brown fat clay (CH)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	204.50	204.82	207.58
Weight of Ring(gm):	43.06	43.22	43.27
Before Shearing			
Weight of Wet Sample+Cont.(gm):	200.78	200.78	200.78
Weight of Dry Sample+Cont.(gm):	175.01	175.01	175.01
Weight of Container(gm):	39.72	39.72	39.72
Vertical Rdg.(in): Initial	0.0000	0.2665	0.2798
Vertical Rdg.(in): Final	0.0082	0.2670	0.2901
After Shearing			
Weight of Wet Sample+Cont.(gm):	202.29	202.15	203.49
Weight of Dry Sample+Cont.(gm):	172.21	173.95	175.16
Weight of Container(gm):	39.17	38.93	38.46
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-013**
Sample No.	**D-7**
Depth (ft)	**35**

Sample Type:

Drive

Soil Identification:
Olive brown fat clay (CH)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 3.358	■ 4.609	▲ 6.992
Shear Stress @ End of Test (ksf)	○ 1.229	□ 2.226	△ 3.857
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	19.05	19.05	19.05
Dry Density (pcf)	112.8	112.9	114.8
Saturation (%)	104.0	104.3	109.8
Soil Height Before Shearing (in.)	1.0082	0.9995	0.9897
Final Moisture Content (%)	22.6	20.9	20.7

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

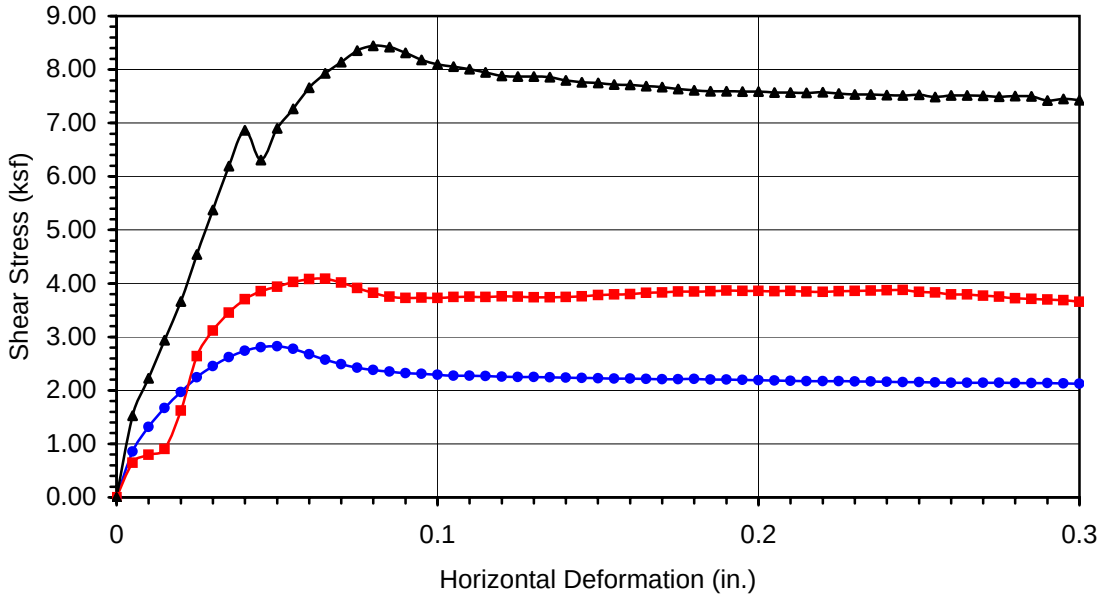
DIRECT SHEAR TEST

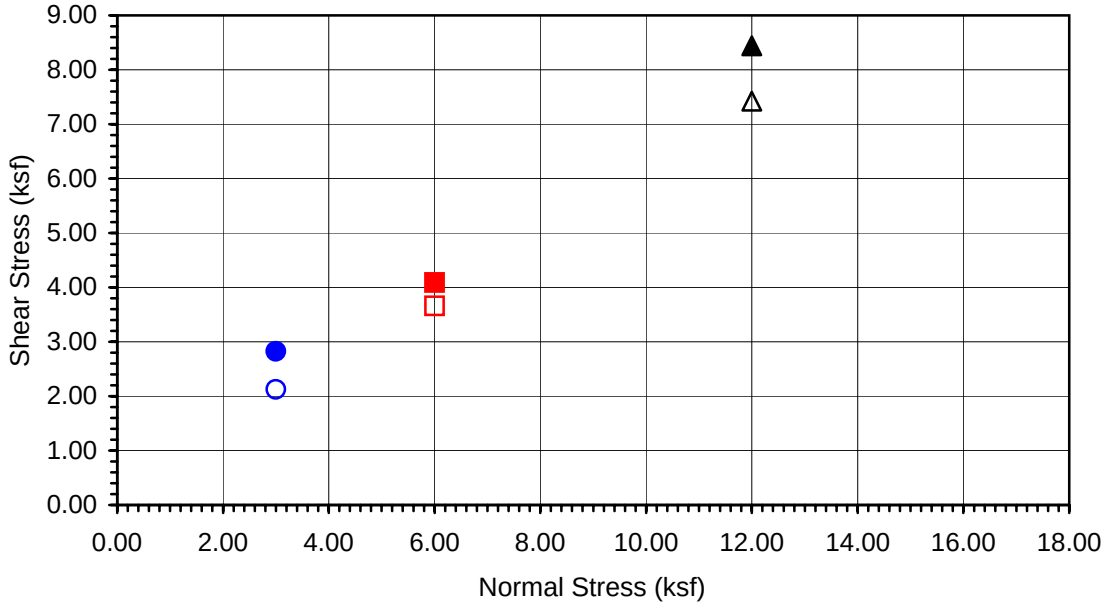
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/05/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-013	Sample Type:	Drive		
Sample No.:	D-11	Depth (ft.):	55.0		

Soil Identification: Yellowish brown sandy lean clay s(CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	203.31	204.70	207.65
Weight of Ring(gm):	43.32	43.43	43.49
Before Shearing			
Weight of Wet Sample+Cont.(gm):	209.97	209.97	209.97
Weight of Dry Sample+Cont.(gm):	185.11	185.11	185.11
Weight of Container(gm):	39.17	39.17	39.17
Vertical Rdg.(in): Initial	0.0000	0.2539	0.2597
Vertical Rdg.(in): Final	-0.0134	0.2760	0.2927
After Shearing			
Weight of Wet Sample+Cont.(gm):	198.33	201.00	200.39
Weight of Dry Sample+Cont.(gm):	171.33	176.04	176.69
Weight of Container(gm):	39.13	39.84	38.47
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-013**
Sample No.	**D-11**
Depth (ft)	**55**

Sample Type:

Drive

Soil Identification:
Yellowish brown sandy lean clay s(CL)

Normal Stress (kip/ft²)	3.000	6.000	12.000
Peak Shear Stress (kip/ft²)	● 2.826	■ 4.090	▲ 8.441
Shear Stress @ End of Test (ksf)	○ 2.125	□ 3.659	△ 7.426
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	17.03	17.03	17.03
Dry Density (pcf)	113.7	114.6	116.7
Saturation (%)	95.3	97.7	103.4
Soil Height Before Shearing (in.)	0.9866	0.9779	0.9670
Final Moisture Content (%)	20.4	18.3	17.1

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

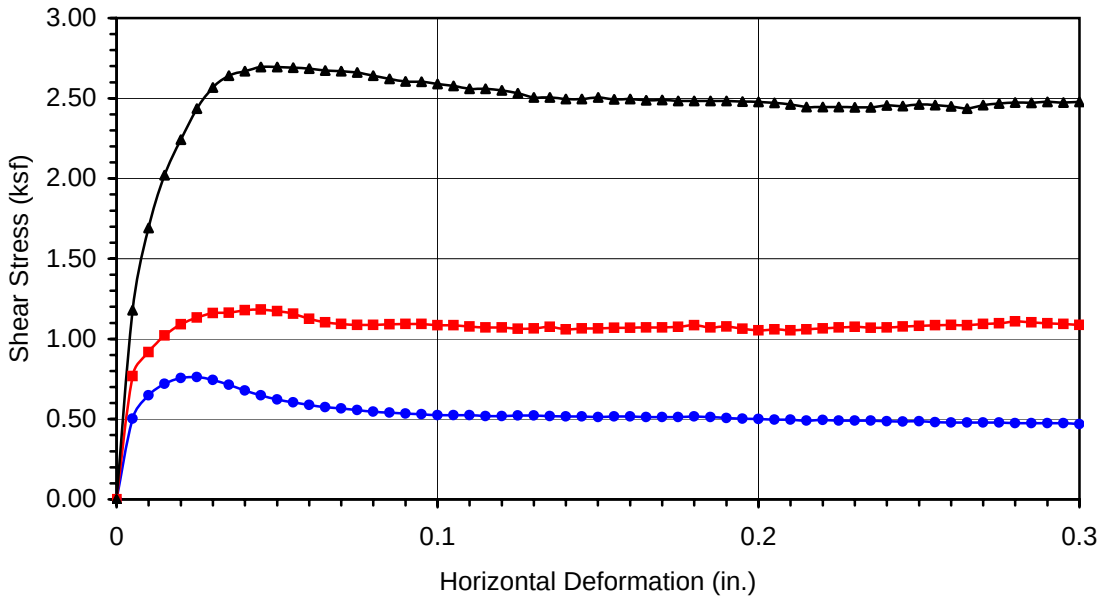
DIRECT SHEAR TEST

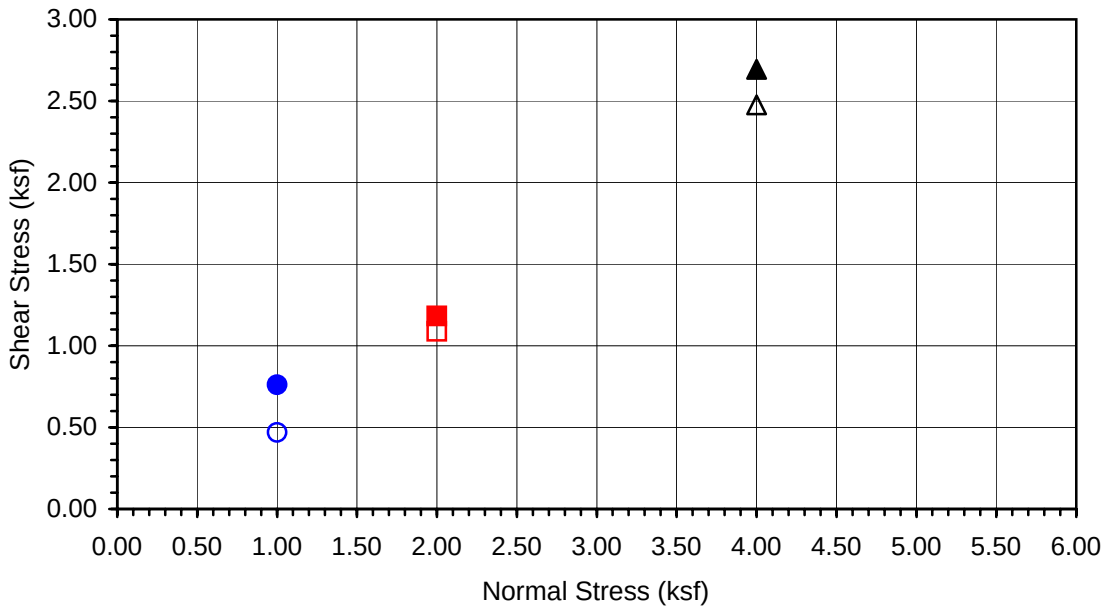
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/26/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-014	Sample Type:	Remolded to 95% Max. Dens. @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	0-7		

Soil Identification: Yellowish brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	194.36	194.14	194.44
Weight of Ring(gm):	43.27	43.05	43.35
Before Shearing			
Weight of Wet Sample+Cont.(gm):	256.43	256.43	256.43
Weight of Dry Sample+Cont.(gm):	233.18	233.18	233.18
Weight of Container(gm):	39.42	39.42	39.42
Vertical Rdg.(in): Initial	0.1479	0.1069	0.1037
Vertical Rdg.(in): Final	0.1509	0.1159	0.1139
After Shearing			
Weight of Wet Sample+Cont.(gm):	198.37	197.85	197.60
Weight of Dry Sample+Cont.(gm):	172.76	172.92	173.12
Weight of Container(gm):	39.25	39.21	38.94
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-014**
Sample No.	**Bag-1**
Depth (ft)	**0-7**

Sample Type:
Remolded to 95% Max. Dens. @ Opt. MC

Soil Identification:
Yellowish brown clayey sand (SC)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.761	■ 1.182	▲ 2.694
Shear Stress @ End of Test (ksf)	○ 0.468	□ 1.088	△ 2.477
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.00	12.00	12.00
Dry Density (pcf)	112.2	112.2	112.2
Saturation (%)	64.5	64.5	64.5
Soil Height Before Shearing (in.)	0.9970	0.9910	0.9898
Final Moisture Content (%)	19.2	18.6	18.2

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

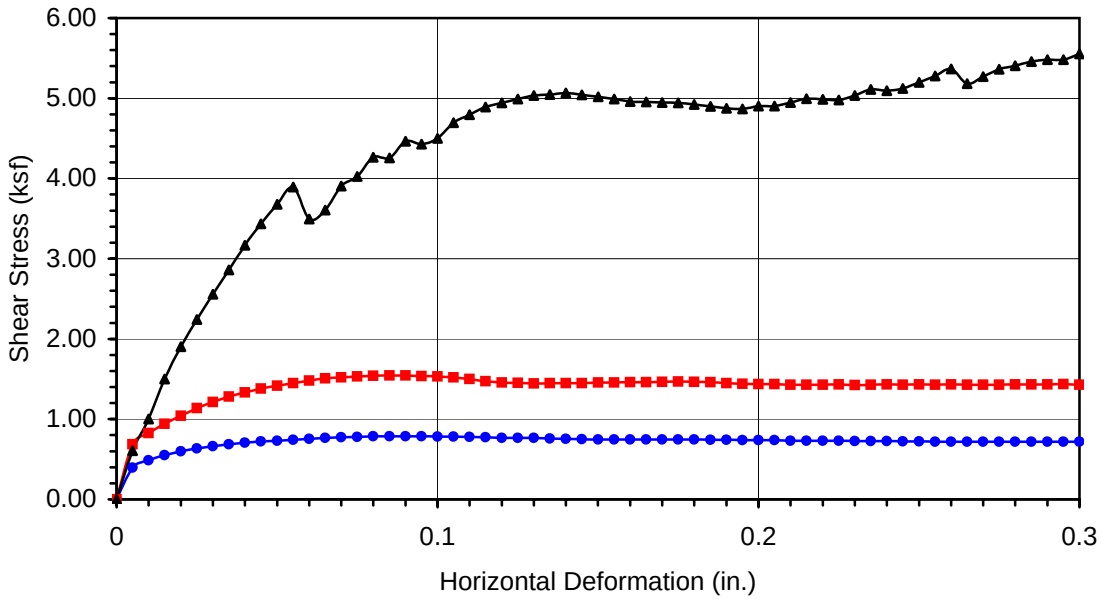
DIRECT SHEAR TEST

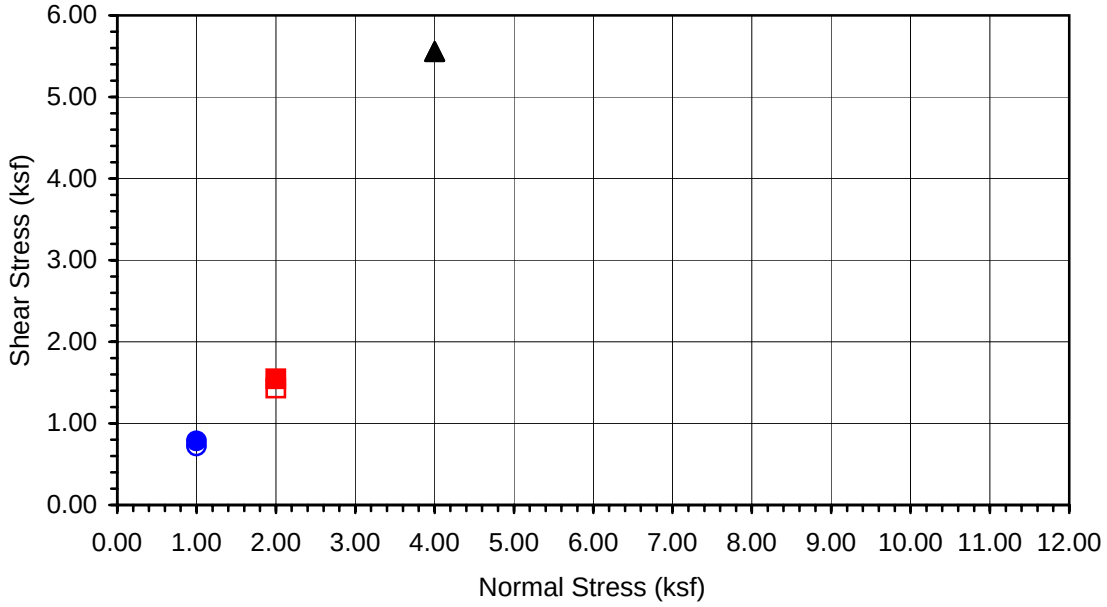
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	G. Bathala	Date:	08/07/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/12/08
Boring No.:	A-08-014	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Yellowish brown poorly graded sand with silt and gravel (SP-SM)g

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	178.19	187.24	191.26
Weight of Ring(gm):	43.65	45.41	43.21
Before Shearing			
Weight of Wet Sample+Cont.(gm):	235.34	235.34	235.34
Weight of Dry Sample+Cont.(gm):	221.26	221.26	221.26
Weight of Container(gm):	39.54	39.54	39.54
Vertical Rdg.(in): Initial	0.2475	0.2742	0.1260
Vertical Rdg.(in): Final	0.2545	0.2877	0.1520
After Shearing			
Weight of Wet Sample+Cont.(gm):	183.33	191.38	192.07
Weight of Dry Sample+Cont.(gm):	156.65	166.61	170.16
Weight of Container(gm):	38.88	39.64	38.43
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-014**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Yellowish brown poorly graded sand with silt and gravel (SP-SM)g

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.786	■ 1.544	▲ 5.555
Shear Stress @ End of Test (ksf)	○ 0.720	□ 1.430	△ 5.555
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	7.75	7.75	7.75
Dry Density (pcf)	103.8	109.5	114.3
Saturation (%)	33.6	38.8	44.0
Soil Height Before Shearing (in.)	0.9930	0.9865	0.9740
Final Moisture Content (%)	22.7	19.5	16.6

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

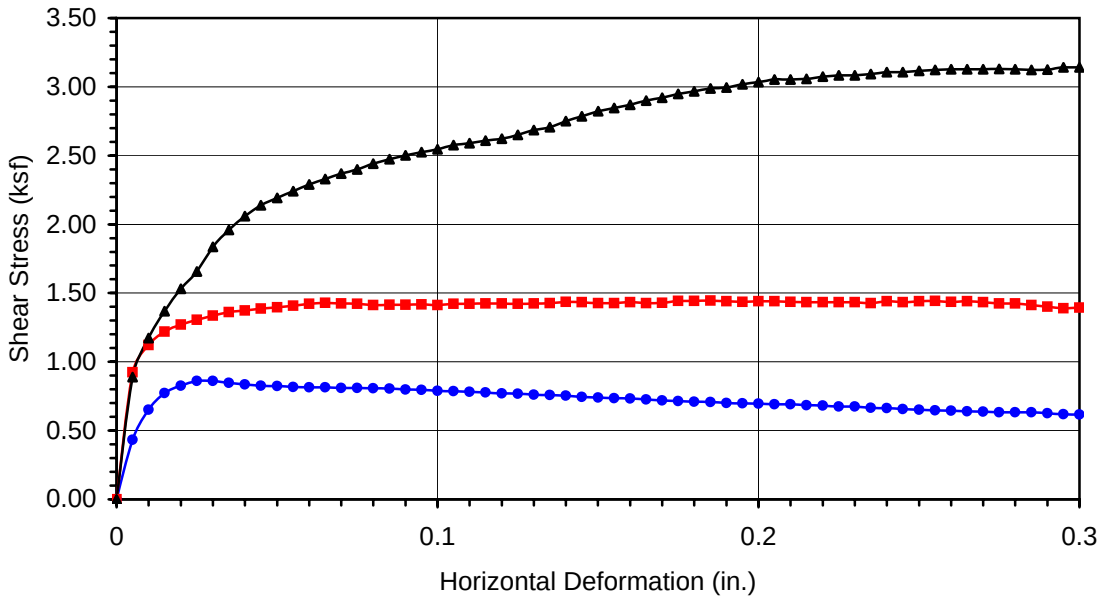
DIRECT SHEAR TEST

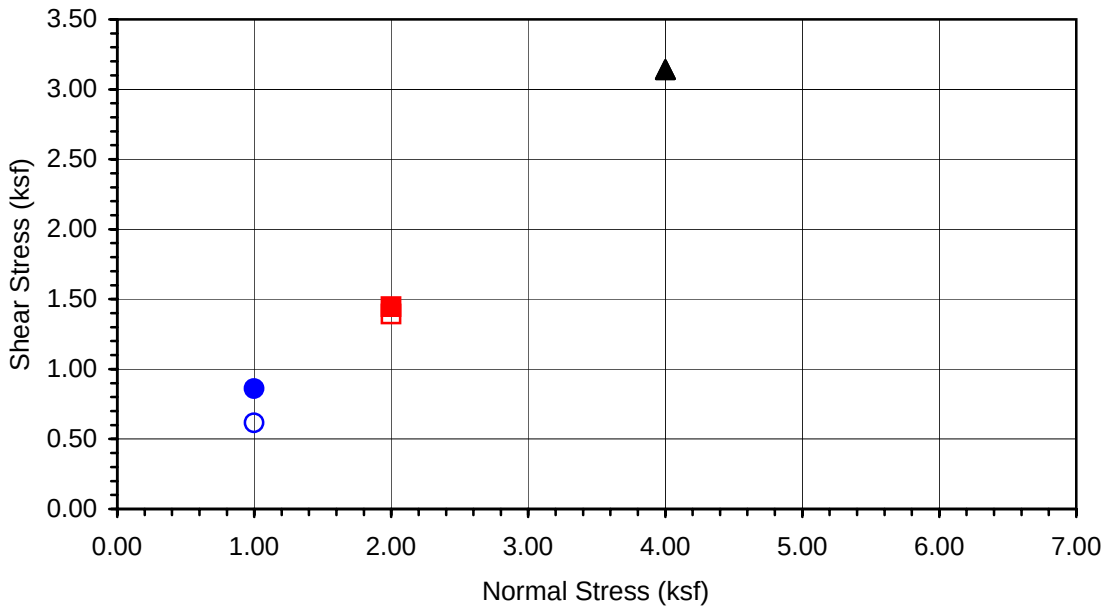
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/27/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-015	Sample Type:	Remolded to 95% Max. Dens. @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	0-7		

Soil Identification: Dark brown lean clay with sand (CL)s

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	190.54	188.46	188.09
Weight of Ring(gm):	45.21	43.13	42.76
Before Shearing			
Weight of Wet Sample+Cont.(gm):	248.85	248.85	248.85
Weight of Dry Sample+Cont.(gm):	223.88	223.88	223.88
Weight of Container(gm):	38.89	38.89	38.89
Vertical Rdg.(in): Initial	0.3783	0.3179	0.3264
Vertical Rdg.(in): Final	0.3462	0.3037	0.3334
After Shearing			
Weight of Wet Sample+Cont.(gm):	195.59	217.14	191.08
Weight of Dry Sample+Cont.(gm):	166.56	189.25	165.71
Weight of Container(gm):	39.12	61.06	39.58
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-015**
Sample No.	**Bag-1**
Depth (ft)	**0-7**

Sample Type:
Remolded to 95% Max. Dens. @ Opt. MC

Soil Identification:
Dark brown lean clay with sand (CL)s

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.861	■ 1.446	▲ 3.141
Shear Stress @ End of Test (ksf)	○ 0.616	□ 1.393	△ 3.141
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	13.50	13.50	13.50
Dry Density (pcf)	106.5	106.5	106.5
Saturation (%)	62.5	62.5	62.5
Soil Height Before Shearing (in.)	1.0321	1.0142	0.9930
Final Moisture Content (%)	22.8	21.8	20.1

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

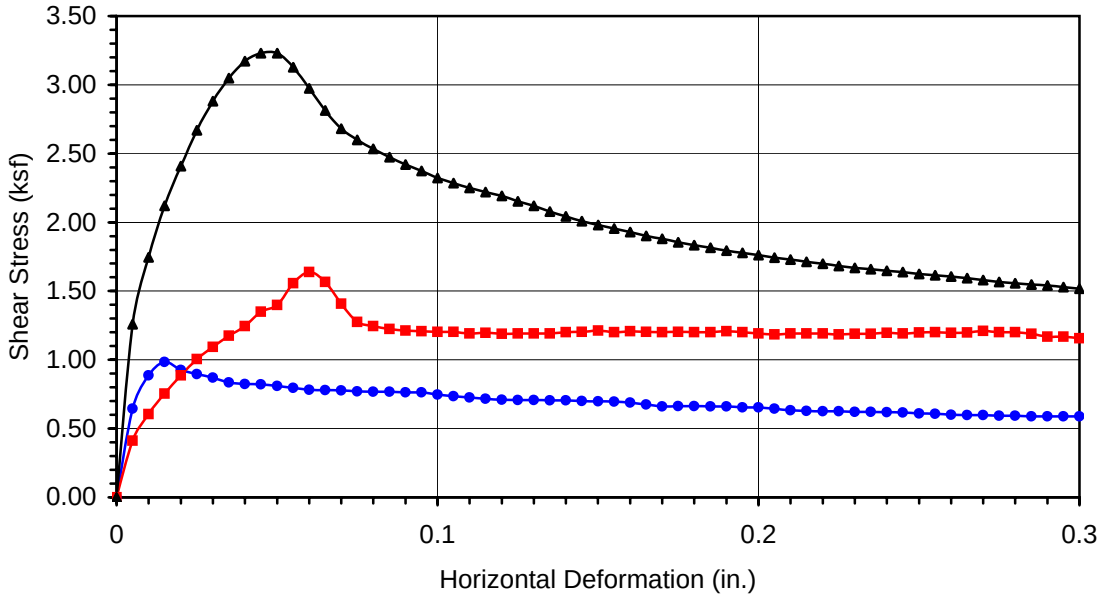
DIRECT SHEAR TEST

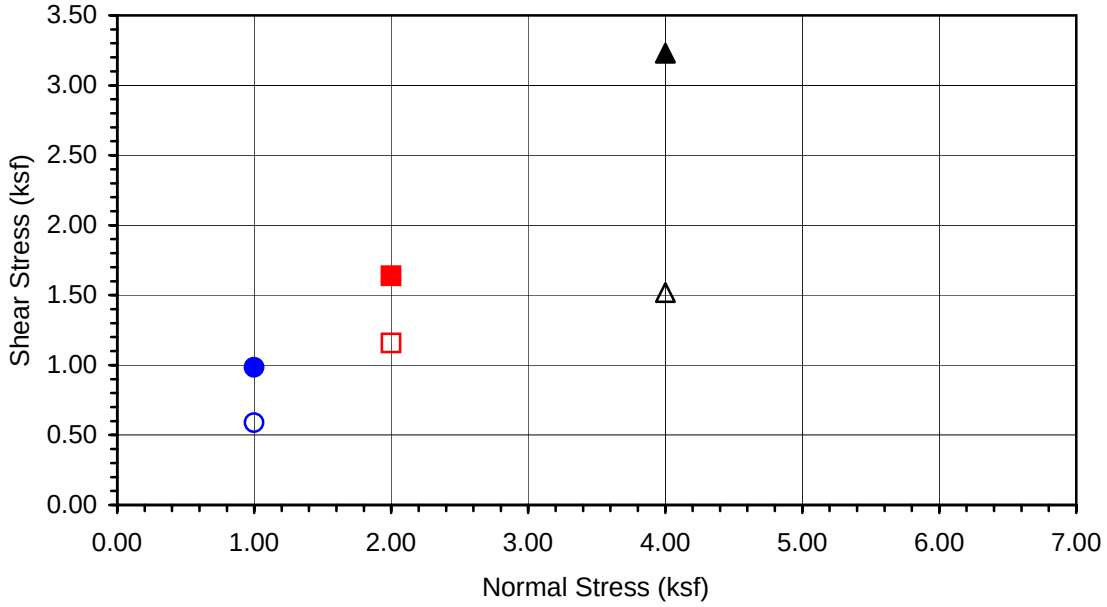
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/05/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/26/08
Boring No.:	A-08-015	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Pale olive fat clay (CH)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	185.74	190.89	193.76
Weight of Ring(gm):	43.69	44.20	44.44
Before Shearing			
Weight of Wet Sample+Cont.(gm):	428.27	428.27	428.27
Weight of Dry Sample+Cont.(gm):	361.85	361.85	361.85
Weight of Container(gm):	39.38	39.38	39.38
Vertical Rdg.(in): Initial	0.0000	0.2619	0.2614
Vertical Rdg.(in): Final	0.0345	0.2391	0.2381
After Shearing			
Weight of Wet Sample+Cont.(gm):	195.19	197.02	198.08
Weight of Dry Sample+Cont.(gm):	160.31	165.20	163.44
Weight of Container(gm):	38.86	39.19	39.45
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-015**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Pale olive fat clay (CH)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.984	■ 1.638	▲ 3.229
Shear Stress @ End of Test (ksf)	○ 0.588	□ 1.157	△ 1.518
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	20.60	20.60	20.60
Dry Density (pcf)	98.0	101.2	103.0
Saturation (%)	77.2	83.5	87.3
Soil Height Before Shearing (in.)	1.0345	1.0228	1.0233
Final Moisture Content (%)	28.7	25.3	27.9

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

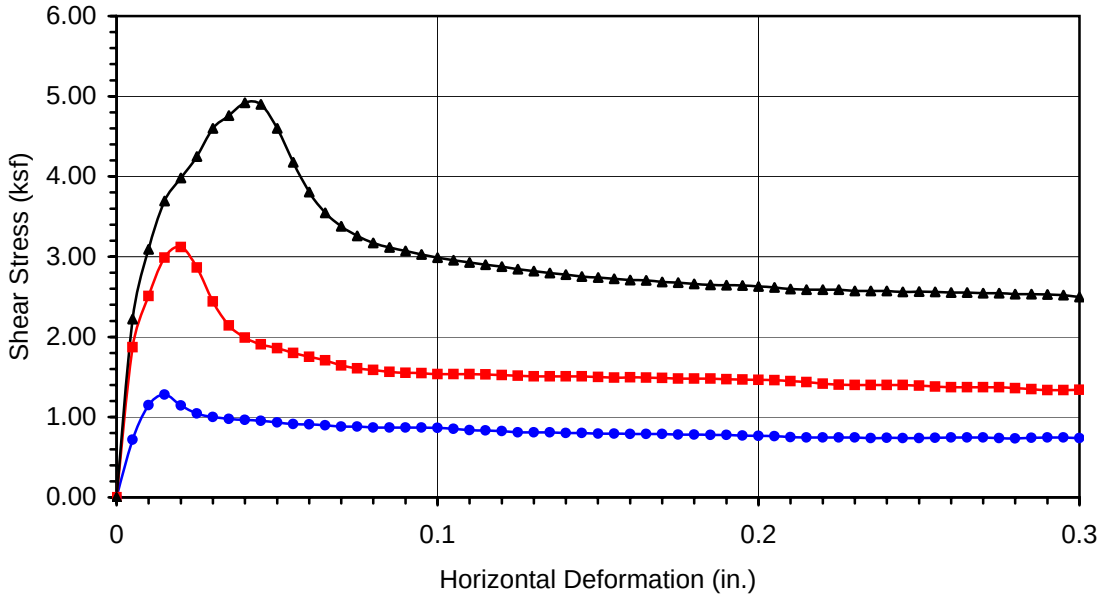
DIRECT SHEAR TEST

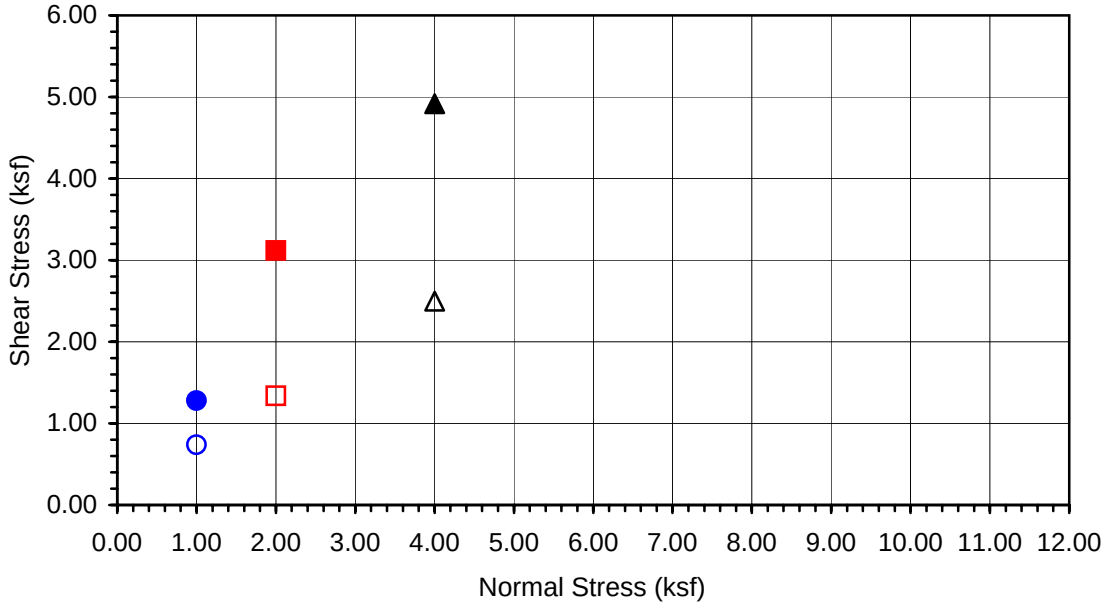
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/21/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/26/08
Boring No.:	A-08-015	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Yellowish brown lean clay (CL) with a layer of caliche

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	204.31	205.86	207.68
Weight of Ring(gm):	44.67	44.40	43.77
Before Shearing			
Weight of Wet Sample+Cont.(gm):	209.31	209.31	209.31
Weight of Dry Sample+Cont.(gm):	189.10	189.10	189.10
Weight of Container(gm):	50.00	50.00	50.00
Vertical Rdg.(in): Initial	0.0000	0.2512	0.2574
Vertical Rdg.(in): Final	0.0045	0.2489	0.2627
After Shearing			
Weight of Wet Sample+Cont.(gm):	202.45	203.99	205.57
Weight of Dry Sample+Cont.(gm):	174.23	176.76	179.30
Weight of Container(gm):	38.95	38.92	39.30
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-015**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay (CL) with a layer of caliche

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.280	■ 3.119	▲ 4.917
Shear Stress @ End of Test (ksf)	○ 0.739	□ 1.339	△ 2.497
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	14.53	14.53	14.53
Dry Density (pcf)	115.9	117.2	119.0
Saturation (%)	86.4	89.6	94.3
Soil Height Before Shearing (in.)	1.0045	1.0023	0.9947
Final Moisture Content (%)	20.9	19.8	18.8

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

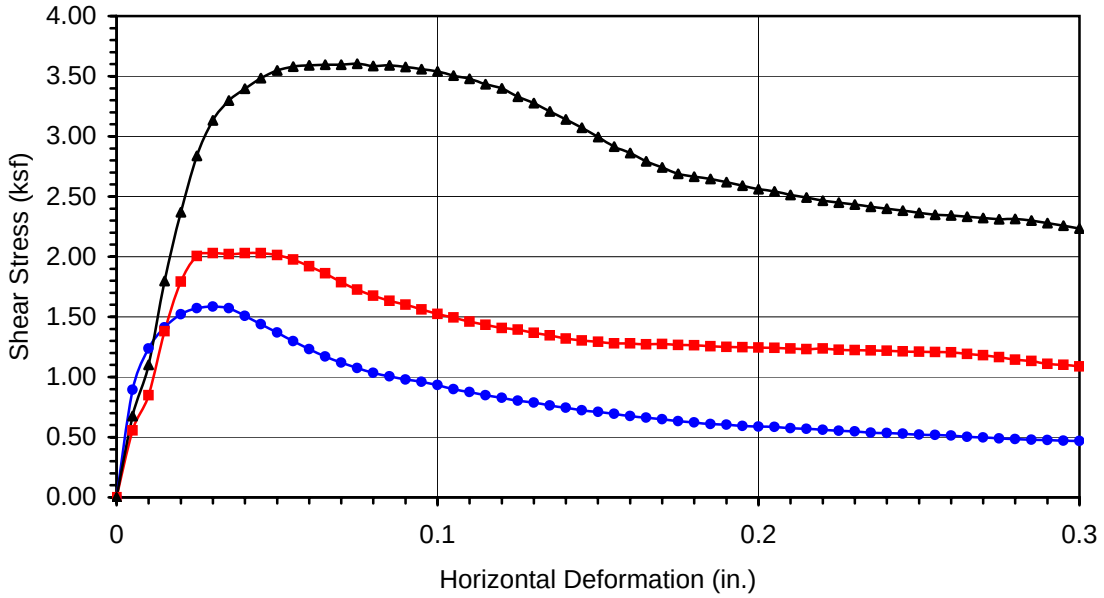
DIRECT SHEAR TEST

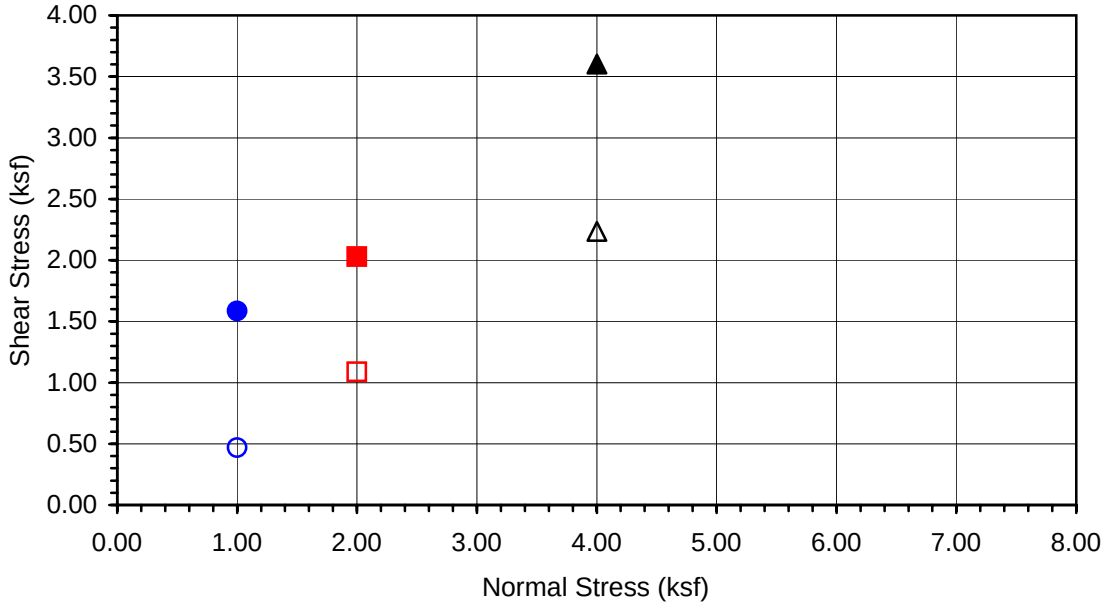
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-016	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Yellowish brown lean clay with sand (CL)s

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	199.28	200.14	202.61
Weight of Ring(gm):	42.81	43.64	43.24
Before Shearing			
Weight of Wet Sample+Cont.(gm):	201.23	201.23	201.23
Weight of Dry Sample+Cont.(gm):	178.59	178.59	178.59
Weight of Container(gm):	39.32	39.32	39.32
Vertical Rdg.(in): Initial	0.0000	0.2561	0.2757
Vertical Rdg.(in): Final	0.0284	0.2406	0.2705
After Shearing			
Weight of Wet Sample+Cont.(gm):	201.64	201.01	201.83
Weight of Dry Sample+Cont.(gm):	169.56	168.83	173.08
Weight of Container(gm):	39.21	39.65	39.18
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-016**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay with sand (CL)s

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.584	■ 2.028	▲ 3.603
Shear Stress @ End of Test (ksf)	○ 0.468	□ 1.088	△ 2.235
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.26	16.26	16.26
Dry Density (pcf)	111.9	112.0	114.0
Saturation (%)	86.8	86.8	91.7
Soil Height Before Shearing (in.)	1.0284	1.0155	1.0052
Final Moisture Content (%)	24.6	24.9	21.5

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

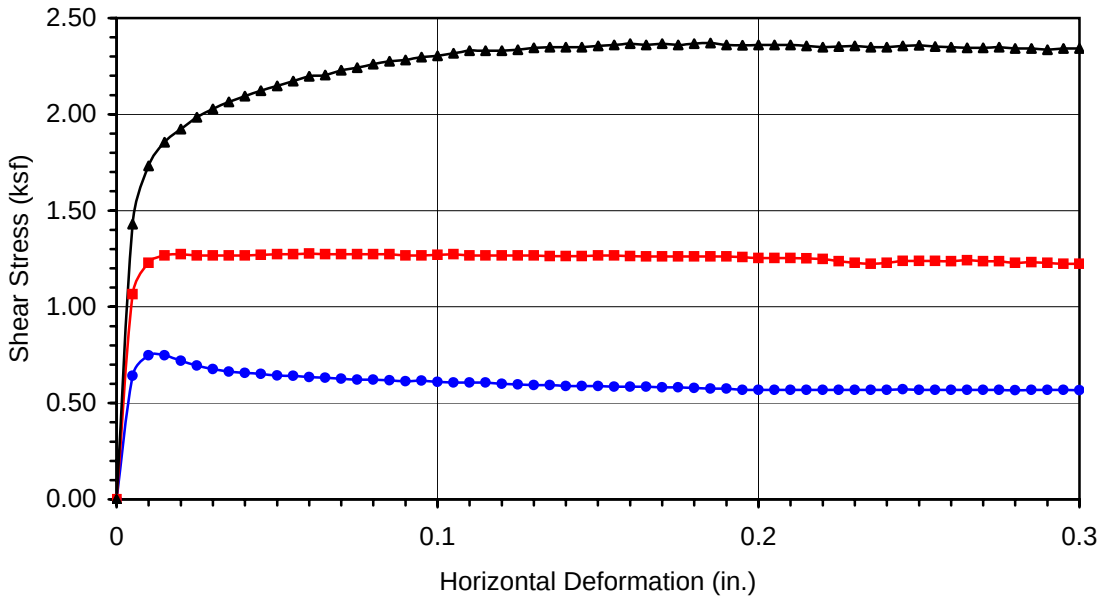
DIRECT SHEAR TEST

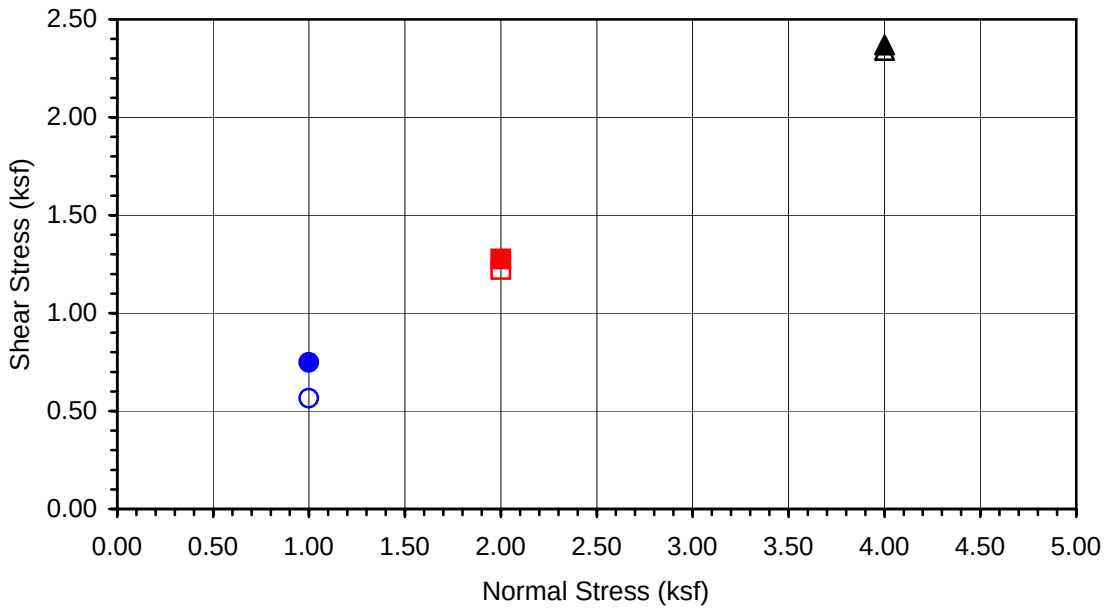
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/28/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-016	Sample Type:	Remolded to 95% Max. Dens. @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	15-20		

Soil Identification: Olive brown lean clay with sand (CL)s

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	192.07	192.34	192.74
Weight of Ring(gm):	42.97	43.24	43.64
Before Shearing			
Weight of Wet Sample+Cont.(gm):	241.44	241.44	241.44
Weight of Dry Sample+Cont.(gm):	221.37	221.37	221.37
Weight of Container(gm):	38.88	38.88	38.88
Vertical Rdg.(in): Initial	0.0000	0.2790	0.2808
Vertical Rdg.(in): Final	0.0223	0.2721	0.2915
After Shearing			
Weight of Wet Sample+Cont.(gm):	197.85	219.10	195.96
Weight of Dry Sample+Cont.(gm):	169.96	193.85	172.01
Weight of Container(gm):	39.28	61.06	39.29
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-016**
Sample No.	**Bag-1**
Depth (ft)	**15-20**

Sample Type:
Remolded to 95% Max. Dens. @ Opt. MC

Soil Identification:
Olive brown lean clay with sand (CL)s

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.748	■ 1.276	▲ 2.370
Shear Stress @ End of Test (ksf)	○ 0.566	□ 1.223	△ 2.342
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.00	11.00	11.00
Dry Density (pcf)	111.7	111.7	111.7
Saturation (%)	58.4	58.4	58.4
Soil Height Before Shearing (in.)	1.0223	1.0069	0.9893
Final Moisture Content (%)	21.3	19.0	18.0

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

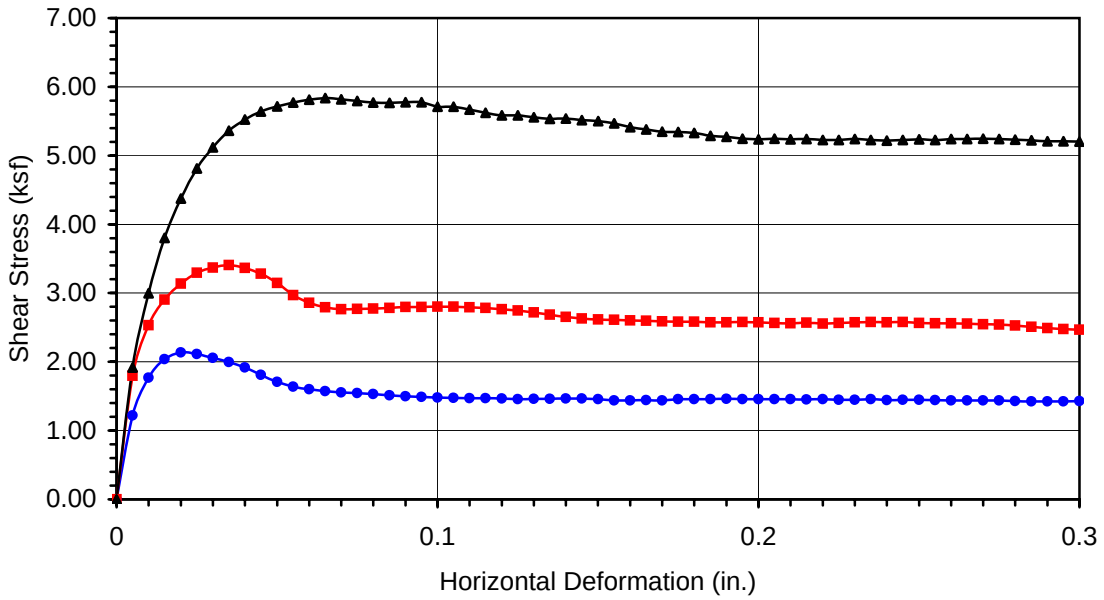
DIRECT SHEAR TEST

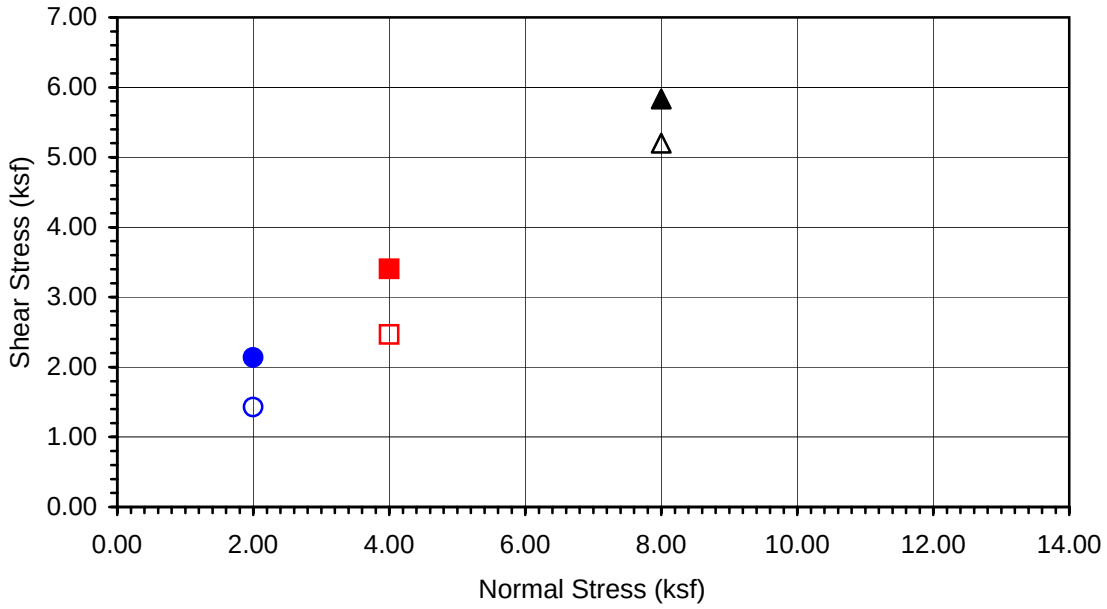
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/15/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/19/08
Boring No.:	A-08-016	Sample Type:	Drive		
Sample No.:	D-5	Depth (ft.):	25.0		

Soil Identification: Yellowish brown lean clay with sand (CL)s and caliche

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	201.08	203.25	211.88
Weight of Ring(gm):	42.61	43.25	43.51
Before Shearing			
Weight of Wet Sample+Cont.(gm):	230.60	230.60	230.60
Weight of Dry Sample+Cont.(gm):	211.54	211.54	211.54
Weight of Container(gm):	38.86	38.86	38.86
Vertical Rdg.(in): Initial	0.0000	0.2539	0.2574
Vertical Rdg.(in): Final	-0.0015	0.2619	0.2715
After Shearing			
Weight of Wet Sample+Cont.(gm):	202.19	202.35	209.99
Weight of Dry Sample+Cont.(gm):	176.21	177.21	186.87
Weight of Container(gm):	38.88	39.12	39.32
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-016**
Sample No.	**D-5**
Depth (ft)	**25**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay with sand (CL)s and caliche

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 2.135	■ 3.405	▲ 5.835
Shear Stress @ End of Test (ksf)	○ 1.427	□ 2.468	△ 5.203
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.04	11.04	11.04
Dry Density (pcf)	118.7	119.8	126.1
Saturation (%)	70.9	73.3	88.5
Soil Height Before Shearing (in.)	0.9985	0.9920	0.9859
Final Moisture Content (%)	18.9	18.2	15.7

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

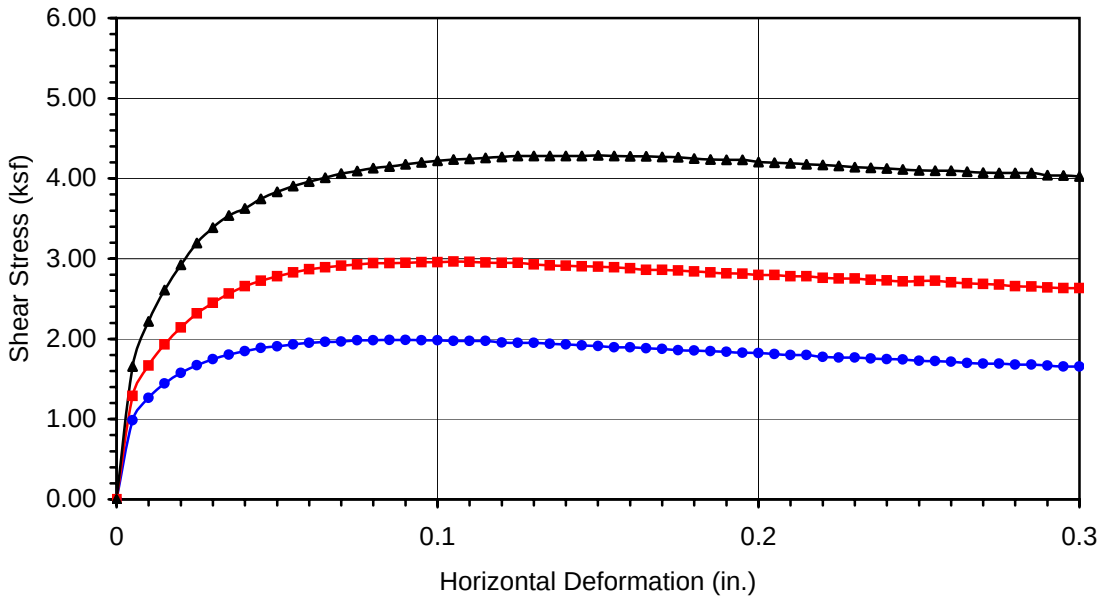
DIRECT SHEAR TEST

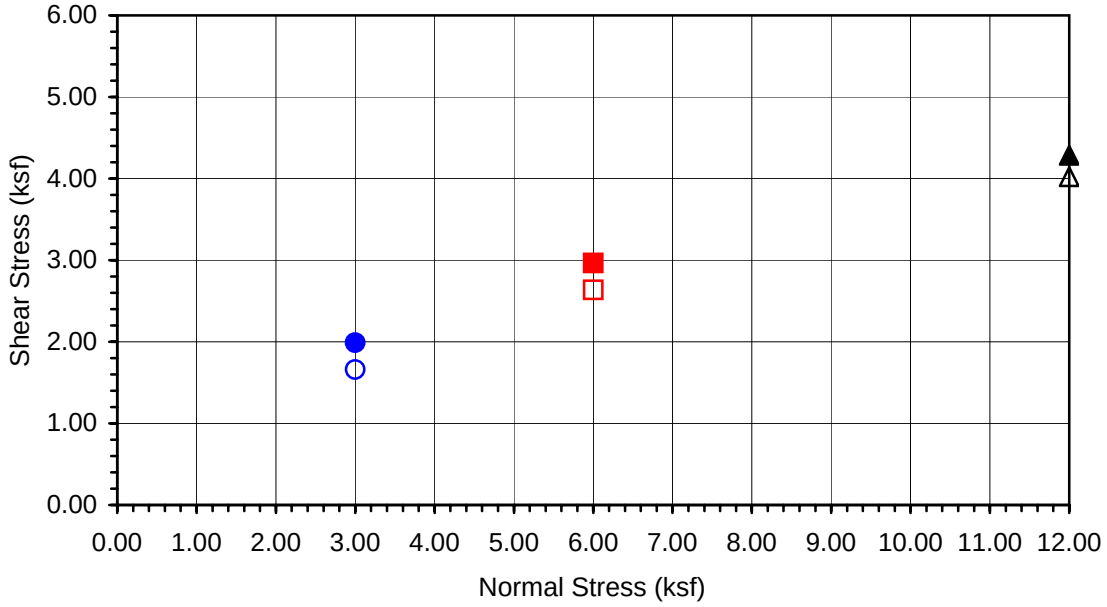
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/18/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/26/08
Boring No.:	A-08-016	Sample Type:	Drive		
Sample No.:	D-9	Depth (ft.):	45.0		

Soil Identification: Brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	203.22	204.46	204.92
Weight of Ring(gm):	43.86	44.29	43.71
Before Shearing			
Weight of Wet Sample+Cont.(gm):	189.44	189.44	189.44
Weight of Dry Sample+Cont.(gm):	163.89	163.89	163.89
Weight of Container(gm):	39.22	39.22	39.22
Vertical Rdg.(in): Initial	0.2802	0.2069	0.2638
Vertical Rdg.(in): Final	0.3088	0.2516	0.3284
After Shearing			
Weight of Wet Sample+Cont.(gm):	197.93	195.26	193.53
Weight of Dry Sample+Cont.(gm):	170.69	170.10	169.98
Weight of Container(gm):	39.24	39.04	39.47
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-016**
Sample No.	**D-9**
Depth (ft)	**45**

Sample Type:

Drive

Soil Identification:
Brown lean clay (CL)

Normal Stress (kip/ft²)	3.000	6.000	12.000
Peak Shear Stress (kip/ft²)	● 1.987	■ 2.965	▲ 4.288
Shear Stress @ End of Test (ksf)	○ 1.657	□ 2.634	△ 4.024
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	20.49	20.49	20.49
Dry Density (pcf)	110.0	110.6	111.3
Saturation (%)	103.9	105.5	107.5
Soil Height Before Shearing (in.)	0.9714	0.9553	0.9354
Final Moisture Content (%)	20.7	19.2	18.0

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

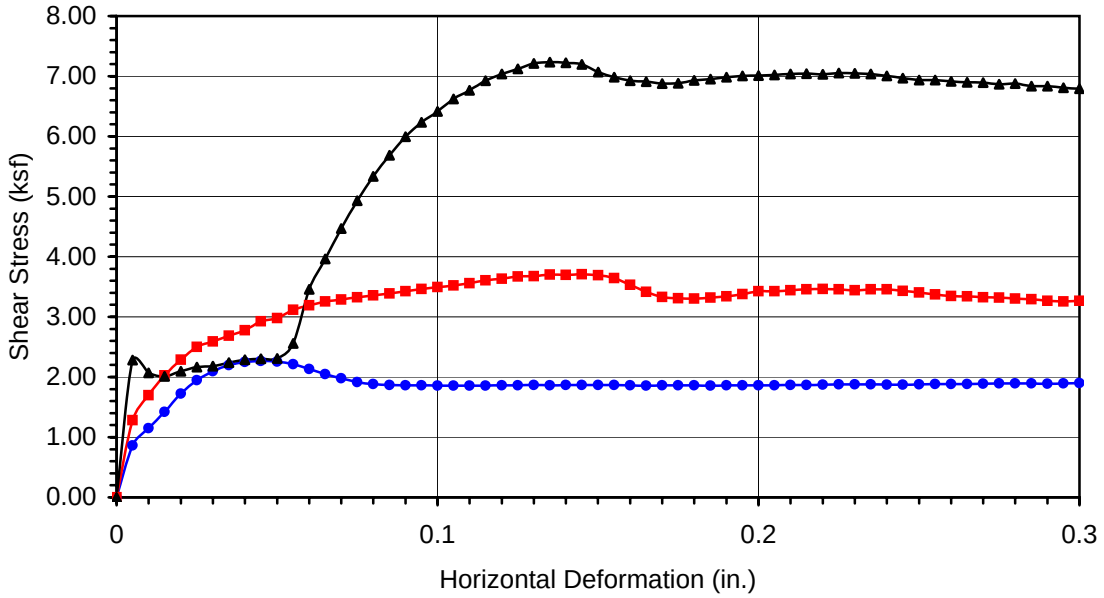
DIRECT SHEAR TEST

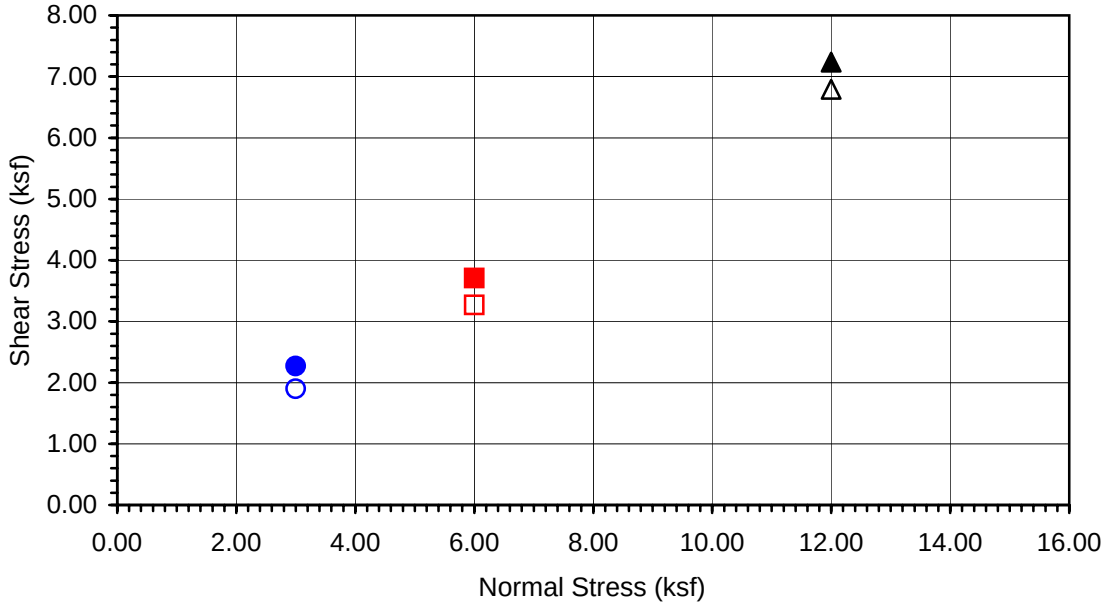
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/18/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/28/08
Boring No.:	A-08-016	Sample Type:	Drive		
Sample No.:	D-13	Depth (ft.):	65.0		

Soil Identification: Olive brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	195.75	197.20	199.83
Weight of Ring(gm):	43.38	43.53	43.74
Before Shearing			
Weight of Wet Sample+Cont.(gm):	167.41	167.41	167.41
Weight of Dry Sample+Cont.(gm):	143.83	143.83	143.83
Weight of Container(gm):	38.78	38.78	38.78
Vertical Rdg.(in): Initial	0.2862	0.3088	0.2962
Vertical Rdg.(in): Final	0.3049	0.3460	0.3442
After Shearing			
Weight of Wet Sample+Cont.(gm):	190.36	190.16	220.09
Weight of Dry Sample+Cont.(gm):	159.92	161.58	191.70
Weight of Container(gm):	38.93	38.99	66.81
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-016**
Sample No.	**D-13**
Depth (ft)	**65**

Sample Type:

Drive

Soil Identification:
Olive brown clayey sand (SC)

Normal Stress (kip/ft²)	3.000	6.000	12.000
Peak Shear Stress (kip/ft²)	● 2.267	■ 3.707	▲ 7.234
Shear Stress @ End of Test (ksf)	○ 1.899	□ 3.266	△ 6.791
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.45	22.45	22.45
Dry Density (pcf)	103.5	104.4	106.0
Saturation (%)	96.4	98.5	102.7
Soil Height Before Shearing (in.)	0.9813	0.9628	0.9520
Final Moisture Content (%)	25.2	23.3	22.7

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/22/08
Project No.:	370900.02.GE.0S	Checked By:	J. Ward	Date:	09/30/08
Boring No.:	A-08-017	Sample Type:	Drive		
Sample No.:	D-2	Depth (ft.):	10.0		

Soil Identification: Olive brown lean clay with sand (CL)s and caliche

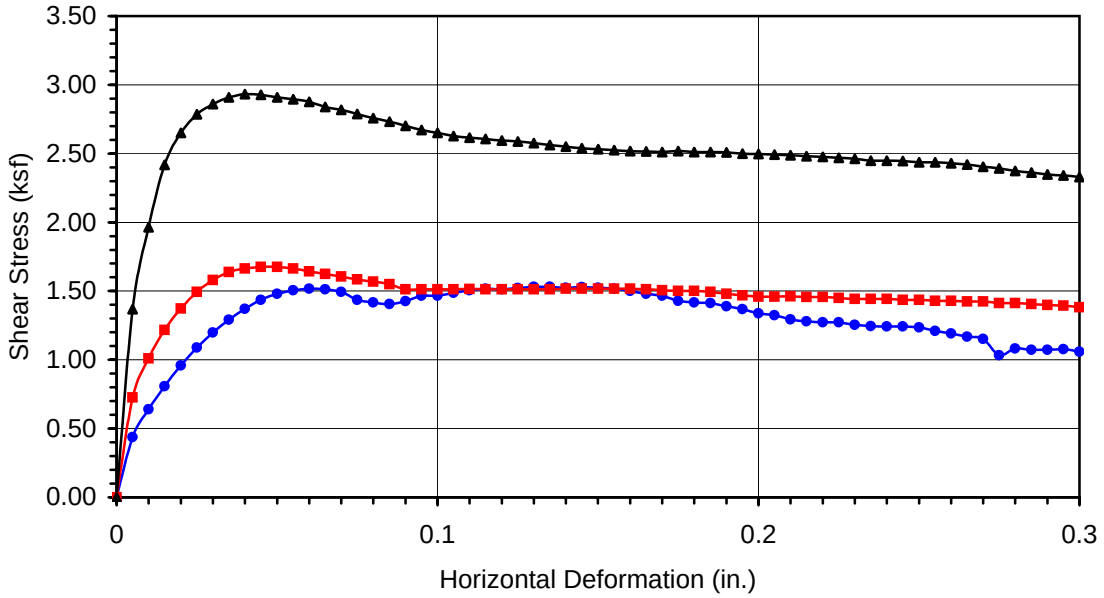
Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	196.12	198.20	201.35
Weight of Ring(gm):	44.34	46.88	46.12

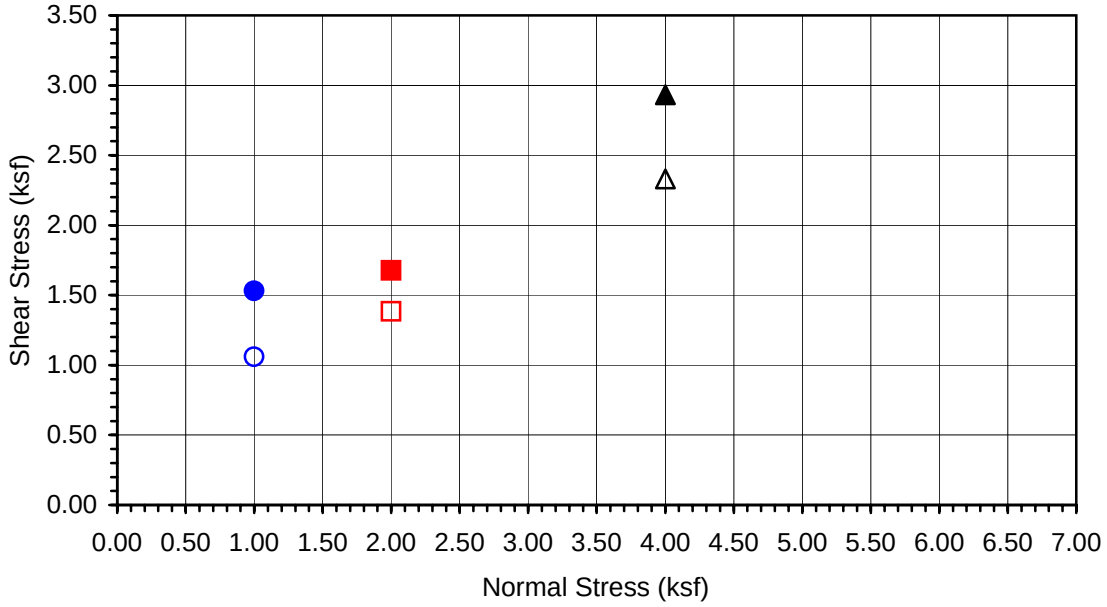
Before Shearing

Weight of Wet Sample+Cont.(gm):	189.90	189.90	189.90
Weight of Dry Sample+Cont.(gm):	162.68	162.68	162.68
Weight of Container(gm):	38.92	38.92	38.92
Vertical Rdg.(in): Initial	0.1617	0.1066	0.1220
Vertical Rdg.(in): Final	0.1689	0.1215	0.1417

After Shearing

Weight of Wet Sample+Cont.(gm):	192.75	191.31	193.62
Weight of Dry Sample+Cont.(gm):	161.86	160.14	162.56
Weight of Container(gm):	39.15	39.45	39.24
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-017**
Sample No.	**D-2**
Depth (ft)	**10**

Sample Type:

Drive

Soil Identification:
Olive brown lean clay with sand (CL)s and caliche

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.531	■ 1.676	▲ 2.933
Shear Stress @ End of Test (ksf)	○ 1.059	□ 1.383	△ 2.330
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	21.99	21.99	21.99
Dry Density (pcf)	103.5	103.2	105.8
Saturation (%)	94.4	93.7	100.2
Soil Height Before Shearing (in.)	0.9928	0.9851	0.9803
Final Moisture Content (%)	25.2	25.8	25.2

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

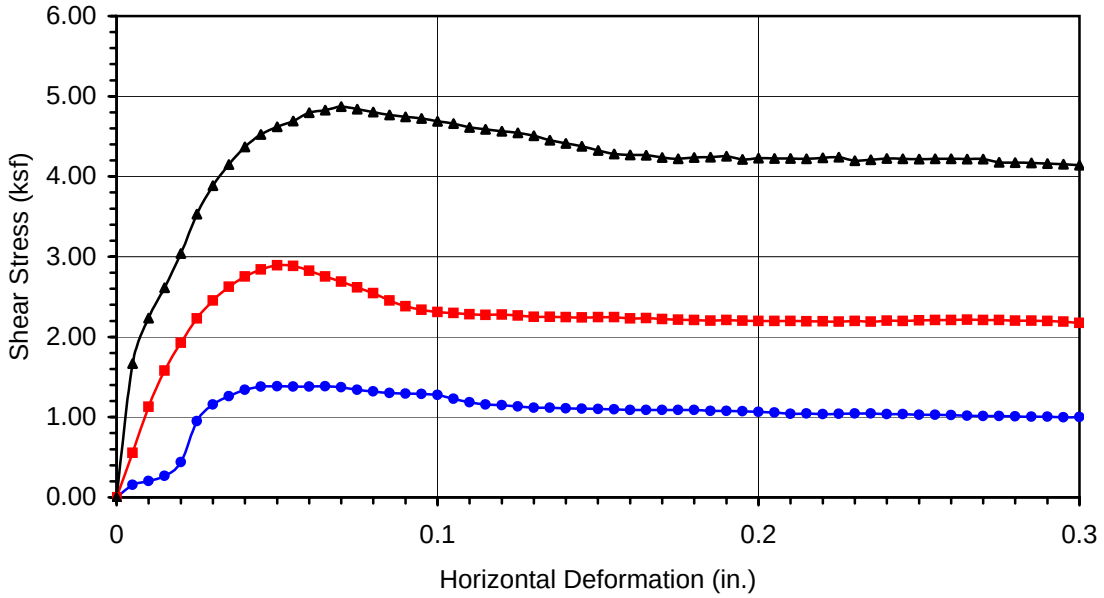
DIRECT SHEAR TEST

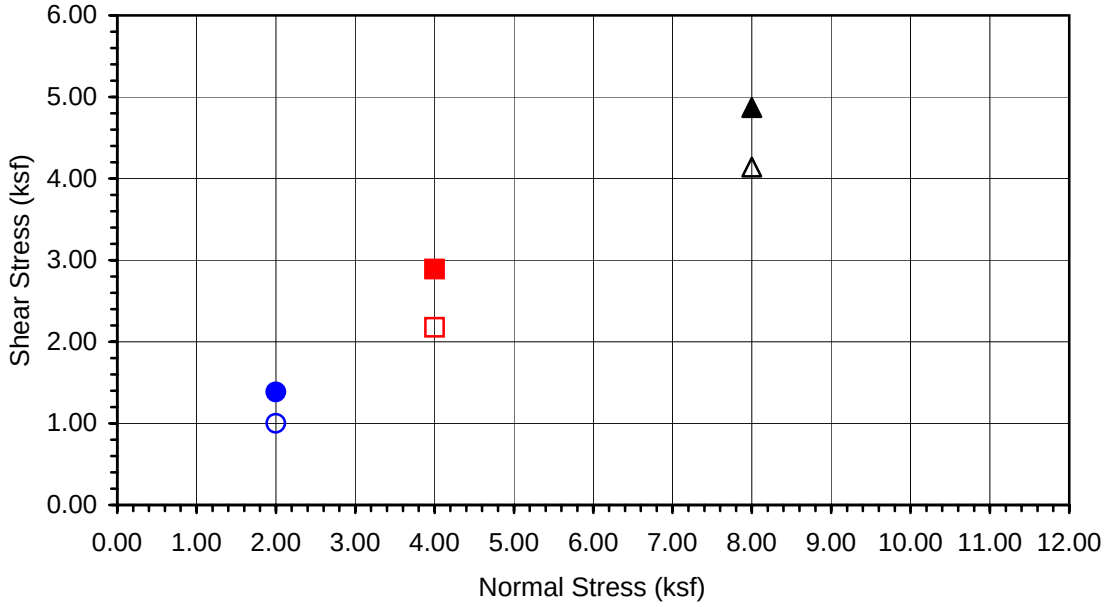
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/23/08
Project No.:	370900.02.GE.0S	Checked By:	J. Ward	Date:	09/30/08
Boring No.:	A-08-017	Sample Type:	Drive		
Sample No.:	D-8	Depth (ft.):	40.0		

Soil Identification: Olive lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	199.07	199.66	200.29
Weight of Ring(gm):	43.36	43.52	42.94
Before Shearing			
Weight of Wet Sample+Cont.(gm):	182.17	182.17	182.17
Weight of Dry Sample+Cont.(gm):	155.87	155.87	155.87
Weight of Container(gm):	39.88	39.88	39.88
Vertical Rdg.(in): Initial	0.2882	0.2316	0.2746
Vertical Rdg.(in): Final	0.3007	0.2508	0.3058
After Shearing			
Weight of Wet Sample+Cont.(gm):	195.53	195.81	195.19
Weight of Dry Sample+Cont.(gm):	164.46	164.79	165.82
Weight of Container(gm):	39.24	39.24	39.49
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-017**
Sample No.	**D-8**
Depth (ft)	**40**

Sample Type:

Drive

Soil Identification:
Olive lean clay (CL)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.386	■ 2.892	▲ 4.870
Shear Stress @ End of Test (ksf)	○ 1.000	□ 2.175	△ 4.140
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.67	22.67	22.67
Dry Density (pcf)	105.6	105.9	106.7
Saturation (%)	102.6	103.3	105.5
Soil Height Before Shearing (in.)	0.9875	0.9808	0.9688
Final Moisture Content (%)	24.8	24.7	23.2

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-018	Sample Type:	Remolded to 95% Max. Dens. @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	0-7		

Soil Identification: Dark brown sandy lean clay s(CL)

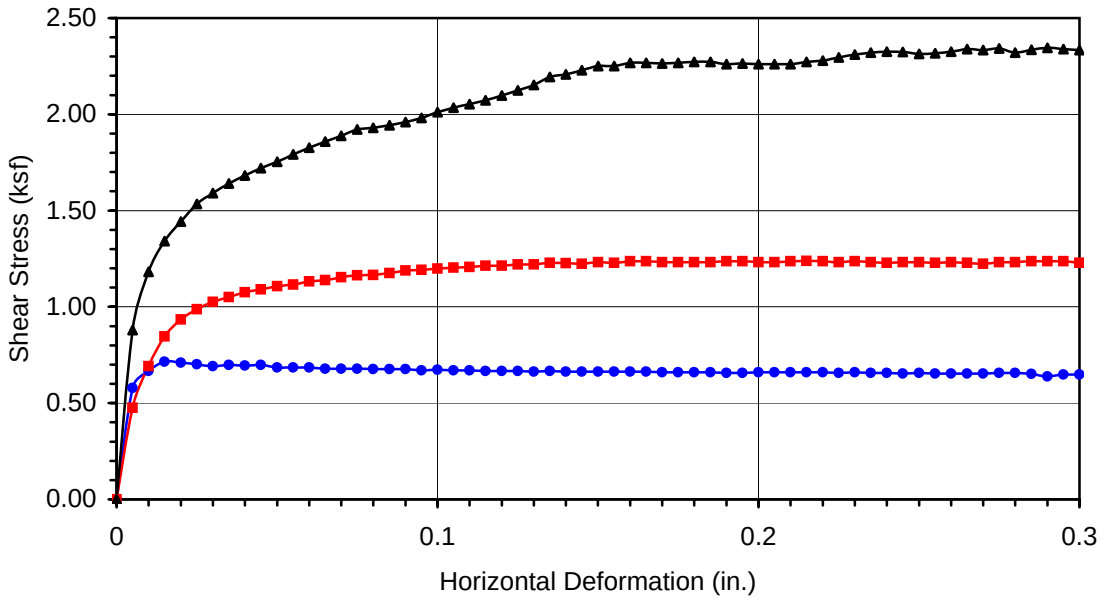
Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	190.51	190.92	193.13
Weight of Ring(gm):	42.79	43.20	45.41

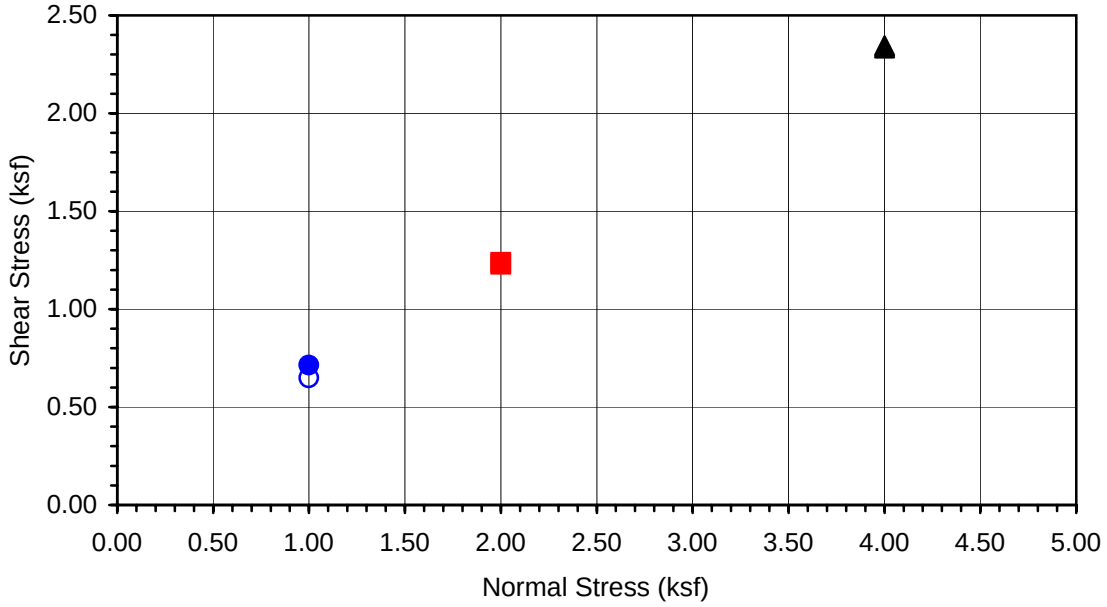
Before Shearing

Weight of Wet Sample+Cont.(gm):	228.88	228.88	228.88
Weight of Dry Sample+Cont.(gm):	212.40	212.40	212.40
Weight of Container(gm):	38.88	38.88	38.88
Vertical Rdg.(in): Initial	0.1225	0.1196	0.1208
Vertical Rdg.(in): Final	0.1078	0.1186	0.1320

After Shearing

Weight of Wet Sample+Cont.(gm):	198.53	197.15	217.37
Weight of Dry Sample+Cont.(gm):	173.10	173.47	195.39
Weight of Container(gm):	39.27	39.05	61.09
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-018**
Sample No.	**Bag-1**
Depth (ft)	**0-7**

Sample Type:
Remolded to 95% Max. Dens. @ Opt. MC

Soil Identification:
Dark brown sandy lean clay s(CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.714	■ 1.239	▲ 2.345
Shear Stress @ End of Test (ksf)	○ 0.648	□ 1.229	△ 2.333
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.50	9.50	9.50
Dry Density (pcf)	112.2	112.2	112.2
Saturation (%)	51.0	51.0	51.0
Soil Height Before Shearing (in.)	1.0147	1.0010	0.9888
Final Moisture Content (%)	19.0	17.6	16.4

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

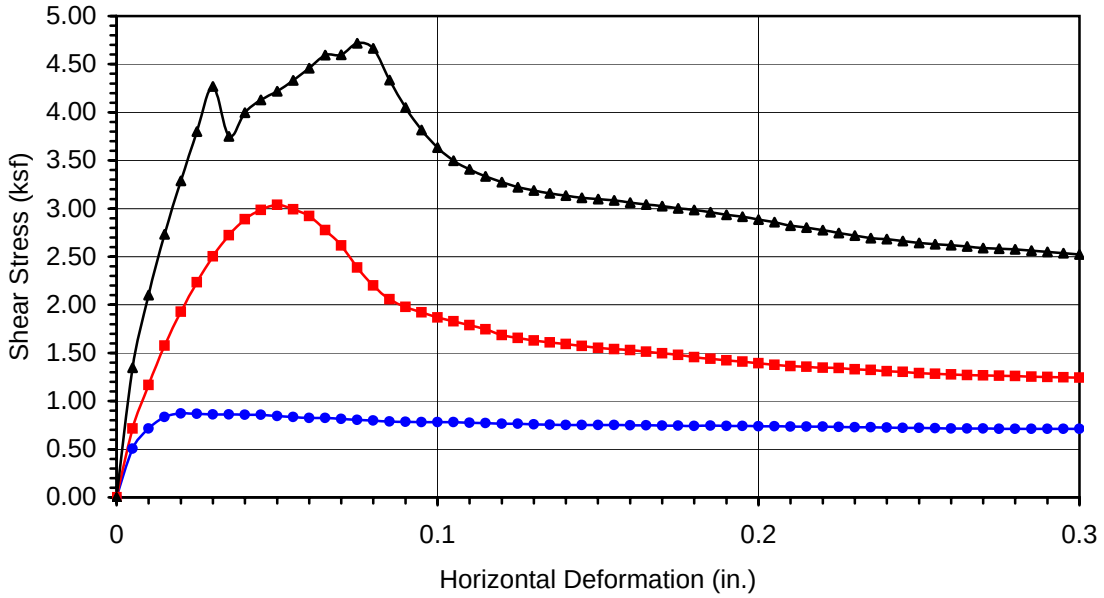
DIRECT SHEAR TEST

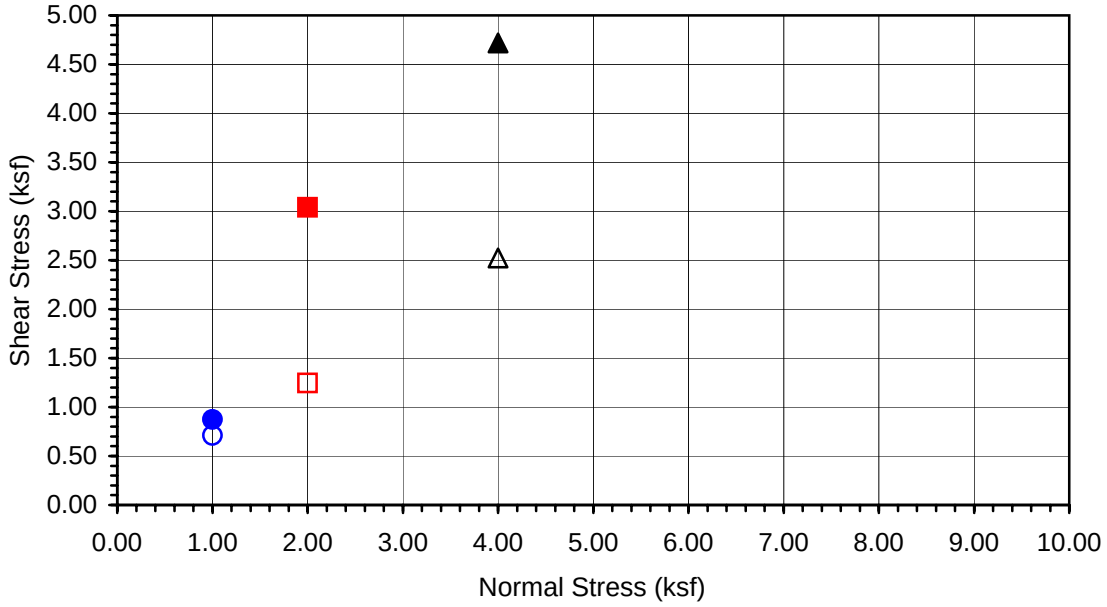
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-021	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Yellowish brown lean clay with sand (CL)s

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	188.11	201.57	205.46
Weight of Ring(gm):	43.31	43.32	43.09
Before Shearing			
Weight of Wet Sample+Cont.(gm):	182.55	182.55	182.55
Weight of Dry Sample+Cont.(gm):	166.54	166.54	166.54
Weight of Container(gm):	39.01	39.01	39.01
Vertical Rdg.(in): Initial	0.0000	0.2590	0.2723
Vertical Rdg.(in): Final	0.0123	0.2451	0.2722
After Shearing			
Weight of Wet Sample+Cont.(gm):	195.38	203.62	205.95
Weight of Dry Sample+Cont.(gm):	165.07	174.97	178.14
Weight of Container(gm):	39.01	38.95	38.99
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-021**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay with sand (CL)s

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.871	■ 3.040	▲ 4.719
Shear Stress @ End of Test (ksf)	○ 0.710	□ 1.245	△ 2.524
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.55	12.55	12.55
Dry Density (pcf)	107.0	116.9	120.0
Saturation (%)	58.9	76.8	83.7
Soil Height Before Shearing (in.)	1.0123	1.0139	1.0001
Final Moisture Content (%)	24.0	21.1	20.0

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

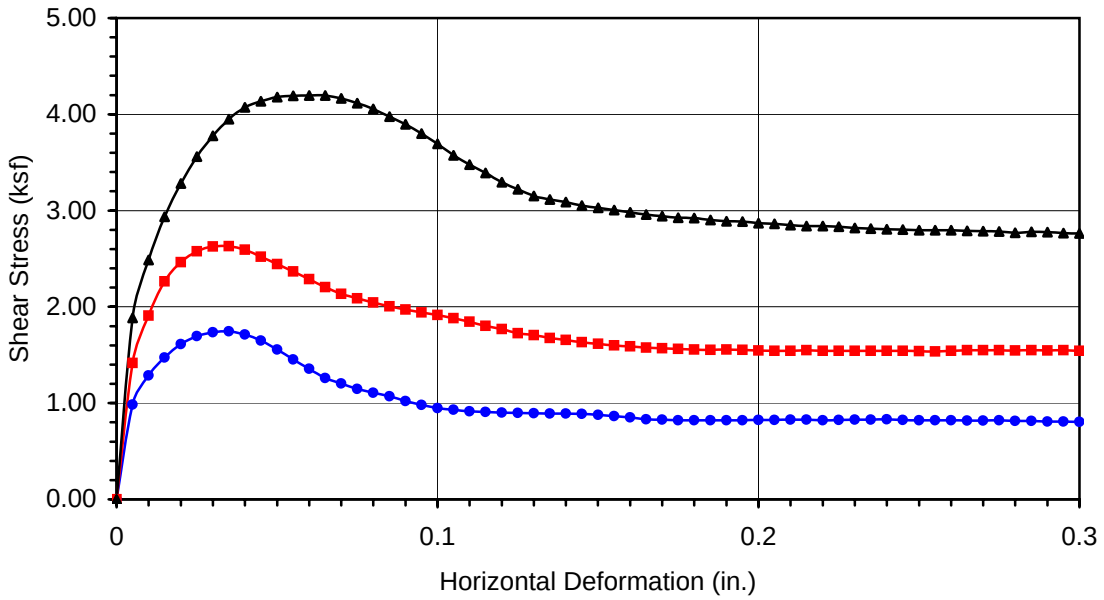
DIRECT SHEAR TEST

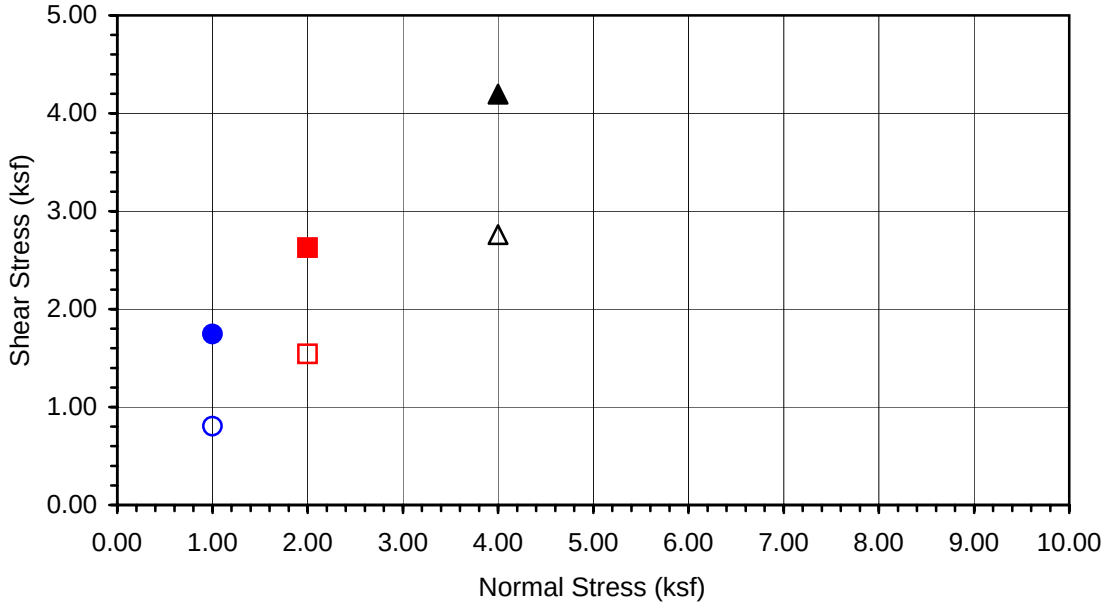
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/21/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-022	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Yellowish brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	207.85	209.23	211.12
Weight of Ring(gm):	43.18	42.89	43.19
Before Shearing			
Weight of Wet Sample+Cont.(gm):	191.37	191.37	191.37
Weight of Dry Sample+Cont.(gm):	173.17	173.17	173.17
Weight of Container(gm):	39.12	39.12	39.12
Vertical Rdg.(in): Initial	0.3155	0.3335	0.2590
Vertical Rdg.(in): Final	0.3219	0.3483	0.2799
After Shearing			
Weight of Wet Sample+Cont.(gm):	227.49	231.98	207.80
Weight of Dry Sample+Cont.(gm):	204.58	210.45	186.42
Weight of Container(gm):	60.86	64.56	39.28
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-022**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Yellowish brown clayey sand (SC)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.745	■ 2.628	▲ 4.197
Shear Stress @ End of Test (ksf)	○ 0.805	□ 1.544	△ 2.763
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	13.58	13.58	13.58
Dry Density (pcf)	120.6	121.8	123.0
Saturation (%)	92.1	95.5	98.9
Soil Height Before Shearing (in.)	0.9936	0.9852	0.9791
Final Moisture Content (%)	15.9	14.8	14.5

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

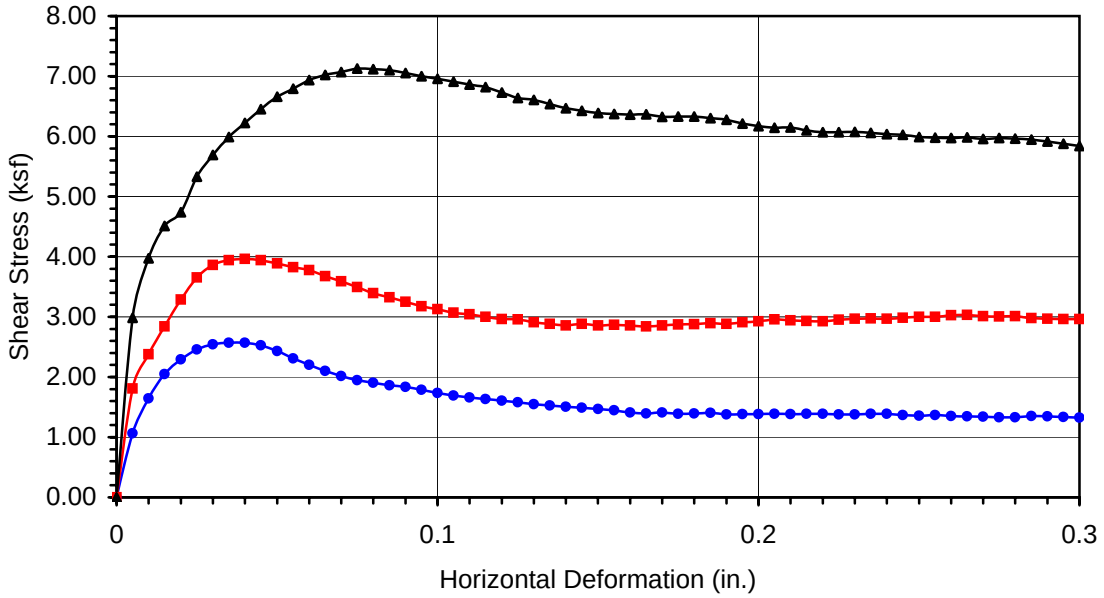
DIRECT SHEAR TEST

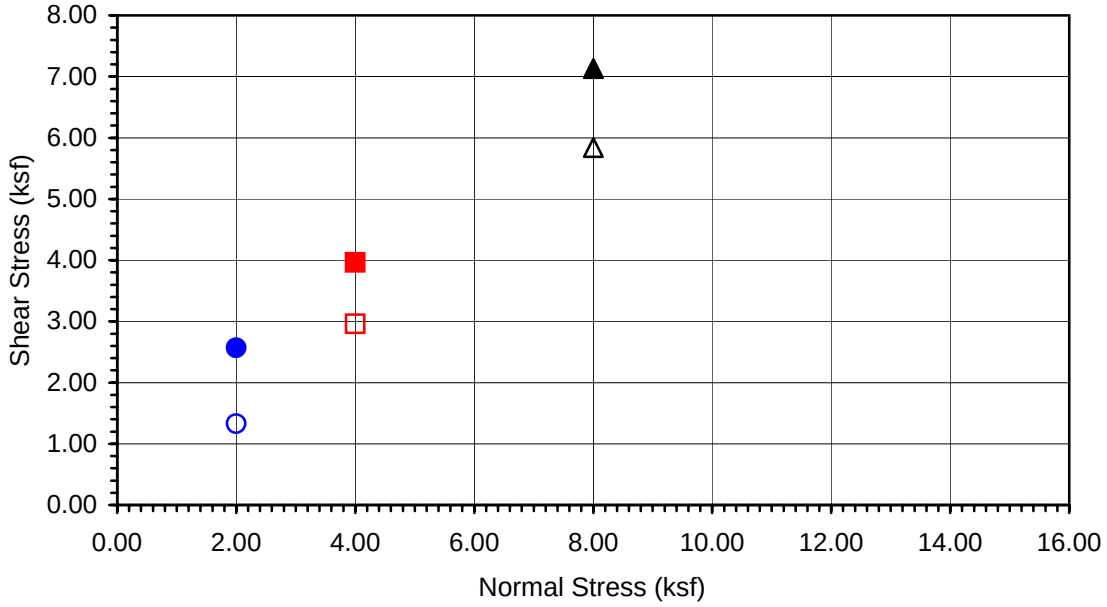
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/26/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-023	Sample Type:	Drive		
Sample No.:	D-5	Depth (ft.):	25.0		

Soil Identification: Dark brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	204.00	202.44	203.26
Weight of Ring(gm):	43.26	43.37	43.29
Before Shearing			
Weight of Wet Sample+Cont.(gm):	212.68	212.68	212.68
Weight of Dry Sample+Cont.(gm):	194.50	194.50	194.50
Weight of Container(gm):	39.52	39.52	39.52
Vertical Rdg.(in): Initial	0.2761	0.2661	0.2583
Vertical Rdg.(in): Final	0.2790	0.2733	0.2760
After Shearing			
Weight of Wet Sample+Cont.(gm):	204.11	203.09	202.77
Weight of Dry Sample+Cont.(gm):	180.54	179.48	181.14
Weight of Container(gm):	38.85	39.72	39.20
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-023**
Sample No.	**D-5**
Depth (ft)	**25**

Sample Type:

Drive

Soil Identification:
Dark brown clayey sand (SC)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 2.568	■ 3.961	▲ 7.130
Shear Stress @ End of Test (ksf)	○ 1.327	□ 2.961	△ 5.838
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.73	11.73	11.73
Dry Density (pcf)	119.6	118.4	119.1
Saturation (%)	77.5	74.8	76.2
Soil Height Before Shearing (in.)	0.9971	0.9928	0.9823
Final Moisture Content (%)	16.6	16.9	15.2

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

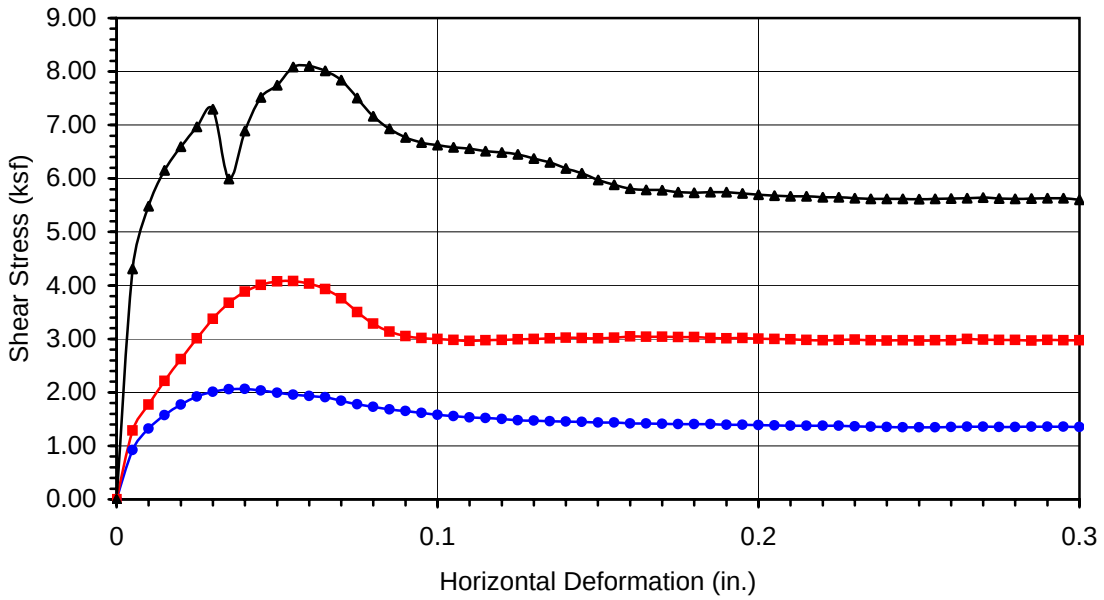
DIRECT SHEAR TEST

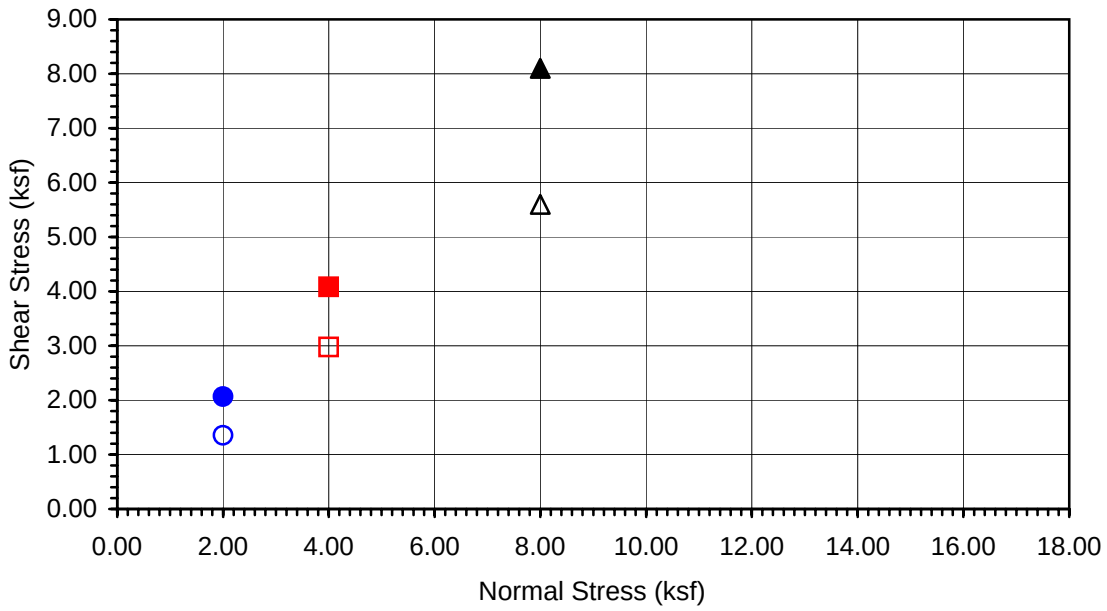
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/27/08
Boring No.:	A-08-023	Sample Type:	Drive		
Sample No.:	D-9	Depth (ft.):	45.0		

Soil Identification: Yellowish brown silty fine sand (SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	194.98	195.51	197.24
Weight of Ring(gm):	43.18	43.48	42.83
Before Shearing			
Weight of Wet Sample+Cont.(gm):	184.72	184.72	184.72
Weight of Dry Sample+Cont.(gm):	172.13	172.13	172.13
Weight of Container(gm):	39.15	39.15	39.15
Vertical Rdg.(in): Initial	0.0000	0.2698	0.2586
Vertical Rdg.(in): Final	-0.0100	0.2849	0.2750
After Shearing			
Weight of Wet Sample+Cont.(gm):	197.94	198.11	198.37
Weight of Dry Sample+Cont.(gm):	175.78	176.87	178.20
Weight of Container(gm):	39.19	39.29	38.57
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-023**
Sample No.	**D-9**
Depth (ft)	**45**

Sample Type:

Drive

Soil Identification:
Yellowish brown silty fine sand (SM)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 2.065	■ 4.084	▲ 8.102
Shear Stress @ End of Test (ksf)	○ 1.355	□ 2.974	△ 5.602
Deformation Rate (in./min.)	0.0033	0.0033	0.0033
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.47	9.47	9.47
Dry Density (pcf)	115.3	115.5	117.3
Saturation (%)	55.4	55.6	58.5
Soil Height Before Shearing (in.)	0.9900	0.9849	0.9836
Final Moisture Content (%)	16.2	15.4	14.4

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

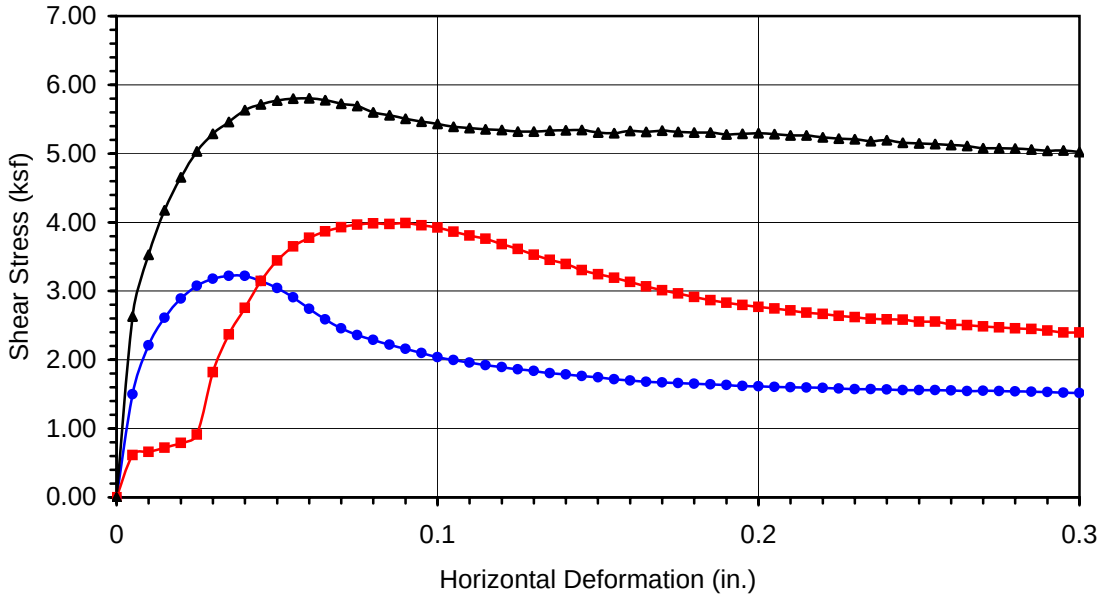
DIRECT SHEAR TEST

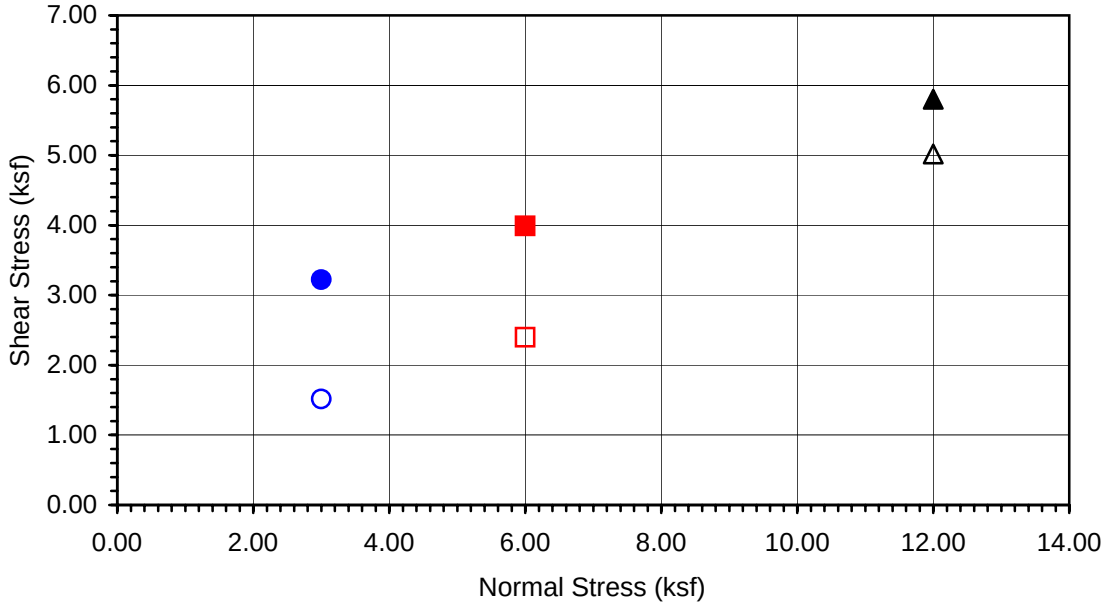
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/23/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-023	Sample Type:	Drive		
Sample No.:	D-13	Depth (ft.):	65.0		

Soil Identification: Brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	199.54	199.71	199.80
Weight of Ring(gm):	43.07	43.43	43.48
Before Shearing			
Weight of Wet Sample+Cont.(gm):	220.57	220.57	220.57
Weight of Dry Sample+Cont.(gm):	187.46	187.46	187.46
Weight of Container(gm):	40.00	40.00	40.00
Vertical Rdg.(in): Initial	0.3270	0.3004	0.3777
Vertical Rdg.(in): Final	0.3358	0.3161	0.4009
After Shearing			
Weight of Wet Sample+Cont.(gm):	196.45	195.65	195.01
Weight of Dry Sample+Cont.(gm):	167.08	166.23	165.28
Weight of Container(gm):	38.70	39.40	39.02
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-023**
Sample No.	**D-13**
Depth (ft)	**65**

Sample Type:

Drive

Soil Identification:
Brown lean clay (CL)

Normal Stress (kip/ft²)	3.000	6.000	12.000
Peak Shear Stress (kip/ft²)	● 3.222	■ 3.989	▲ 5.803
Shear Stress @ End of Test (ksf)	○ 1.515	□ 2.399	△ 5.021
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	22.45	22.45	22.45
Dry Density (pcf)	106.3	106.1	106.2
Saturation (%)	103.4	103.1	103.2
Soil Height Before Shearing (in.)	0.9912	0.9843	0.9768
Final Moisture Content (%)	22.9	23.2	23.5

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

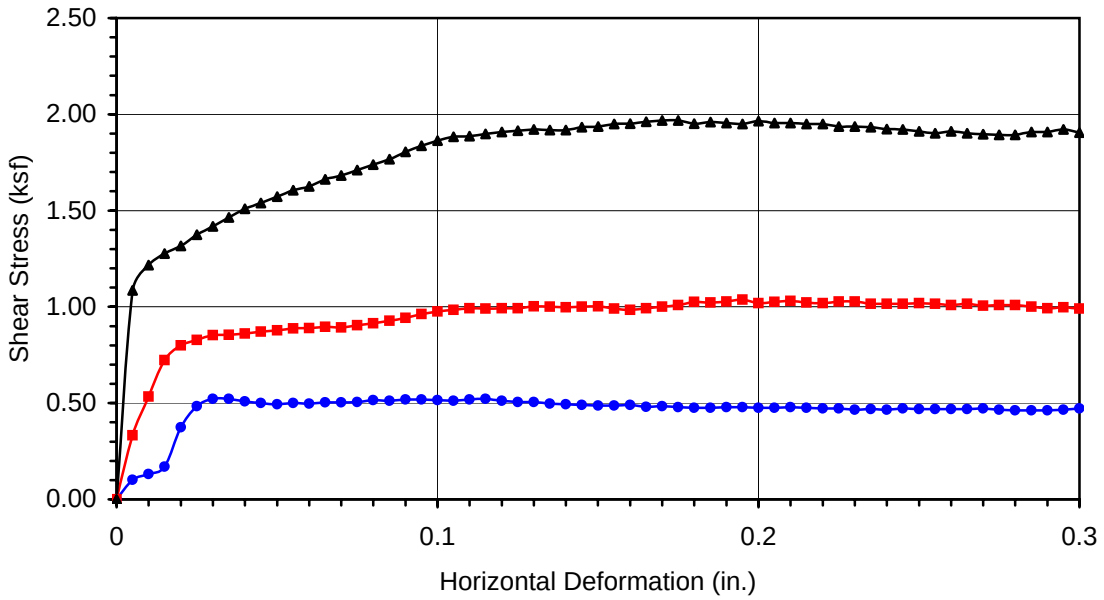
DIRECT SHEAR TEST

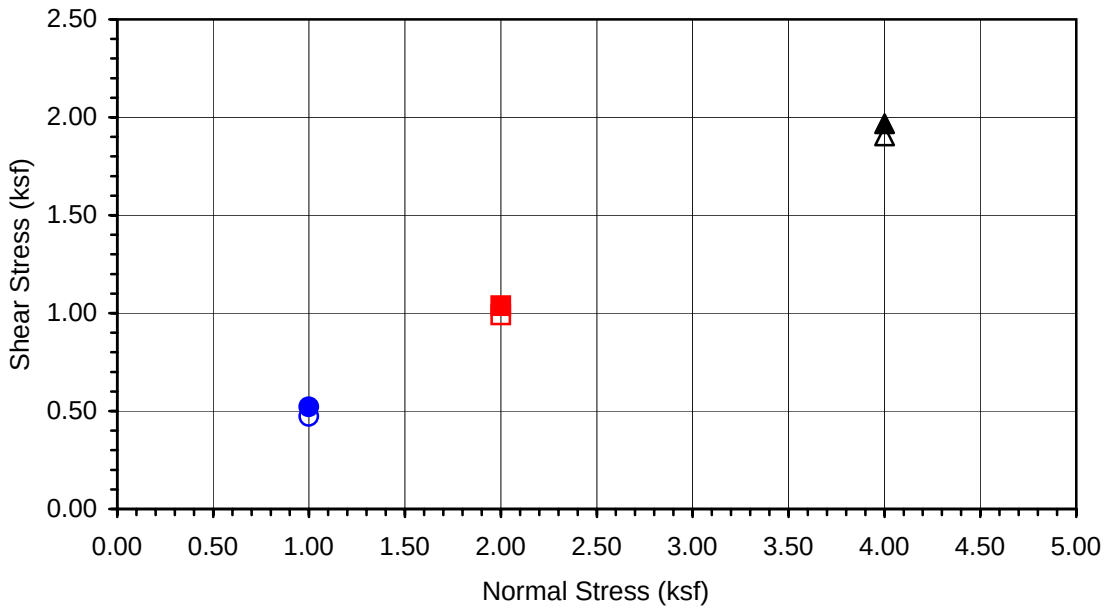
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/02/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-024	Sample Type:	Remolded to 95% Max. Dens @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	2-7		

Soil Identification: Olive lean clay with sand (CL)s

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	187.06	186.60	186.37
Weight of Ring(gm):	43.66	43.20	42.97
Before Shearing			
Weight of Wet Sample+Cont.(gm):	227.69	227.69	227.69
Weight of Dry Sample+Cont.(gm):	208.97	208.97	208.97
Weight of Container(gm):	38.83	38.83	38.83
Vertical Rdg.(in): Initial	0.0000	0.2653	0.2735
Vertical Rdg.(in): Final	0.0193	0.2630	0.2827
After Shearing			
Weight of Wet Sample+Cont.(gm):	197.07	195.80	192.91
Weight of Dry Sample+Cont.(gm):	167.04	167.20	167.00
Weight of Container(gm):	39.29	39.31	39.05
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-024**
Sample No.	**Bag-1**
Depth (ft)	**2-7**

Sample Type:
Remolded to 95% Max. Dens @ Opt. MC

Soil Identification:
Olive lean clay with sand (CL)s

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.522	■ 1.037	▲ 1.968
Shear Stress @ End of Test (ksf)	○ 0.472	□ 0.990	△ 1.905
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.00	11.00	11.00
Dry Density (pcf)	107.4	107.4	107.4
Saturation (%)	52.2	52.2	52.2
Soil Height Before Shearing (in.)	1.0193	1.0023	0.9908
Final Moisture Content (%)	23.5	22.4	20.3

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

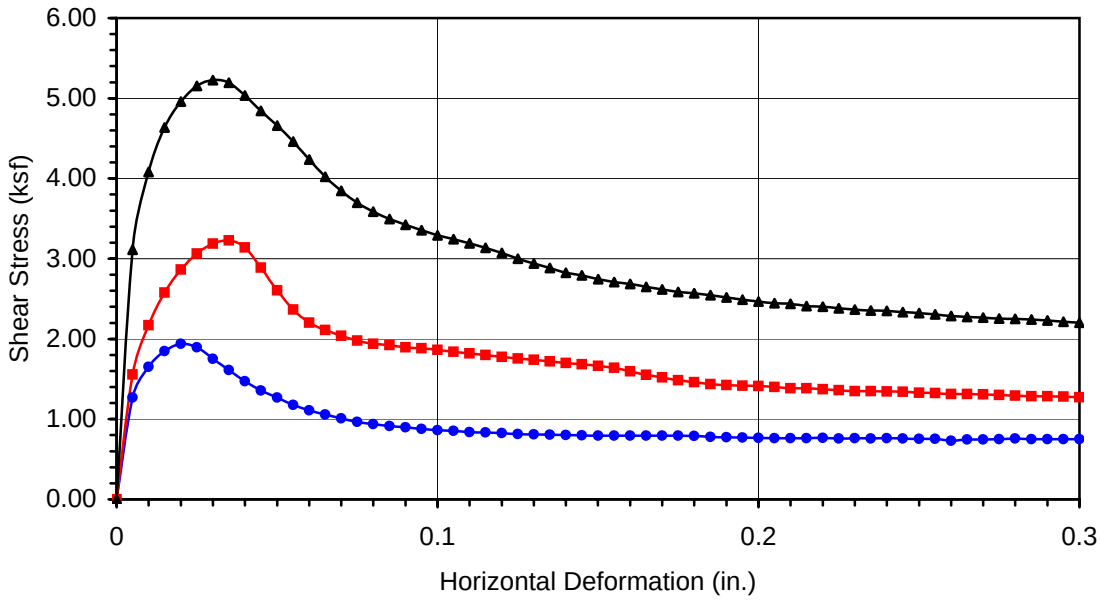
DIRECT SHEAR TEST

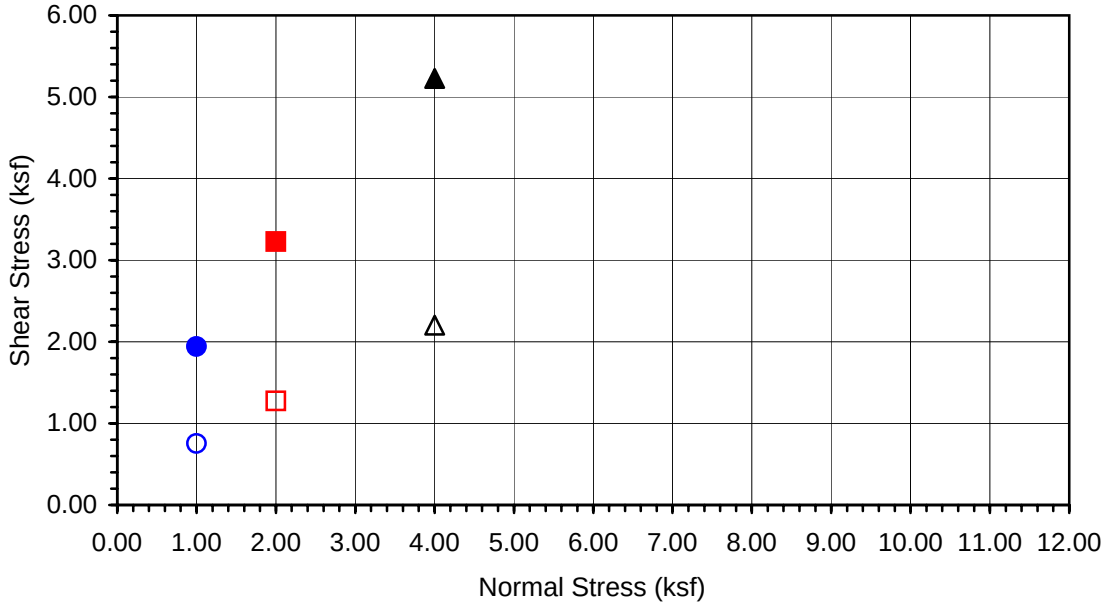
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-024	Sample Type:	Drive		
Sample No.:	D-1	Depth (ft.):	5.0		

Soil Identification: Olive brown sandy lean clay s(CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	206.14	208.47	209.97
Weight of Ring(gm):	43.12	43.27	43.47
Before Shearing			
Weight of Wet Sample+Cont.(gm):	217.06	217.06	217.06
Weight of Dry Sample+Cont.(gm):	198.78	198.78	198.78
Weight of Container(gm):	39.20	39.20	39.20
Vertical Rdg.(in): Initial	0.3509	0.3468	0.2639
Vertical Rdg.(in): Final	0.3378	0.3461	0.2768
After Shearing			
Weight of Wet Sample+Cont.(gm):	209.09	209.72	210.29
Weight of Dry Sample+Cont.(gm):	181.16	184.18	184.11
Weight of Container(gm):	39.31	39.41	38.99
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-024**
Sample No.	**D-1**
Depth (ft)	**5**

Sample Type:

Drive

Soil Identification:
Olive brown sandy lean clay s(CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.940	■ 3.229	▲ 5.228
Shear Stress @ End of Test (ksf)	○ 0.751	□ 1.273	△ 2.204
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	11.46	11.46	11.46
Dry Density (pcf)	121.6	123.3	124.2
Saturation (%)	80.2	84.2	86.7
Soil Height Before Shearing (in.)	1.0131	1.0007	0.9871
Final Moisture Content (%)	19.7	17.6	18.0

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

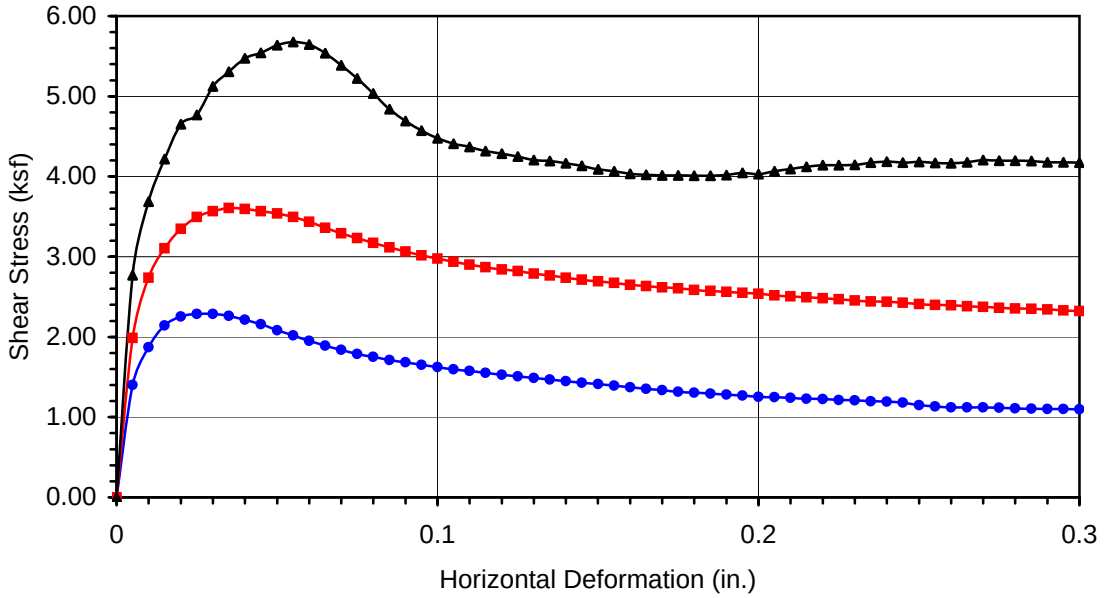
DIRECT SHEAR TEST

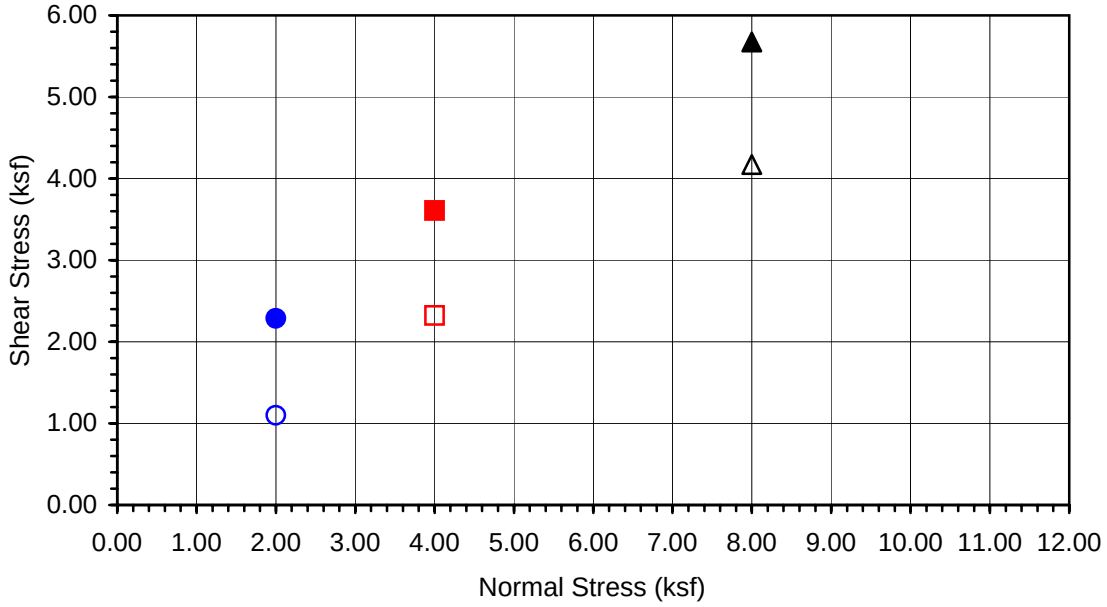
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/02/08
Boring No.:	A-08-025	Sample Type:	Drive		
Sample No.:	D-5	Depth (ft.):	25.0		

Soil Identification: Olive lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	196.88	197.07	200.26
Weight of Ring(gm):	43.18	43.28	43.10
Before Shearing			
Weight of Wet Sample+Cont.(gm):	218.95	218.95	218.95
Weight of Dry Sample+Cont.(gm):	191.34	191.34	191.34
Weight of Container(gm):	39.28	39.28	39.28
Vertical Rdg.(in): Initial	0.1183	0.1287	0.1281
Vertical Rdg.(in): Final	0.1195	0.1394	0.1450
After Shearing			
Weight of Wet Sample+Cont.(gm):	194.90	195.11	197.14
Weight of Dry Sample+Cont.(gm):	161.76	163.87	169.32
Weight of Container(gm):	38.86	39.67	39.27
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-025**
Sample No.	**D-5**
Depth (ft)	**25**

Sample Type:

Drive

Soil Identification:
Olive lean clay (CL)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 2.286	■ 3.606	▲ 5.675
Shear Stress @ End of Test (ksf)	○ 1.097	□ 2.320	△ 4.172
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	18.16	18.16	18.16
Dry Density (pcf)	108.2	108.2	110.6
Saturation (%)	87.8	88.0	93.6
Soil Height Before Shearing (in.)	0.9988	0.9893	0.9831
Final Moisture Content (%)	27.0	25.2	21.4

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

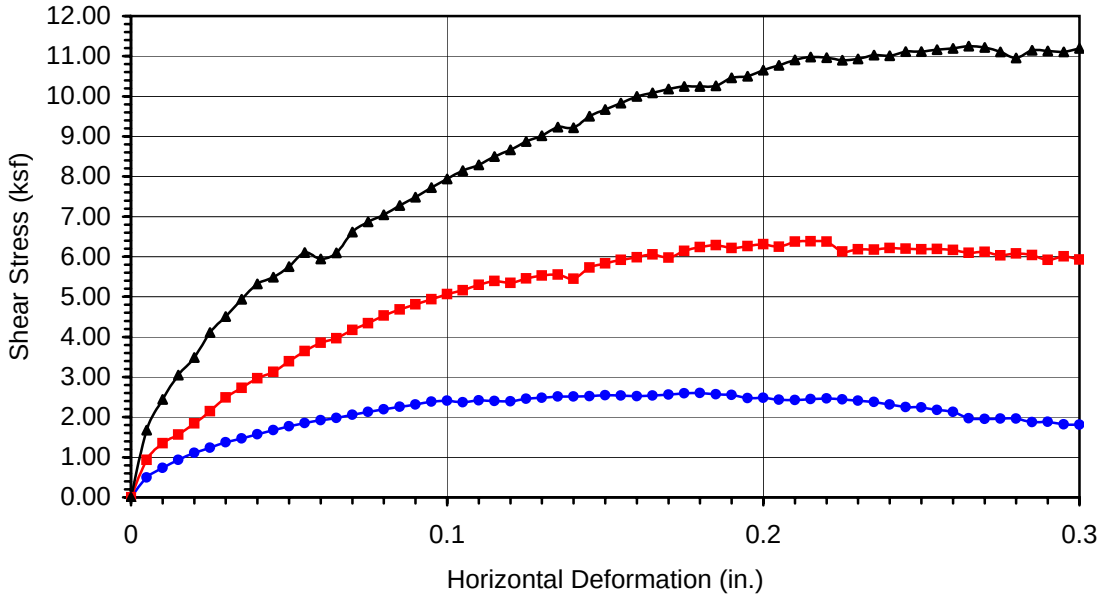
DIRECT SHEAR TEST

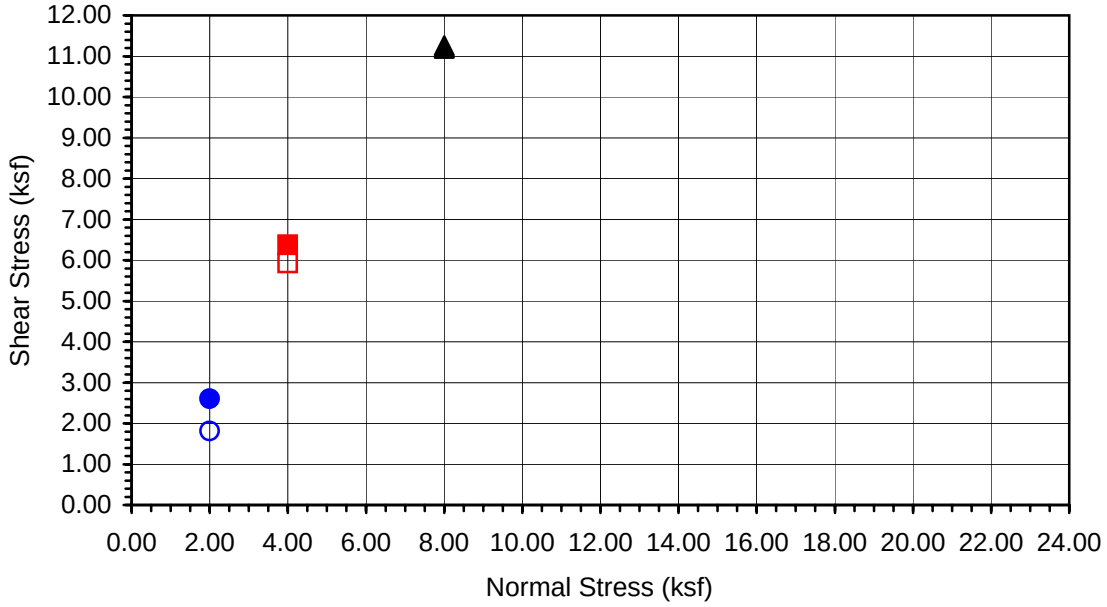
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/21/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/16/08
Boring No.:	A-08-025	Sample Type:	Drive		
Sample No.:	D-9	Depth (ft.):	45.0		

Soil Identification: Gray well-graded sand with silt and gravel (SW-SM)g

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	193.77	195.17	196.40
Weight of Ring(gm):	43.12	43.10	43.19
Before Shearing			
Weight of Wet Sample+Cont.(gm):	348.92	348.92	348.92
Weight of Dry Sample+Cont.(gm):	342.82	342.82	342.82
Weight of Container(gm):	39.16	39.16	39.16
Vertical Rdg.(in): Initial	0.2571	0.3076	0.3284
Vertical Rdg.(in): Final	0.2690	0.3250	0.3620
After Shearing			
Weight of Wet Sample+Cont.(gm):	198.70	218.68	201.07
Weight of Dry Sample+Cont.(gm):	182.02	203.60	185.50
Weight of Container(gm):	39.59	61.03	39.67
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-025**
Sample No.	**D-9**
Depth (ft)	**45**

Sample Type:

Drive

Soil Identification:
Gray well-graded sand with silt and gravel (SW-SM)g

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 2.603	■ 6.379	▲11.252
Shear Stress @ End of Test (ksf)	○ 1.811	□ 5.932	△11.195
Deformation Rate (in./min.)	0.0050	0.0050	0.0050
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	2.01	2.01	2.01
Dry Density (pcf)	122.8	124.0	124.9
Saturation (%)	14.6	15.1	15.5
Soil Height Before Shearing (in.)	0.9881	0.9826	0.9664
Final Moisture Content (%)	11.7	10.6	10.7

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

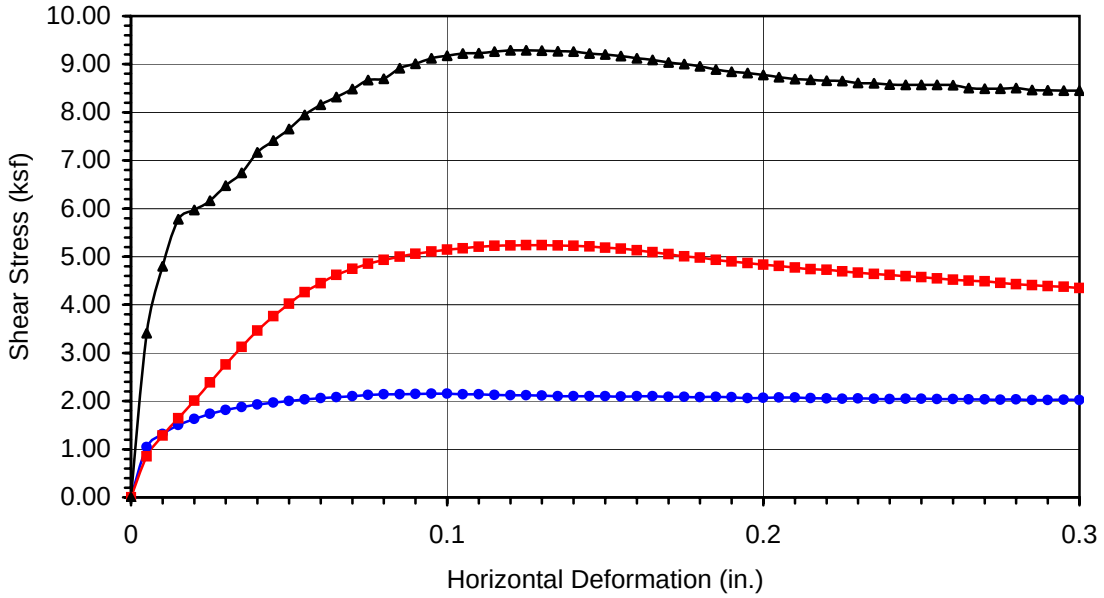
DIRECT SHEAR TEST

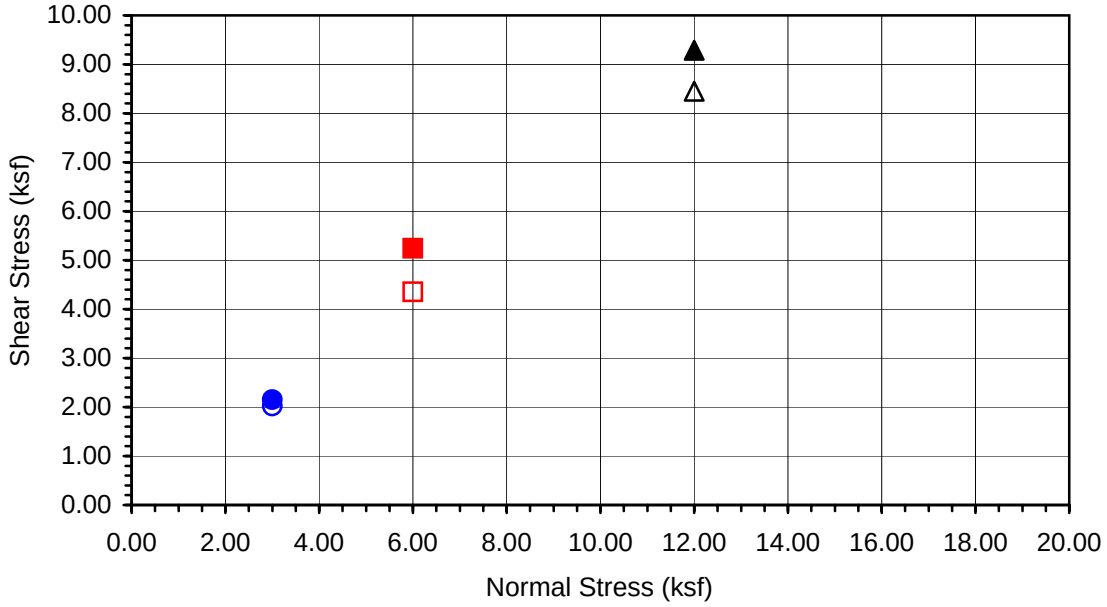
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/04/08
Boring No.:	A-08-025	Sample Type:	Drive		
Sample No.:	D-13	Depth (ft.):	65.0		

Soil Identification: Brown sandy lean clay s(CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	197.36	211.72	212.48
Weight of Ring(gm):	43.04	43.36	43.19
Before Shearing			
Weight of Wet Sample+Cont.(gm):	215.24	215.24	215.24
Weight of Dry Sample+Cont.(gm):	198.55	198.55	198.55
Weight of Container(gm):	39.80	39.80	39.80
Vertical Rdg.(in): Initial	0.3118	0.2978	0.3059
Vertical Rdg.(in): Final	0.3280	0.3175	0.3398
After Shearing			
Weight of Wet Sample+Cont.(gm):	197.33	209.00	211.00
Weight of Dry Sample+Cont.(gm):	174.72	186.51	188.05
Weight of Container(gm):	38.50	39.24	39.29
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-025**
Sample No.	**D-13**
Depth (ft)	**65**

Sample Type:

Drive

Soil Identification:
Brown sandy lean clay s(CL)

Normal Stress (kip/ft²)	3.000	6.000	12.000
Peak Shear Stress (kip/ft²)	● 2.153	■ 5.241	▲ 9.287
Shear Stress @ End of Test (ksf)	○ 2.021	□ 4.351	△ 8.454
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	10.51	10.51	10.51
Dry Density (pcf)	116.1	126.7	127.4
Saturation (%)	62.9	85.9	87.9
Soil Height Before Shearing (in.)	0.9838	0.9803	0.9661
Final Moisture Content (%)	16.6	15.3	15.4

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

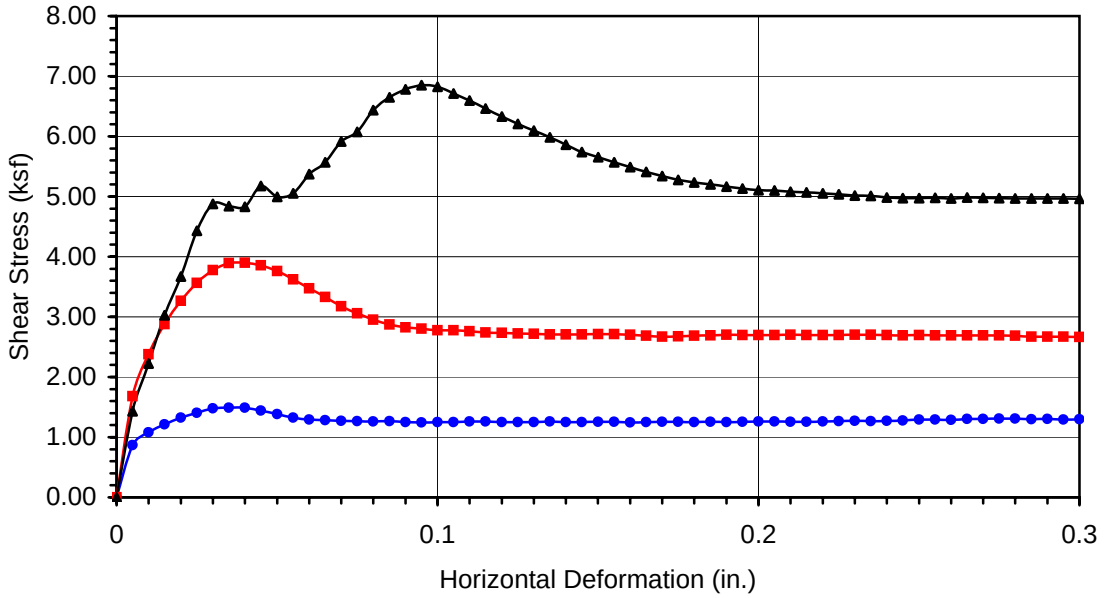
DIRECT SHEAR TEST

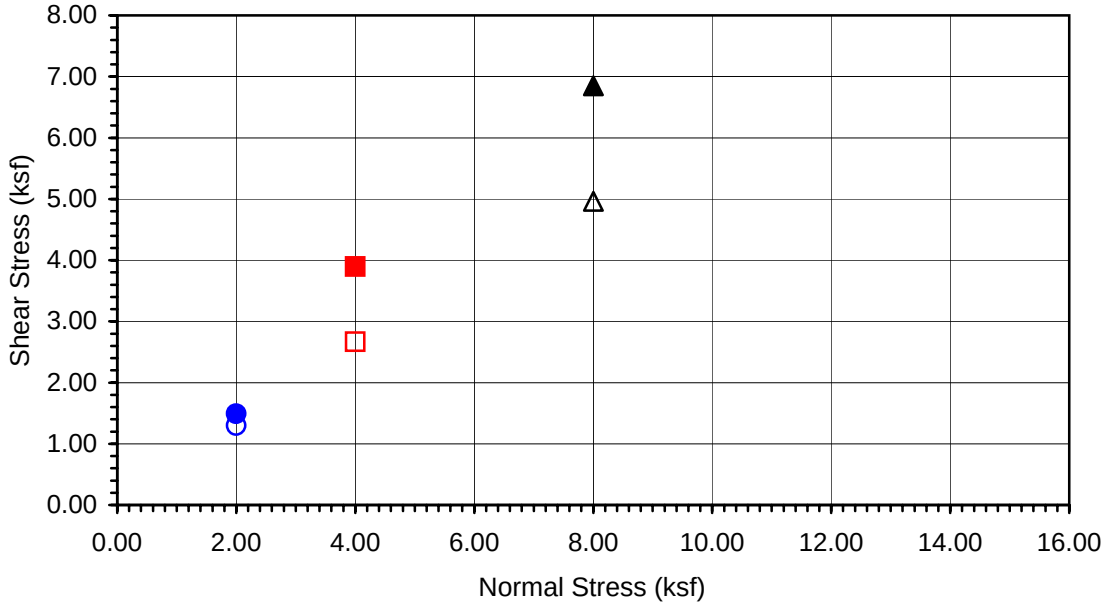
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/22/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/25/08
Boring No.:	A-08-026	Sample Type:	Drive		
Sample No.:	D-6	Depth (ft.):	30.0		

Soil Identification: Yellowish brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	209.63	213.32	214.34
Weight of Ring(gm):	46.46	46.15	44.96
Before Shearing			
Weight of Wet Sample+Cont.(gm):	207.98	207.98	207.98
Weight of Dry Sample+Cont.(gm):	188.31	188.31	188.31
Weight of Container(gm):	38.60	38.60	38.60
Vertical Rdg.(in): Initial	0.2882	0.2713	0.3337
Vertical Rdg.(in): Final	0.2993	0.2840	0.3571
After Shearing			
Weight of Wet Sample+Cont.(gm):	204.51	209.31	210.74
Weight of Dry Sample+Cont.(gm):	177.97	185.66	188.26
Weight of Container(gm):	39.04	39.69	39.63
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-026**
Sample No.	**D-6**
Depth (ft)	**30.0**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay (CL)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.490	■ 3.898	▲ 6.850
Shear Stress @ End of Test (ksf)	○ 1.298	□ 2.666	△ 4.961
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	13.14	13.14	13.14
Dry Density (pcf)	119.9	122.9	124.5
Saturation (%)	87.5	95.4	100.3
Soil Height Before Shearing (in.)	0.9889	0.9873	0.9766
Final Moisture Content (%)	19.1	16.2	15.1

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

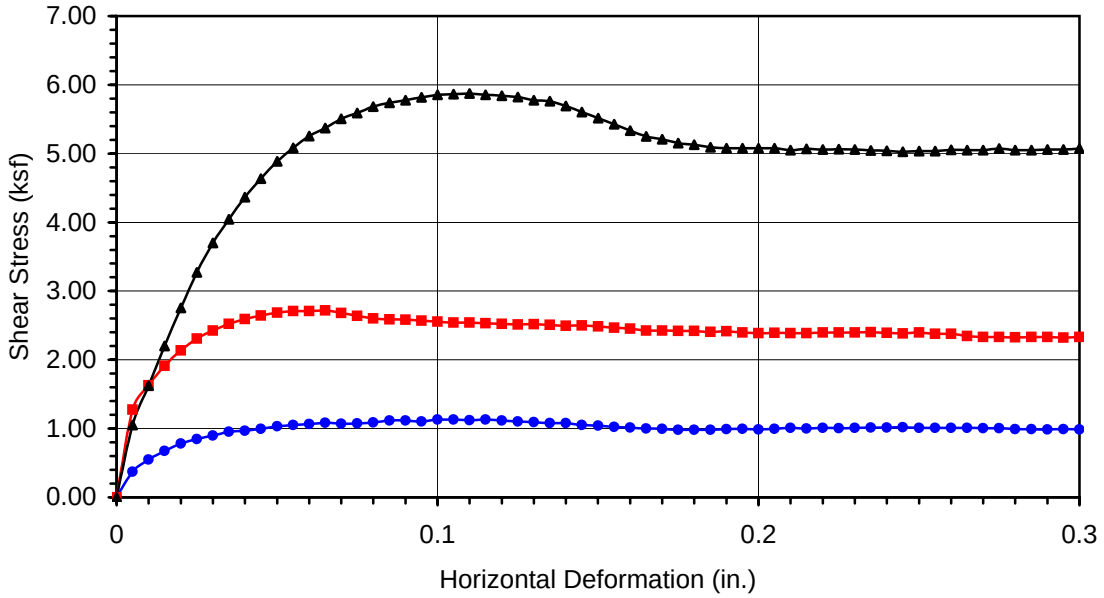
DIRECT SHEAR TEST

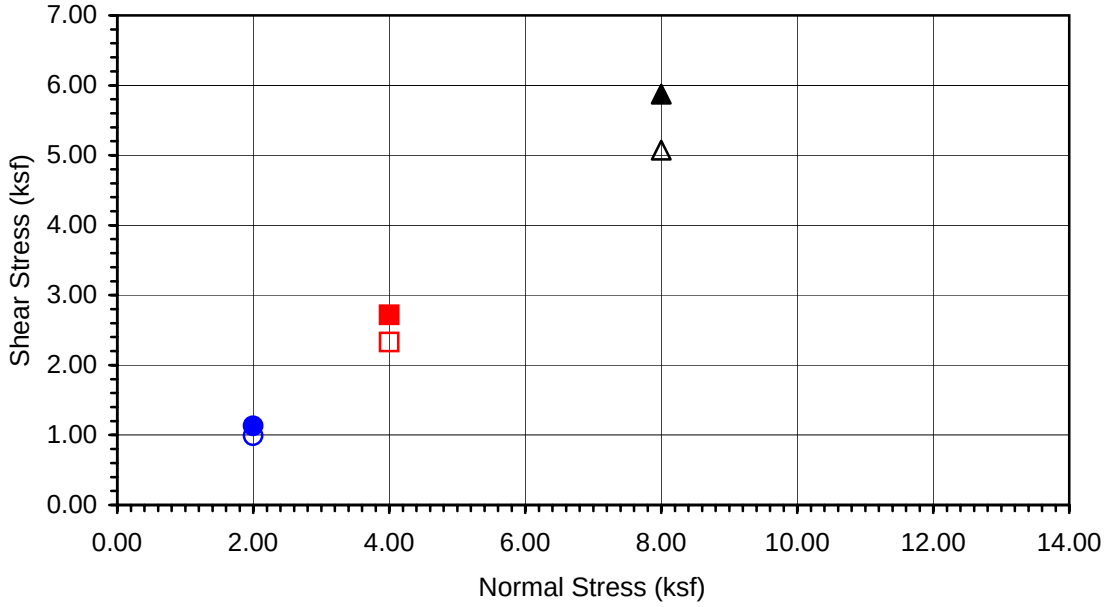
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/22/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/30/08
Boring No.:	A-08-026	Sample Type:	Drive		
Sample No.:	D-8	Depth (ft.):	40.0		

Soil Identification: Yellowish brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	196.21	203.21	204.54
Weight of Ring(gm):	45.45	43.58	43.45
Before Shearing			
Weight of Wet Sample+Cont.(gm):	215.48	215.48	215.48
Weight of Dry Sample+Cont.(gm):	190.12	190.12	190.12
Weight of Container(gm):	39.90	39.90	39.90
Vertical Rdg.(in): Initial	0.2419	0.3153	0.2623
Vertical Rdg.(in): Final	0.2630	0.3445	0.2969
After Shearing			
Weight of Wet Sample+Cont.(gm):	192.22	196.77	197.83
Weight of Dry Sample+Cont.(gm):	165.42	171.22	173.75
Weight of Container(gm):	39.40	39.54	39.17
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-026**
Sample No.	**D-8**
Depth (ft)	**40.0**

Sample Type:

Drive

Soil Identification:
Yellowish brown clayey sand (SC)

Normal Stress (kip/ft²)	2.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.132	■ 2.716	▲ 5.873
Shear Stress @ End of Test (ksf)	○ 0.987	□ 2.330	△ 5.074
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.88	16.88	16.88
Dry Density (pcf)	107.3	113.6	114.6
Saturation (%)	79.8	94.2	96.9
Soil Height Before Shearing (in.)	0.9789	0.9708	0.9654
Final Moisture Content (%)	21.3	19.4	17.9

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

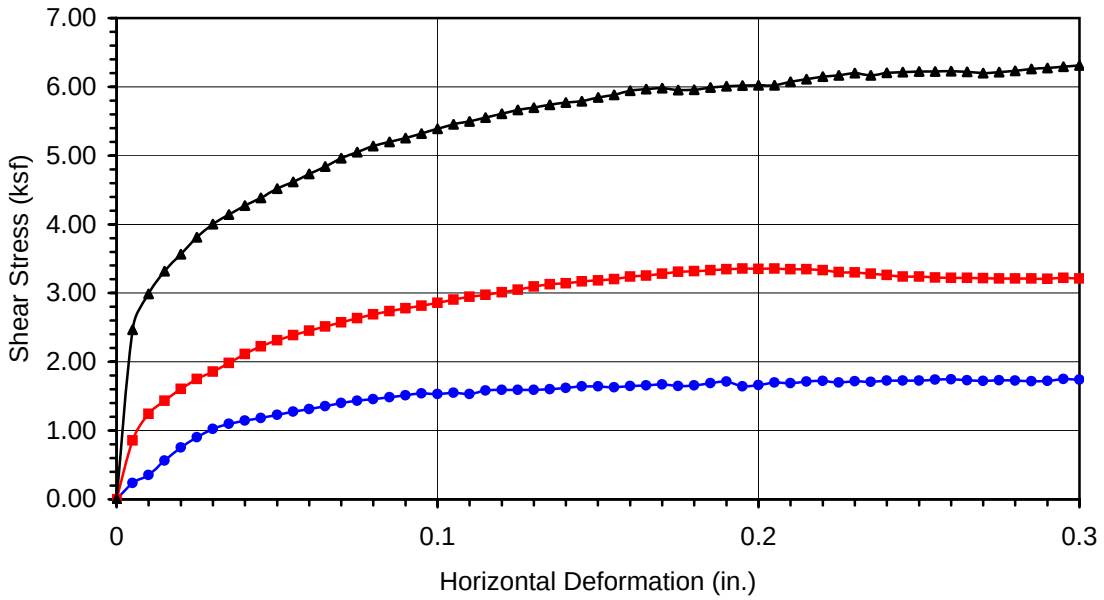
DIRECT SHEAR TEST

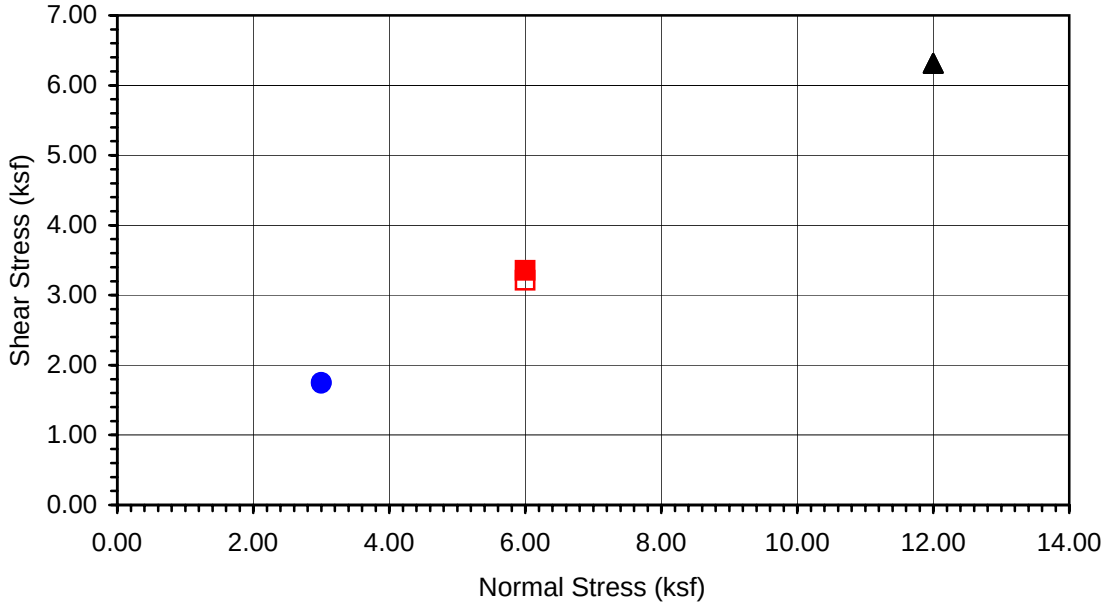
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	09/17/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/25/08
Boring No.:	A-08-026	Sample Type:	Drive		
Sample No.:	D-12	Depth (ft.):	60.0		

Soil Identification: Brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	193.77	196.80	197.40
Weight of Ring(gm):	43.19	43.40	42.87
Before Shearing			
Weight of Wet Sample+Cont.(gm):	112.50	112.50	112.50
Weight of Dry Sample+Cont.(gm):	97.83	97.83	97.83
Weight of Container(gm):	38.21	38.21	38.21
Vertical Rdg.(in): Initial	0.0000	0.2592	0.2791
Vertical Rdg.(in): Final	-0.0561	0.3301	0.3730
After Shearing			
Weight of Wet Sample+Cont.(gm):	182.49	185.17	185.32
Weight of Dry Sample+Cont.(gm):	155.28	160.16	162.06
Weight of Container(gm):	38.47	38.62	39.21
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-026**
Sample No.	**D-12**
Depth (ft)	**60.0**

Sample Type:

Drive

Soil Identification:
Brown lean clay (CL)

Normal Stress (kip/ft²)	3.000	6.000	12.000
Peak Shear Stress (kip/ft²)	● 1.751	■ 3.354	▲ 6.313
Shear Stress @ End of Test (ksf)	○ 1.739	□ 3.213	△ 6.313
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	24.61	24.61	24.61
Dry Density (pcf)	100.5	102.4	103.1
Saturation (%)	98.1	102.8	104.7
Soil Height Before Shearing (in.)	0.9439	0.9291	0.9061
Final Moisture Content (%)	23.3	20.6	18.9

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

09-08

Leighton

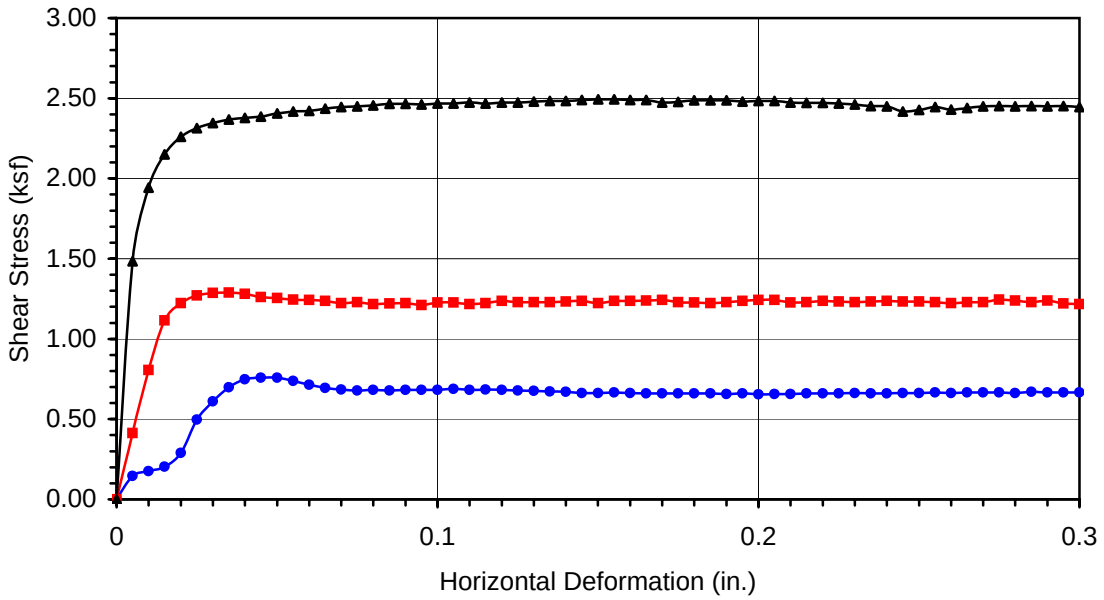
DIRECT SHEAR TEST

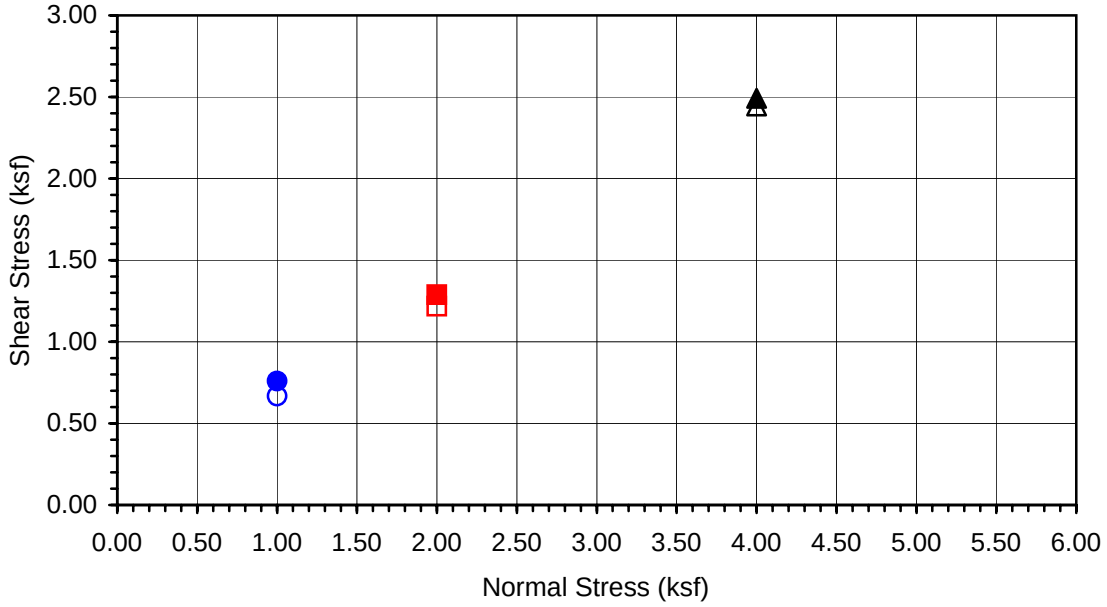
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/21/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/10/08
Boring No.:	A-08-027	Sample Type:	Remolded to 95% Max. Dens @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	0-7		

Soil Identification: Pale olive sandy lean clay s(CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	196.19	197.20	195.74
Weight of Ring(gm):	43.18	44.19	42.73
Before Shearing			
Weight of Wet Sample+Cont.(gm):	244.18	244.18	244.18
Weight of Dry Sample+Cont.(gm):	222.17	222.17	222.17
Weight of Container(gm):	38.73	38.73	38.73
Vertical Rdg.(in): Initial	0.0000	0.2529	0.2545
Vertical Rdg.(in): Final	0.0154	0.2478	0.2594
After Shearing			
Weight of Wet Sample+Cont.(gm):	201.00	199.99	199.79
Weight of Dry Sample+Cont.(gm):	173.91	173.98	174.58
Weight of Container(gm):	39.21	39.00	39.73
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-027**
Sample No.	**Bag-1**
Depth (ft)	**0-7**

Sample Type:
Remolded to 95% Max. Dens @ Opt. MC

Soil Identification:
Pale olive sandy lean clay s(CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.758	■ 1.289	▲ 2.493
Shear Stress @ End of Test (ksf)	○ 0.666	□ 1.217	△ 2.446
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.00	12.00	12.00
Dry Density (pcf)	113.6	113.6	113.6
Saturation (%)	67.0	67.0	67.0
Soil Height Before Shearing (in.)	1.0154	1.0051	0.9951
Final Moisture Content (%)	20.1	19.3	18.7

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

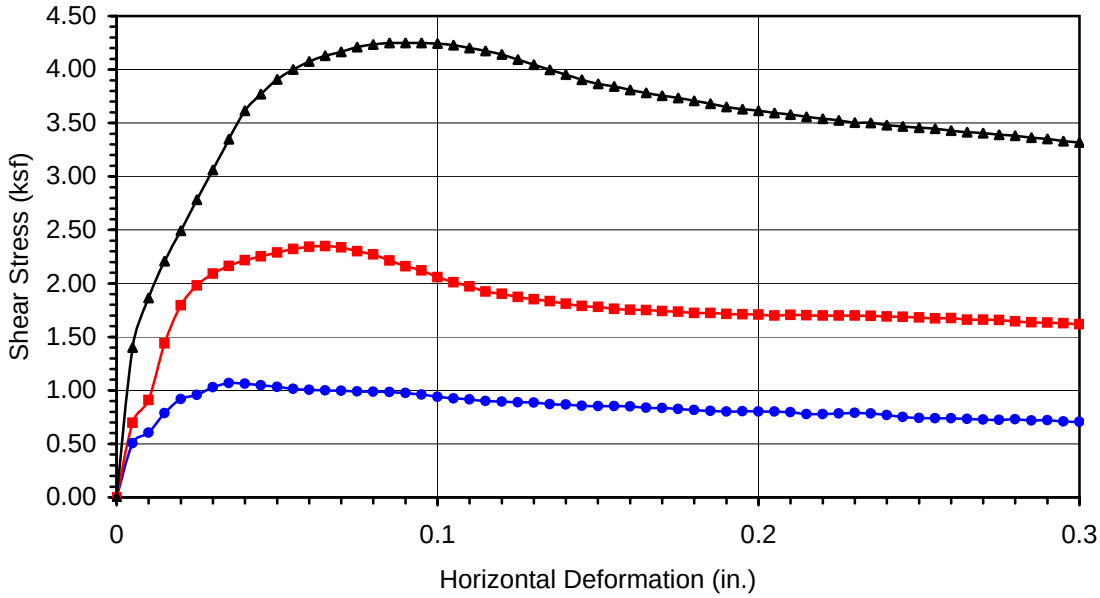
DIRECT SHEAR TEST

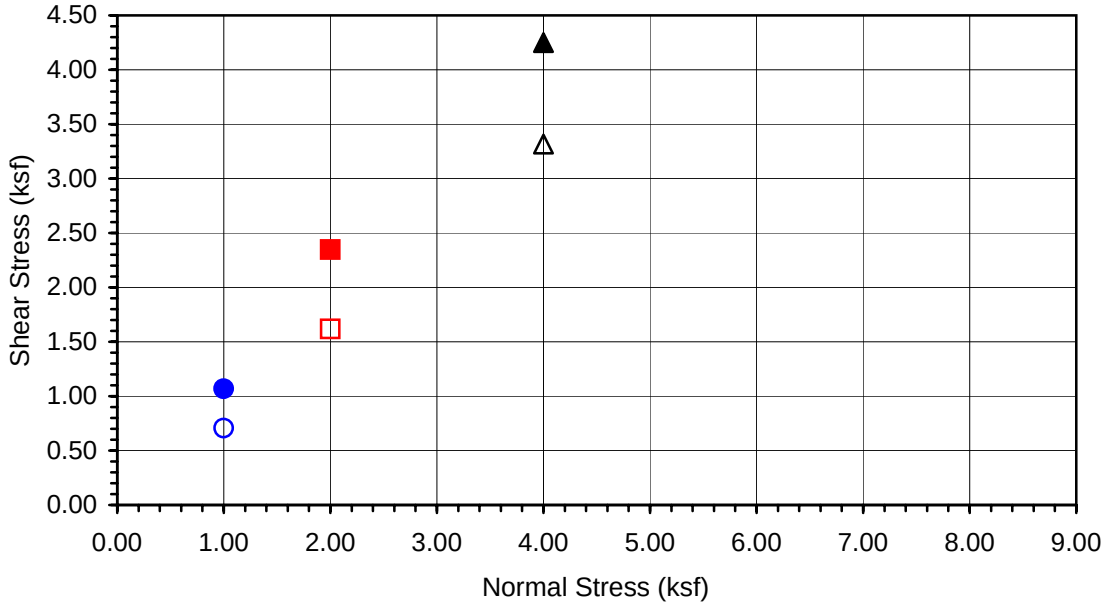
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Boring No.:	A-08-027	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Dark brown sandy lean clay s(CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	202.26	205.74	207.98
Weight of Ring(gm):	42.09	41.75	42.31
Before Shearing			
Weight of Wet Sample+Cont.(gm):	204.88	204.88	204.88
Weight of Dry Sample+Cont.(gm):	189.95	189.95	189.95
Weight of Container(gm):	39.02	39.02	39.02
Vertical Rdg.(in): Initial	0.2435	0.2568	0.1305
Vertical Rdg.(in): Final	0.2282	0.2537	0.1442
After Shearing			
Weight of Wet Sample+Cont.(gm):	206.36	207.80	207.17
Weight of Dry Sample+Cont.(gm):	177.70	180.63	181.38
Weight of Container(gm):	39.44	38.82	39.19
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-027**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Dark brown sandy lean clay s(CL)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.069	■ 2.348	▲ 4.250
Shear Stress @ End of Test (ksf)	○ 0.707	□ 1.618	△ 3.317
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.89	9.89	9.89
Dry Density (pcf)	121.2	124.1	125.4
Saturation (%)	68.4	74.6	77.5
Soil Height Before Shearing (in.)	1.0153	1.0031	0.9863
Final Moisture Content (%)	20.7	19.2	18.1

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

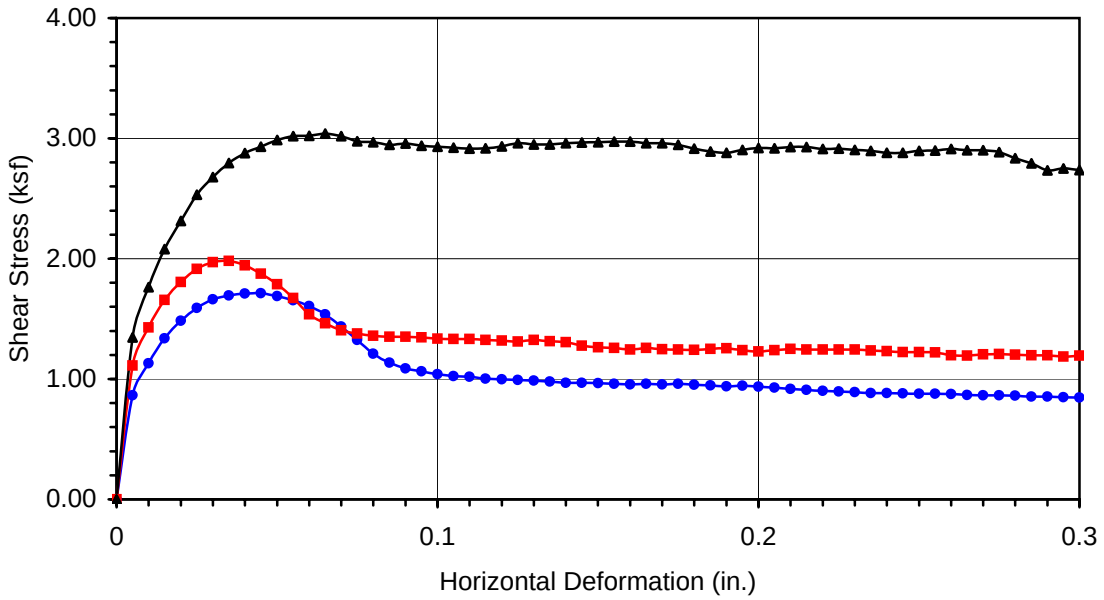
DIRECT SHEAR TEST

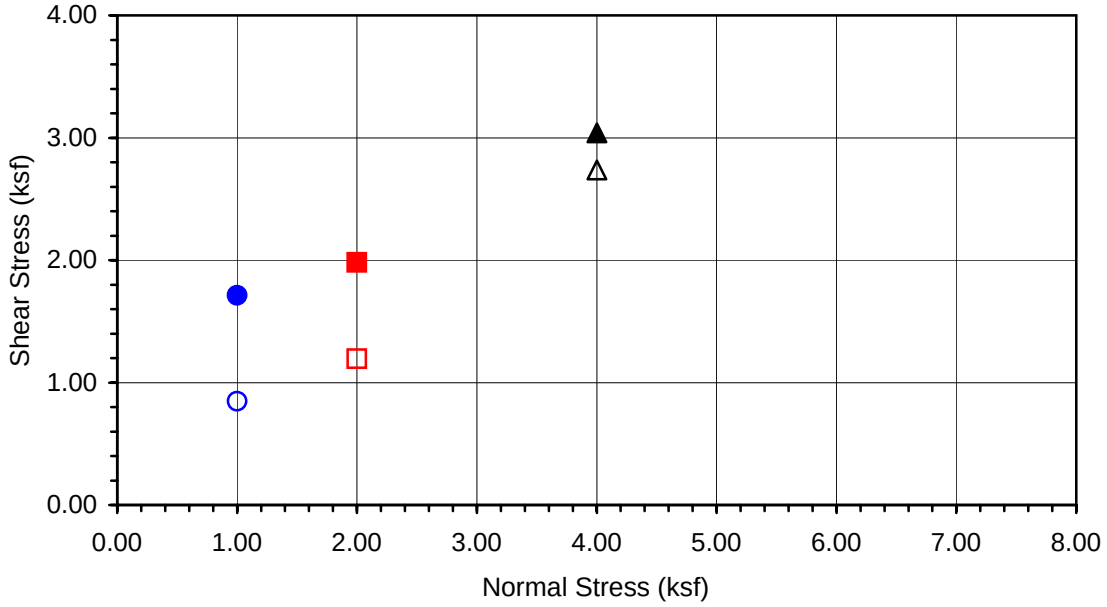
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/31/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/06/08
Boring No.:	A-08-027	Sample Type:	Drive		
Sample No.:	D-5	Depth (ft.):	25.0		

Soil Identification: Yellowish brown sandy lean clay with gravel s(CL)g

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	202.11	210.17	205.26
Weight of Ring(gm):	42.18	43.54	42.39
Before Shearing			
Weight of Wet Sample+Cont.(gm):	206.04	206.04	206.04
Weight of Dry Sample+Cont.(gm):	186.45	186.45	186.45
Weight of Container(gm):	39.20	39.20	39.20
Vertical Rdg.(in): Initial	0.0000	0.2793	0.2618
Vertical Rdg.(in): Final	-0.0038	0.2847	0.2777
After Shearing			
Weight of Wet Sample+Cont.(gm):	201.56	209.14	203.38
Weight of Dry Sample+Cont.(gm):	175.96	186.01	180.03
Weight of Container(gm):	38.98	39.22	39.09
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-027**
Sample No.	**D-5**
Depth (ft)	**25**

Sample Type:

Drive

Soil Identification:
Yellowish brown sandy lean clay with gravel s(CL)g

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.713	■ 1.981	▲ 3.040
Shear Stress @ End of Test (ksf)	○ 0.846	□ 1.195	△ 2.738
Deformation Rate (in./min.)	0.0025	0.0025	0.0025
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	13.30	13.30	13.30
Dry Density (pcf)	117.4	122.3	119.5
Saturation (%)	82.4	95.0	87.6
Soil Height Before Shearing (in.)	0.9962	0.9946	0.9841
Final Moisture Content (%)	18.7	15.8	16.6

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	08/11/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	09/16/08
Boring No.:	A-08-028	Sample Type:	Remolded to 95% Max. Dens. @ Opt. MC		
Sample No.:	Bag-1	Depth (ft.):	0-7		

Soil Identification: Olive sandy lean clay with gravel s(CL)g

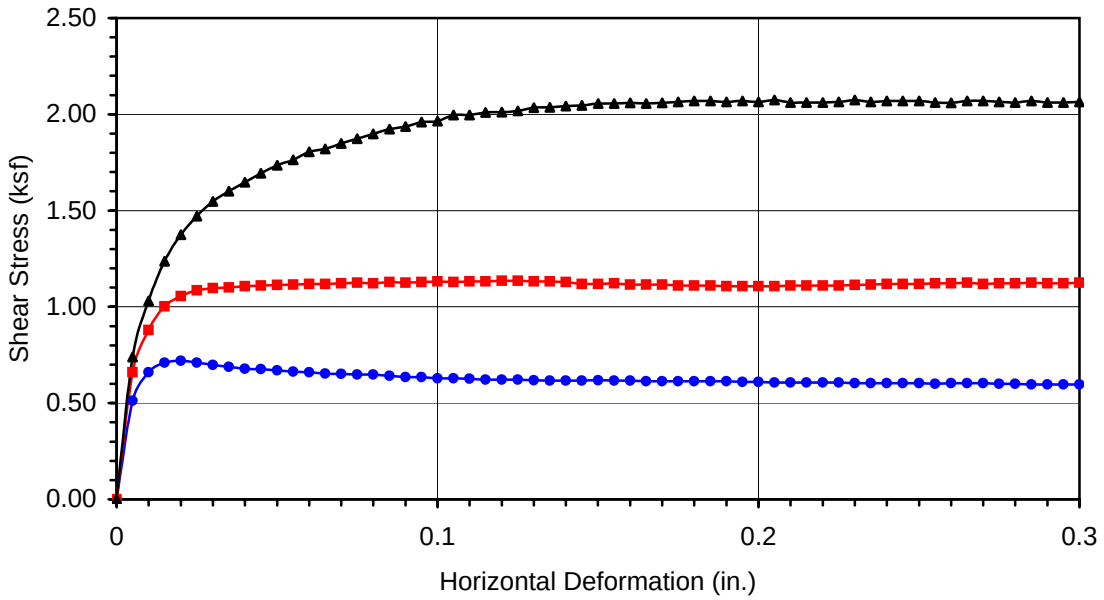
Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	191.90	191.97	191.89
Weight of Ring(gm):	43.47	43.54	43.46

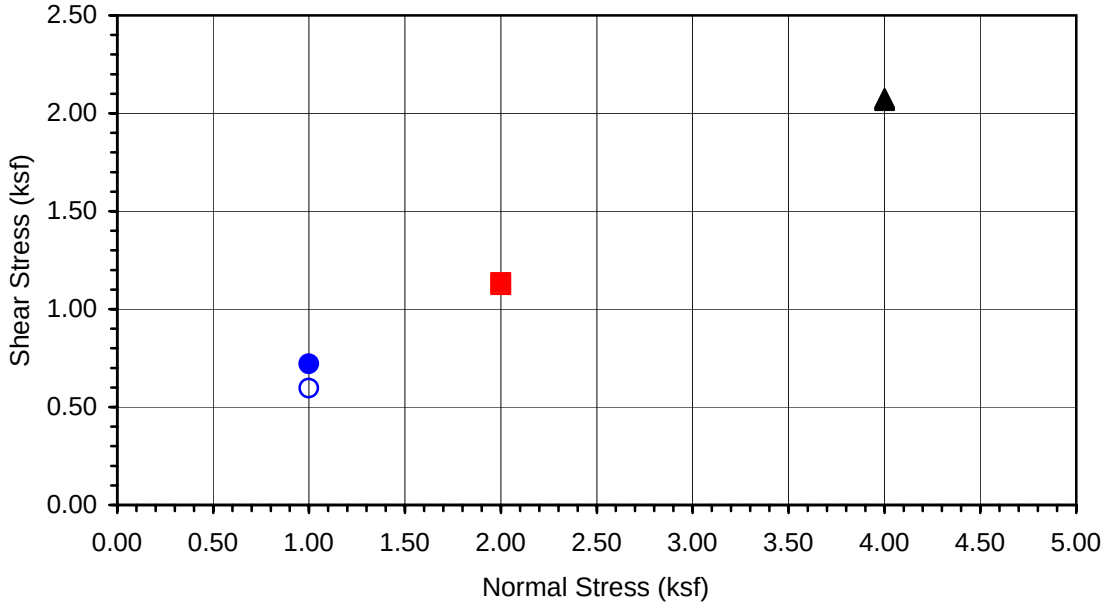
Before Shearing

Weight of Wet Sample+Cont.(gm):	233.66	233.66	233.66
Weight of Dry Sample+Cont.(gm):	215.18	215.18	215.18
Weight of Container(gm):	39.17	39.17	39.17
Vertical Rdg.(in): Initial	0.0000	0.2626	0.2747
Vertical Rdg.(in): Final	0.0235	0.2538	0.2780

After Shearing

Weight of Wet Sample+Cont.(gm):	200.04	198.55	197.38
Weight of Dry Sample+Cont.(gm):	171.58	171.26	170.88
Weight of Container(gm):	39.36	38.91	38.21
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-028**
Sample No.	**Bag-1**
Depth (ft)	**0-7**

Sample Type:
Remolded to 95% Max. Dens. @ Opt. MC

Soil Identification:
Olive sandy lean clay with gravel s(CL)g

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.720	■ 1.135	▲ 2.075
Shear Stress @ End of Test (ksf)	○ 0.597	□ 1.125	△ 2.065
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	10.50	10.50	10.50
Dry Density (pcf)	111.7	111.7	111.7
Saturation (%)	55.7	55.7	55.7
Soil Height Before Shearing (in.)	1.0235	1.0088	0.9967
Final Moisture Content (%)	21.5	20.6	20.0

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

08-08

Leighton

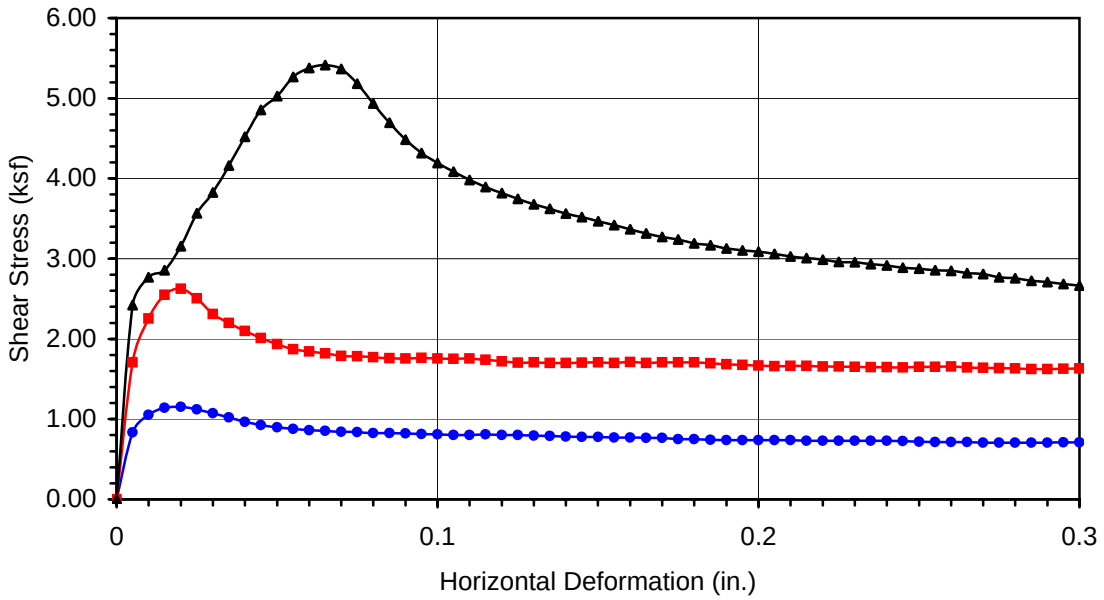
DIRECT SHEAR TEST

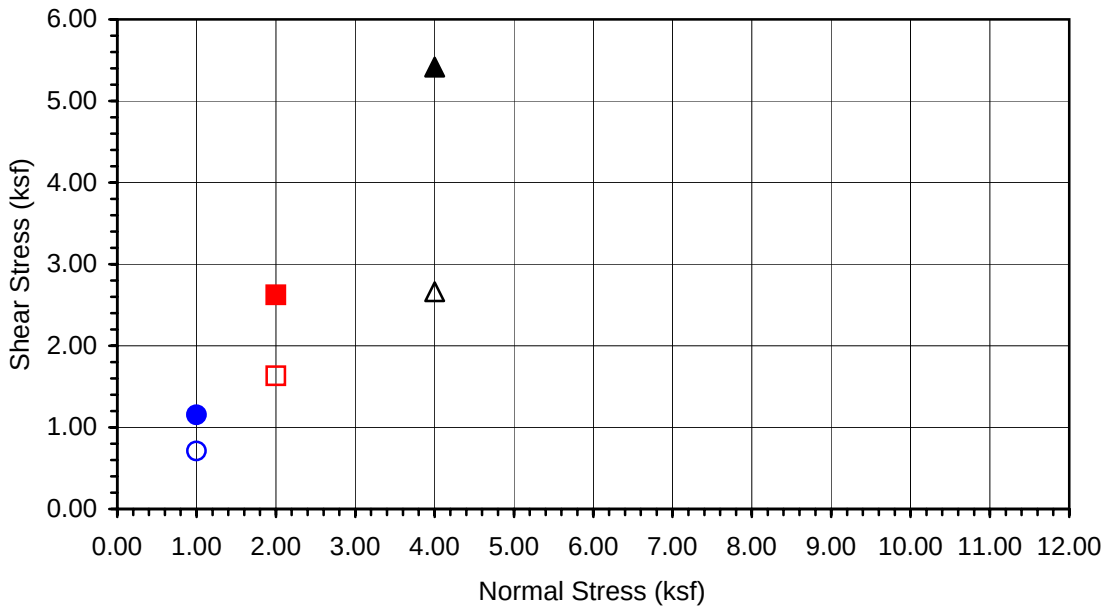
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/31/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	08/06/08
Boring No.:	A-08-028	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Grayish brown clayey sand (SC)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	196.18	201.82	207.09
Weight of Ring(gm):	43.58	44.72	43.32
Before Shearing			
Weight of Wet Sample+Cont.(gm):	247.18	247.18	247.18
Weight of Dry Sample+Cont.(gm):	224.40	224.40	224.40
Weight of Container(gm):	39.19	39.19	39.19
Vertical Rdg.(in): Initial	0.0000	0.2752	0.2701
Vertical Rdg.(in): Final	0.0013	0.2762	0.2739
After Shearing			
Weight of Wet Sample+Cont.(gm):	202.83	205.10	207.43
Weight of Dry Sample+Cont.(gm):	176.73	180.18	180.38
Weight of Container(gm):	39.34	39.04	38.95
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-028**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Grayish brown clayey sand (SC)

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 1.154	■ 2.625	▲ 5.414
Shear Stress @ End of Test (ksf)	○ 0.710	□ 1.632	△ 2.663
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	12.30	12.30	12.30
Dry Density (pcf)	113.0	116.3	121.3
Saturation (%)	67.6	74.0	85.2
Soil Height Before Shearing (in.)	1.0013	0.9990	0.9962
Final Moisture Content (%)	19.0	17.7	19.1

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

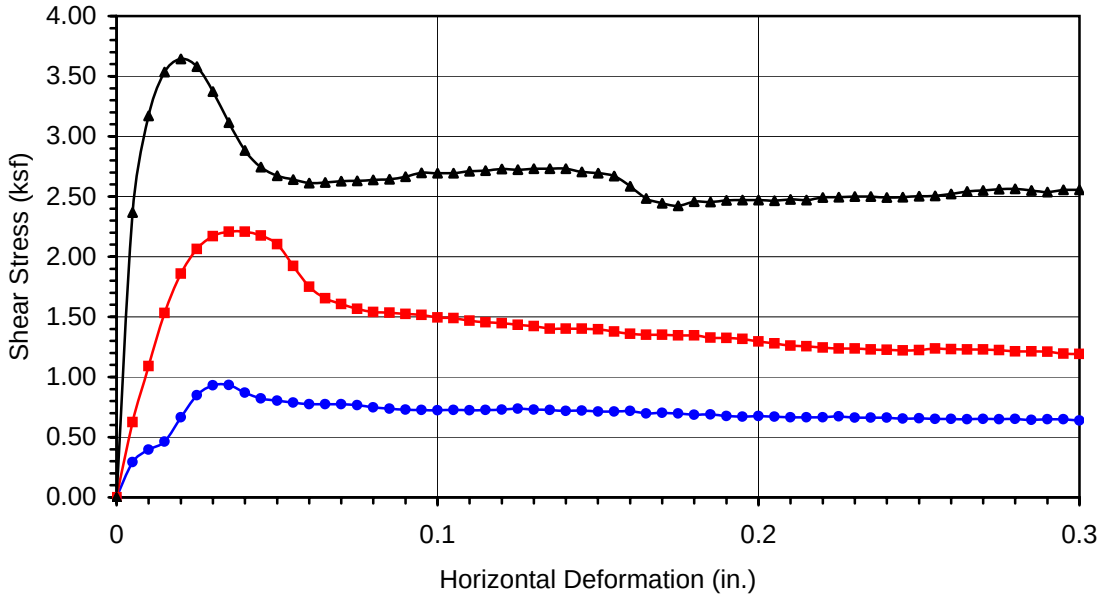
DIRECT SHEAR TEST

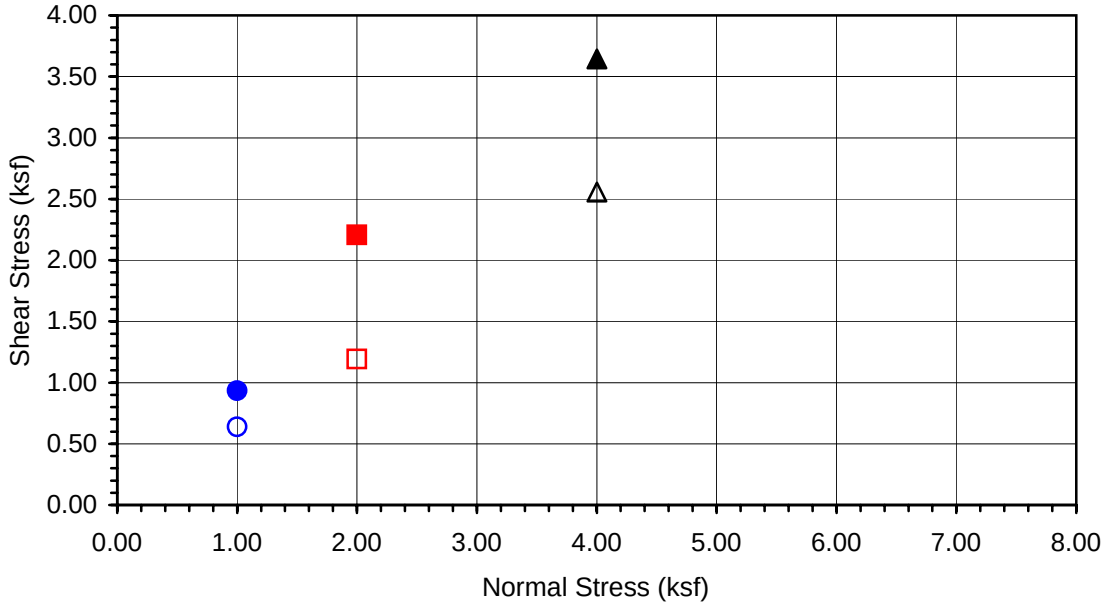
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Boring No.:	A-08-030	Sample Type:	Drive		
Sample No.:	D-3	Depth (ft.):	15.0		

Soil Identification: Yellowish brown lean clay with sand (CL)s

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	194.74	205.67	211.40
Weight of Ring(gm):	43.41	43.50	43.45
Before Shearing			
Weight of Wet Sample+Cont.(gm):	180.79	180.79	180.79
Weight of Dry Sample+Cont.(gm):	162.40	162.40	162.40
Weight of Container(gm):	39.34	39.34	39.34
Vertical Rdg.(in): Initial	0.2671	0.2536	0.1101
Vertical Rdg.(in): Final	0.2558	0.2492	0.1242
After Shearing			
Weight of Wet Sample+Cont.(gm):	200.51	206.52	212.34
Weight of Dry Sample+Cont.(gm):	166.45	177.60	189.15
Weight of Container(gm):	38.90	38.83	38.81
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-030**
Sample No.	**D-3**
Depth (ft)	**15**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay with sand (CL)s

Normal Stress (kip/ft²)	1.000	2.000	4.000
Peak Shear Stress (kip/ft²)	● 0.934	■ 2.207	▲ 3.644
Shear Stress @ End of Test (ksf)	○ 0.638	□ 1.191	△ 2.556
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	14.94	14.94	14.94
Dry Density (pcf)	109.5	117.3	121.5
Saturation (%)	74.8	92.4	104.2
Soil Height Before Shearing (in.)	1.0113	1.0044	0.9859
Final Moisture Content (%)	26.7	20.8	15.4

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/28/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/31/08
Boring No.:	A-08-030	Sample Type:	Drive		
Sample No.:	D-9	Depth (ft.):	45.0		

Soil Identification: Yellowish brown lean clay (CL)

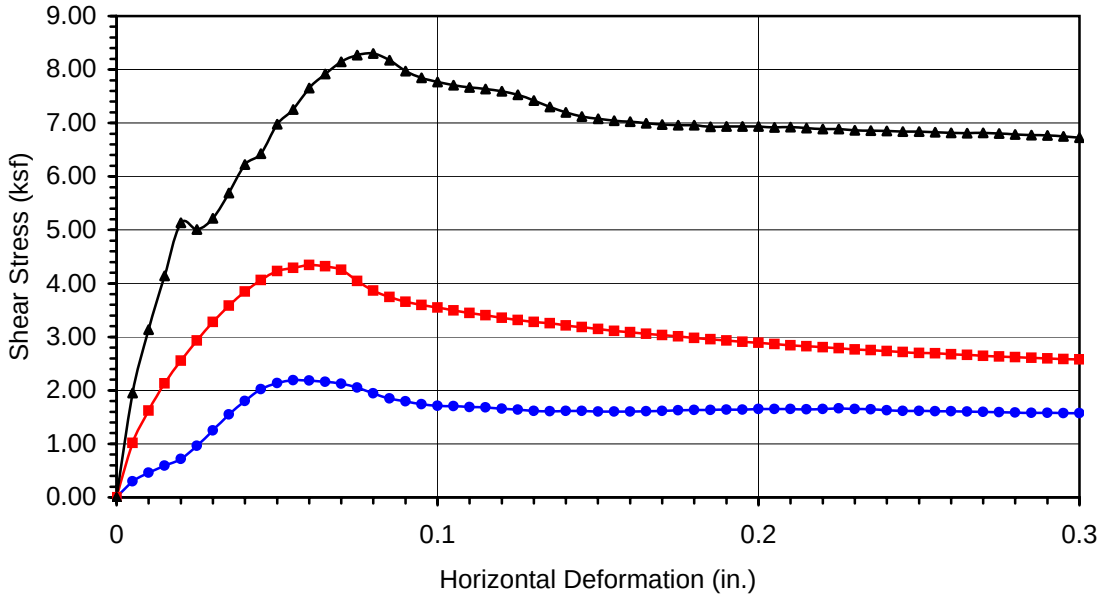
Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	195.22	199.60	201.00
Weight of Ring(gm):	43.76	43.76	43.54

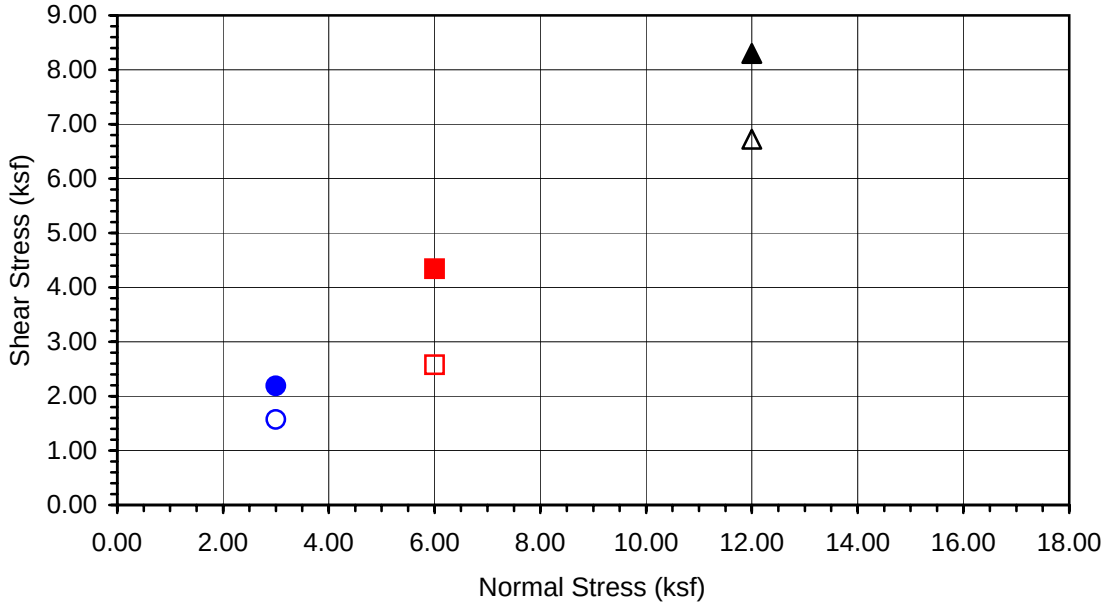
Before Shearing

Weight of Wet Sample+Cont.(gm):	179.07	179.07	179.07
Weight of Dry Sample+Cont.(gm):	159.11	159.11	159.11
Weight of Container(gm):	39.11	39.11	39.11
Vertical Rdg.(in): Initial	0.0000	0.2595	0.2330
Vertical Rdg.(in): Final	-0.0079	0.2787	0.2579

After Shearing

Weight of Wet Sample+Cont.(gm):	193.33	196.43	197.96
Weight of Dry Sample+Cont.(gm):	161.62	167.26	171.19
Weight of Container(gm):	38.88	39.52	39.42
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-030**
Sample No.	**D-9**
Depth (ft)	**45**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay (CL)

Normal Stress (kip/ft²)	3.000	6.000	12.000
Peak Shear Stress (kip/ft²)	● 2.191	■ 4.342	▲ 8.300
Shear Stress @ End of Test (ksf)	○ 1.572	□ 2.578	△ 6.725
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.63	16.63	16.63
Dry Density (pcf)	108.0	111.1	112.3
Saturation (%)	80.1	86.9	89.6
Soil Height Before Shearing (in.)	0.9921	0.9808	0.9751
Final Moisture Content (%)	25.8	22.8	20.3

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Leighton

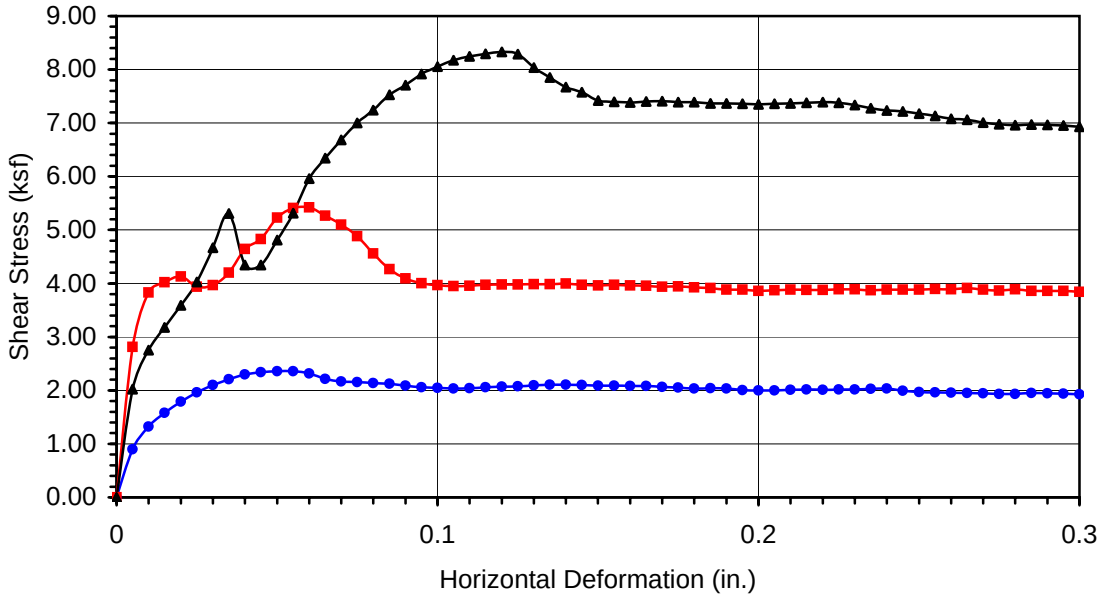
DIRECT SHEAR TEST

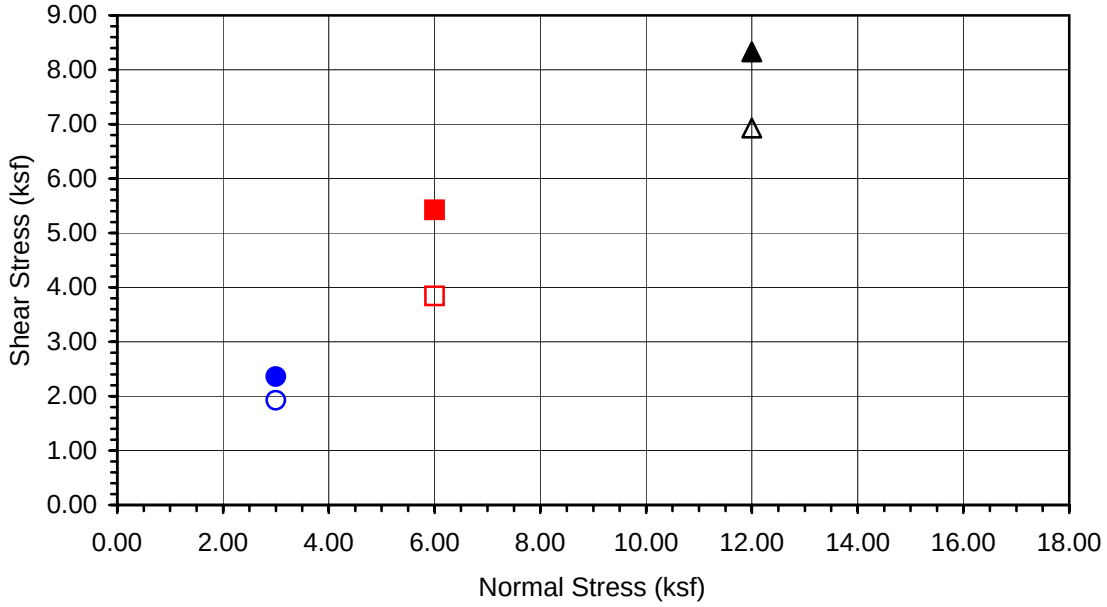
Consolidated Drained - ASTM D 3080

Project Name:	SR-57 Widening	Tested By:	F. Tabibkhoei	Date:	07/25/08
Project No.:	370900.02.GE.0S	Checked By:	LF	Date:	07/30/08
Boring No.:	A-08-030	Sample Type:	Drive		
Sample No.:	D-11	Depth (ft.):	55.0		

Soil Identification: Yellowish brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	200.92	201.06	203.51
Weight of Ring(gm):	43.86	43.58	43.40
Before Shearing			
Weight of Wet Sample+Cont.(gm):	174.25	174.25	174.25
Weight of Dry Sample+Cont.(gm):	153.12	153.12	153.12
Weight of Container(gm):	39.19	39.19	39.19
Vertical Rdg.(in): Initial	0.1237	0.2594	0.2743
Vertical Rdg.(in): Final	0.1479	0.2745	0.3112
After Shearing			
Weight of Wet Sample+Cont.(gm):	199.73	200.46	200.40
Weight of Dry Sample+Cont.(gm):	170.11	175.63	171.94
Weight of Container(gm):	39.42	38.10	39.77
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**A-08-030**
Sample No.	**D-11**
Depth (ft)	**55**

Sample Type:

Drive

Soil Identification:
Yellowish brown lean clay (CL)

Normal Stress (kip/ft²)	3.000	6.000	12.000
Peak Shear Stress (kip/ft²)	● 2.358	■ 5.423	▲ 8.328
Shear Stress @ End of Test (ksf)	○ 1.924	□ 3.842	△ 6.932
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	18.55	18.55	18.55
Dry Density (pcf)	110.2	110.5	112.3
Saturation (%)	94.5	95.3	100.0
Soil Height Before Shearing (in.)	0.9758	0.9849	0.9631
Final Moisture Content (%)	22.7	18.1	21.5

Leighton

DIRECT SHEAR TEST RESULTS
Consolidated Drained - ASTM D 3080

Project No.: 370900.02.GE.0S

SR-57 Widening

07-08

Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/14/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/20/08
Boring No.:	A-08-010	Sample Type:		Drive	
Sample No.:	D-5	Depth(ft):	25		
Sample Description:	Olive brown clayey sand (SC)				

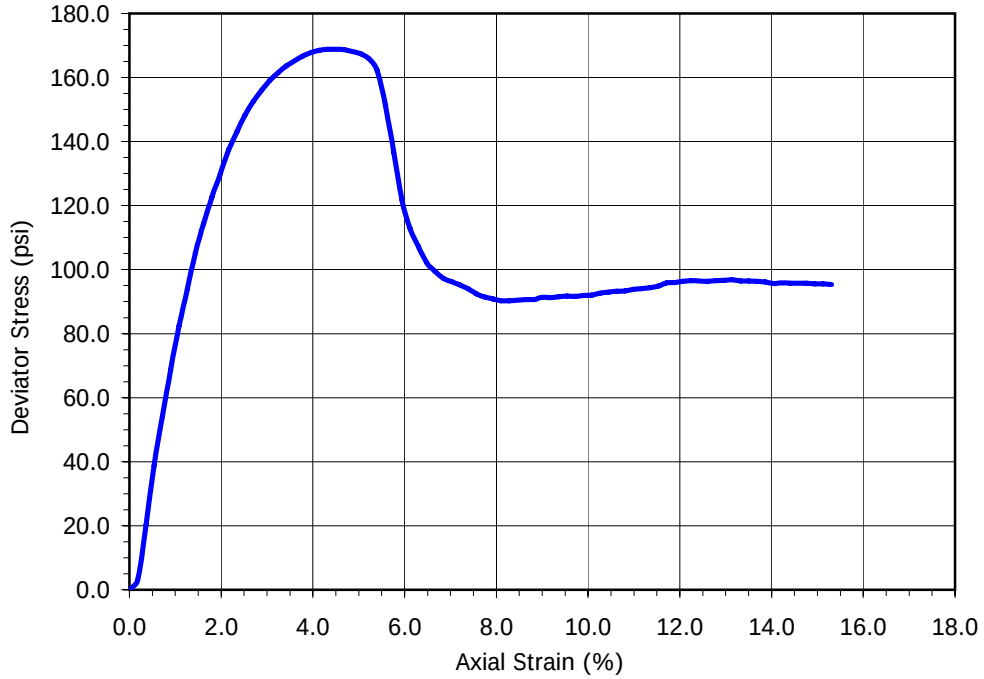
Diameter (in)	1	2.42
	2	2.416
	3	2.413
	Average	2.416
Height (in)	1	5.556
	2	5.554
	3	5.551
	Average	5.554
Weight of Sample + Tube / Rings (g)		930.70
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		1038.50
Weight of Dry Sample + Container (g)		949.50
Weight of Container (g)		109.30
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		11.5
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	10.59
Dry Density (pcf)	125.9
Void Ratio	0.338
% Saturation	84.5

At Failure*	
Deviator stress (psi)	**168.85**
Minor principal total stress (psi)	**11.46**
Major principal total stress (psi)	**180.31**
Axial strain (%)	**4.50**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/14/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/20/08
Boring No.:	A-08-012	Sample Type:		Drive	
Sample No.:	D-5	Depth(ft):	25		
Sample Description:	Olive fat clay (CH)				

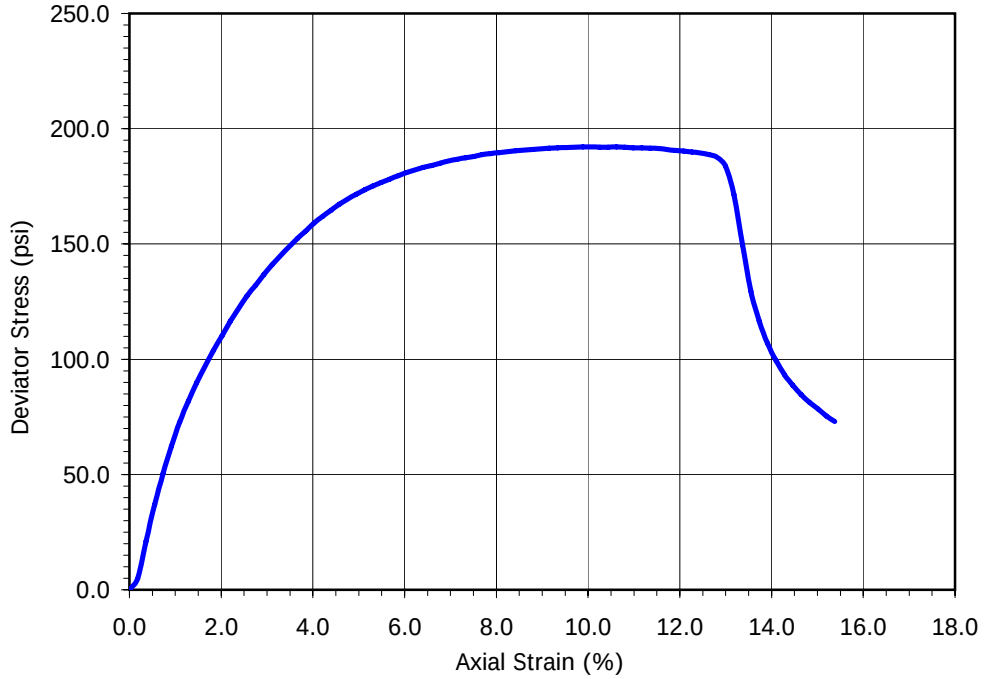
Diameter (in)	1	2.420
	2	2.421
	3	2.424
	Average	2.422
Height (in)	1	5.464
	2	5.462
	3	5.461
	Average	5.462
Weight of Sample + Tube / Rings (g)		887.10
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		993.50
Weight of Dry Sample + Container (g)		868.90
Weight of Container (g)		106.80
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		13.9
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	16.35
Dry Density (pcf)	115.5
Void Ratio	0.459
% Saturation	96.1

At Failure*	
Deviator stress (psi)	**192.08**
Minor principal total stress (psi)	**13.90**
Major principal total stress (psi)	**205.98**
Axial strain (%)	**9.89**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/18/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/20/08
Boring No.:	A-08-013	Sample Type:		Drive	
Sample No.:	D-9	Depth(ft):	45		
Sample Description:	Olive lean clay (CL)				

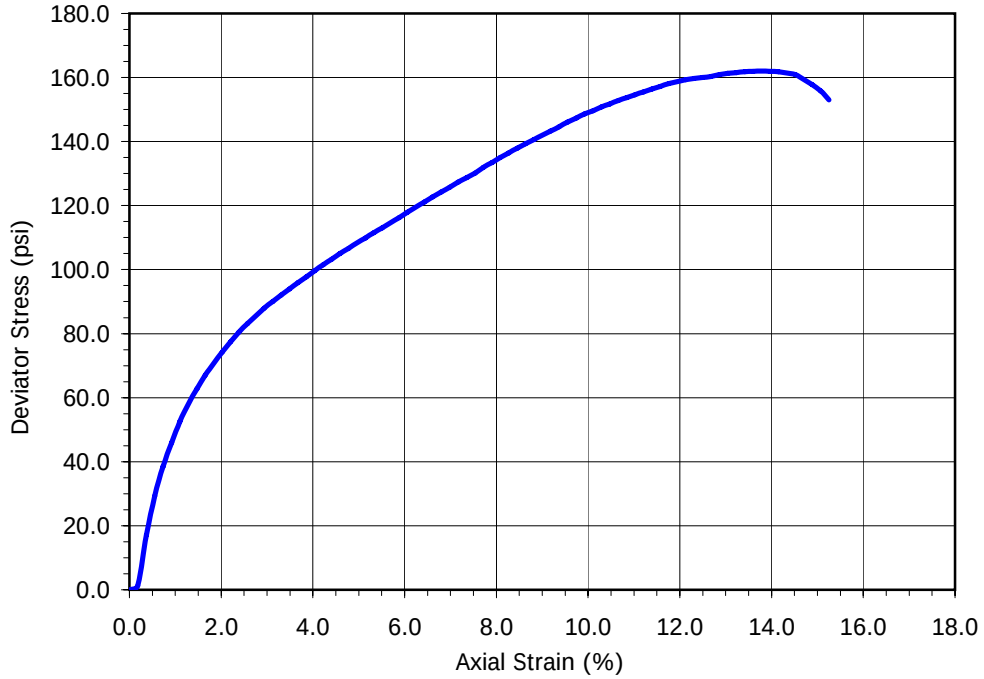
Diameter (in)	1	2.424
	2	2.423
	3	2.420
	Average	2.422
Height (in)	1	5.443
	2	5.441
	3	5.444
	Average	5.442
Weight of Sample + Tube / Rings (g)		871.60
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		978.80
Weight of Dry Sample + Container (g)		841.10
Weight of Container (g)		107.84
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		20.8
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	18.78
Dry Density (pcf)	111.5
Void Ratio	0.512
% Saturation	99.1

At Failure*	
Deviator stress (psi)	**161.98**
Minor principal total stress (psi)	**20.83**
Major principal total stress (psi)	**182.81**
Axial strain (%)	**13.78**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/18/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/20/08
Boring No.:	A-08-016	Sample Type:		Drive	
Sample No.:	D-7	Depth(ft):	35		
Sample Description:	Dark olive brown lean clay (CL)				

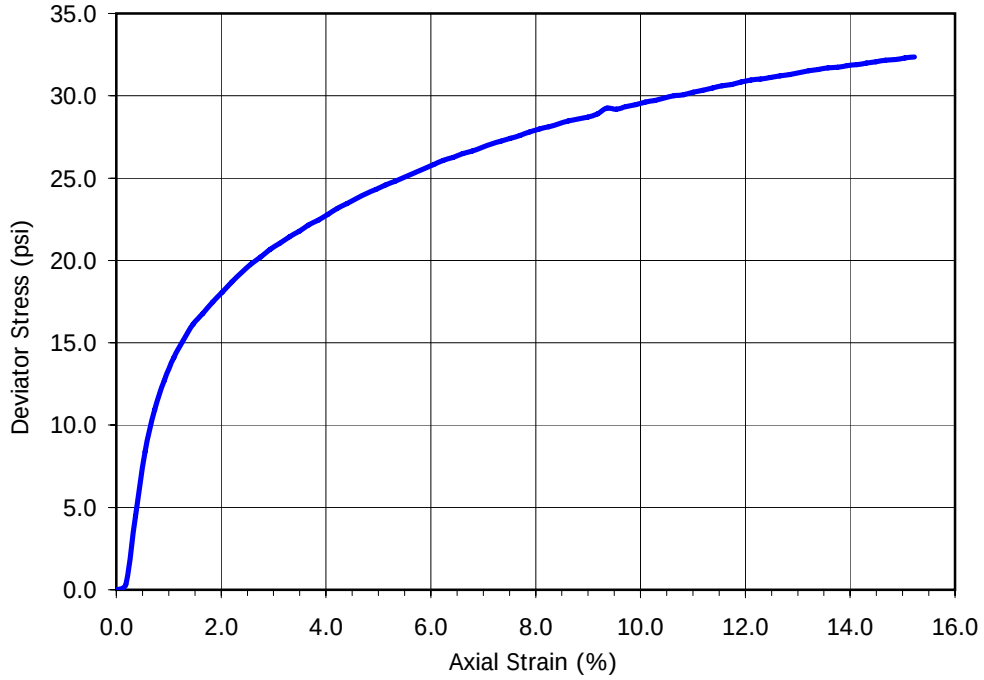
Diameter (in)	1	2.420
	2	2.416
	3	2.418
	Average	2.418
Height (in)	1	5.452
	2	5.450
	3	5.452
	Average	5.451
Weight of Sample + Tube / Rings (g)		829.50
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		939.60
Weight of Dry Sample + Container (g)		788.10
Weight of Container (g)		110.84
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		13.9
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	22.37
Dry Density (pcf)	103.2
Void Ratio	0.633
% Saturation	95.4

At Failure*	
Deviator stress (psi)	**32.36**
Minor principal total stress (psi)	**13.90**
Major principal total stress (psi)	**46.26**
Axial strain (%)	**15.23**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/15/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/20/08
Boring No.:	A-08-016	Sample Type:		Drive	
Sample No.:	D-15	Depth(ft):	75		
Sample Description:	Pale olive clayey / silty sand (SC/SM)				

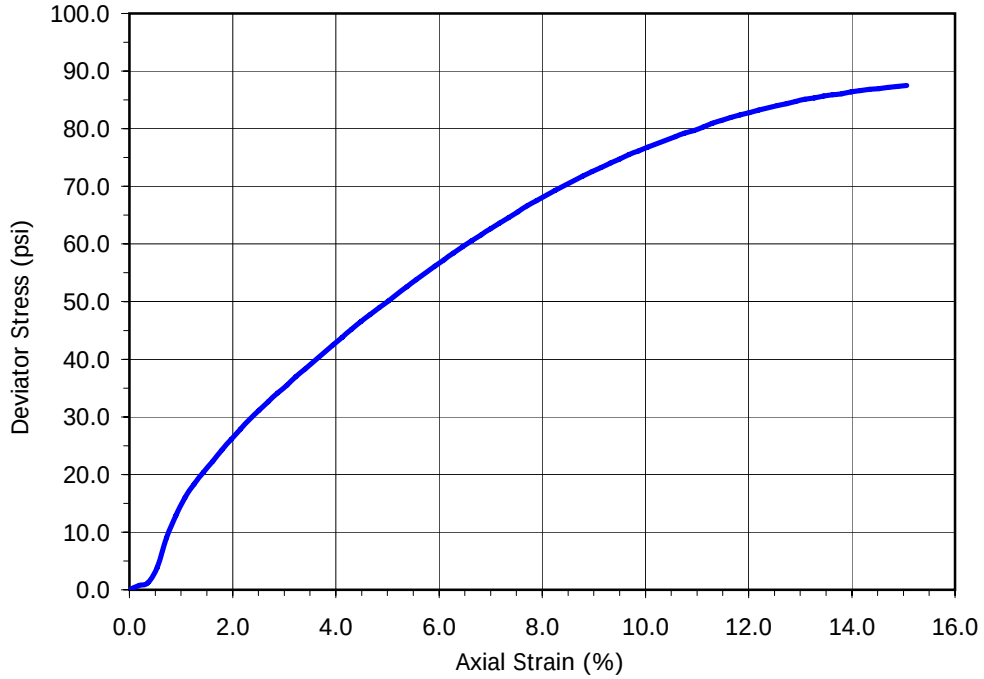
Diameter (in)	1	2.423
	2	2.424
	3	2.425
	Average	2.424
Height (in)	1	5.578
	2	5.576
	3	5.577
	Average	5.577
Weight of Sample + Tube / Rings (g)		864.00
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		971.30
Weight of Dry Sample + Container (g)		823.60
Weight of Container (g)		108.30
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		31.3
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	20.65
Dry Density (pcf)	106.0
Void Ratio	0.589
% Saturation	94.6

At Failure*	
Deviator stress (psi)	**87.53**
Minor principal total stress (psi)	**31.25**
Major principal total stress (psi)	**118.78**
Axial strain (%)	**15.06**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	09/23/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	09/25/08
Boring No.:	A-08-017	Sample Type:	Drive		
Sample No.:	D-6	Depth(ft):	30		
Sample Description:	Olive gray fat clay (CH)				

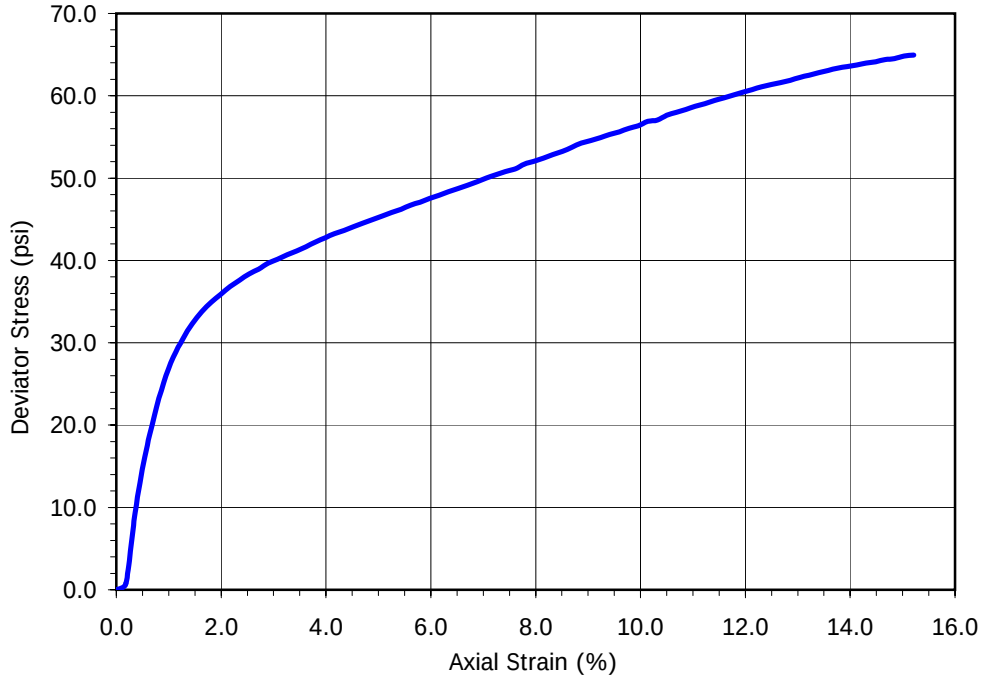
Diameter (in)	1	2.415
	2	2.417
	3	2.420
	Average	2.417
Height (in)	1	5.524
	2	5.521
	3	5.523
	Average	5.523
Weight of Sample + Tube / Rings (g)		832.70
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		942.40
Weight of Dry Sample + Container (g)		778.30
Weight of Container (g)		110.60
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		25.0
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	24.58
Dry Density (pcf)	100.5
Void Ratio	0.677
% Saturation	98.0

At Failure*	
Deviator stress (psi)	**64.96**
Minor principal total stress (psi)	**25.00**
Major principal total stress (psi)	**89.96**
Axial strain (%)	**15.21**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	09/23/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	09/25/08
Boring No.:	A-08-017	Sample Type:	Drive		
Sample No.:	D-10	Depth(ft):	50		
Sample Description:	Dark olive fat clay (CH)				

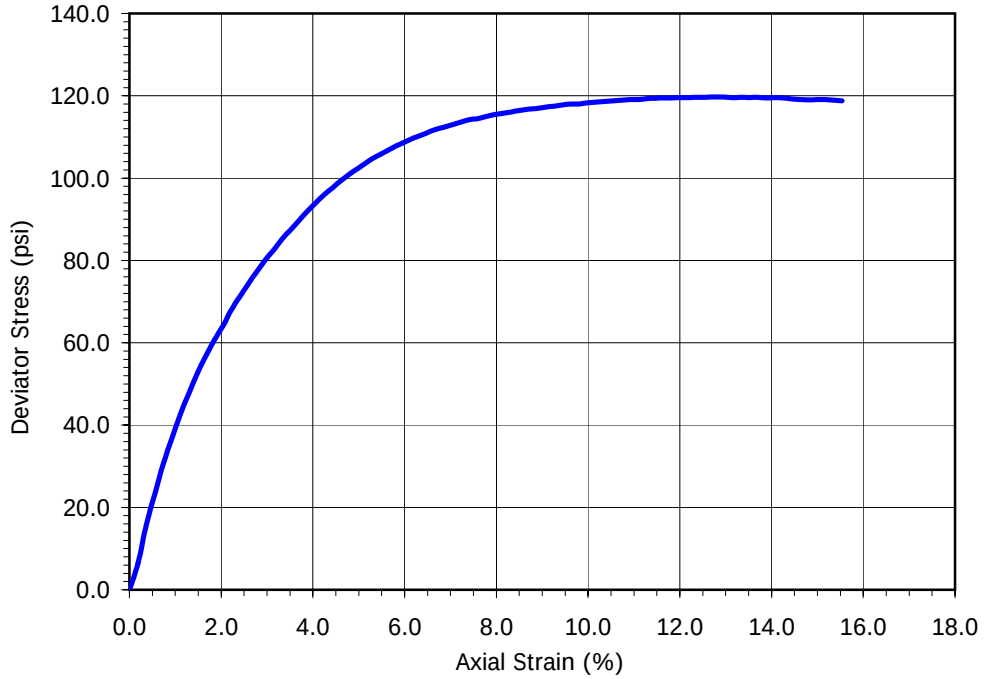
Diameter (in)	1	2.419
	2	2.420
	3	2.420
	Average	2.420
Height (in)	1	5.404
	2	5.406
	3	5.407
	Average	5.405
Weight of Sample + Tube / Rings (g)		837.10
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		944.30
Weight of Dry Sample + Container (g)		793.30
Weight of Container (g)		108.21
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		38.2
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	22.04
Dry Density (pcf)	105.1
Void Ratio	0.603
% Saturation	98.8

At Failure*	
Deviator stress (psi)	**119.71**
Minor principal total stress (psi)	**38.20**
Major principal total stress (psi)	**157.91**
Axial strain (%)	**12.77**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/19/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/20/08
Boring No.:	A-08-023	Sample Type:		Drive	
Sample No.:	D-7	Depth(ft):	35		
Sample Description:	Grayish brown lean clay with sand (CL)s				

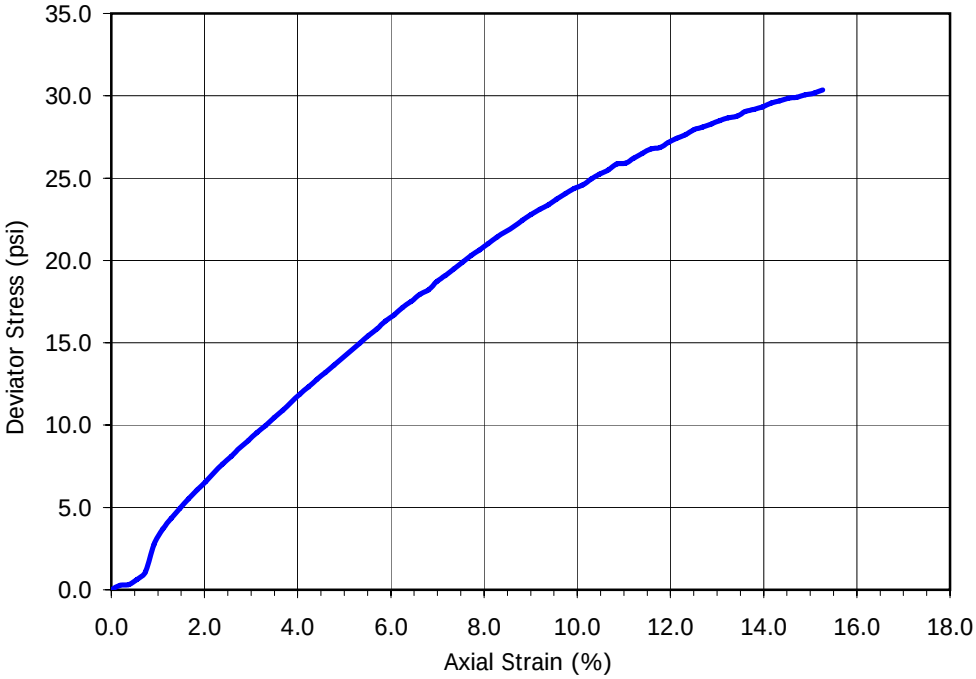
Diameter (in)	1	2.416
	2	2.418
	3	2.420
	Average	2.418
Height (in)	1	5.436
	2	5.438
	3	5.439
	Average	5.438
Weight of Sample + Tube / Rings (g)		879.60
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		987.00
Weight of Dry Sample + Container (g)		877.90
Weight of Container (g)		108.20
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		13.9
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	14.17
Dry Density (pcf)	117.5
Void Ratio	0.433
% Saturation	88.3

At Failure*	
Deviator stress (psi)	**30.35**
Minor principal total stress (psi)	**13.90**
Major principal total stress (psi)	**44.25**
Axial strain (%)	**15.26**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/19/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/20/08
Boring No.:	A-08-023	Sample Type:		Drive	
Sample No.:	D-11	Depth(ft):	55		
Sample Description:	Yellowish brown lean clay (CL)				

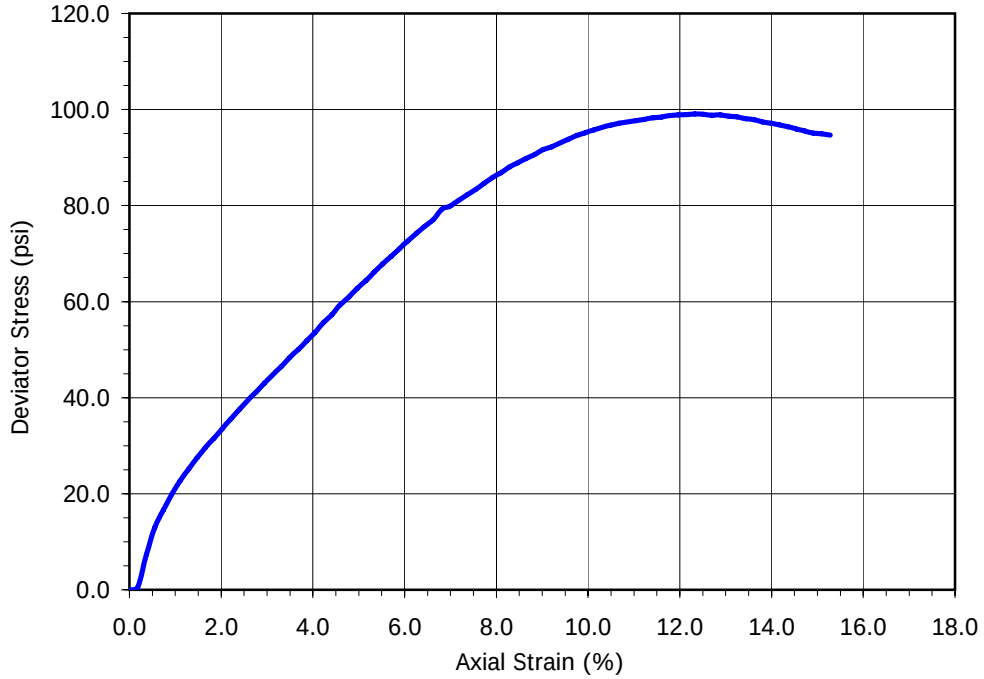
Diameter (in)	1	2.420
	2	2.421
	3	2.424
	Average	2.422
Height (in)	1	5.434
	2	5.432
	3	5.435
	Average	5.434
Weight of Sample + Tube / Rings (g)		846.60
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		955.80
Weight of Dry Sample + Container (g)		821.30
Weight of Container (g)		110.10
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		22.9
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	18.91
Dry Density (pcf)	108.4
Void Ratio	0.555
% Saturation	92.1

At Failure*	
Deviator stress (psi)	**99.09**
Minor principal total stress (psi)	**22.90**
Major principal total stress (psi)	**121.99**
Axial strain (%)	**12.33**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/19/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/20/08
Boring No.:	A-08-023	Sample Type:		Drive	
Sample No.:	D-15	Depth(ft):	75		
Sample Description:	Yellowish brown lean clay (CL)				

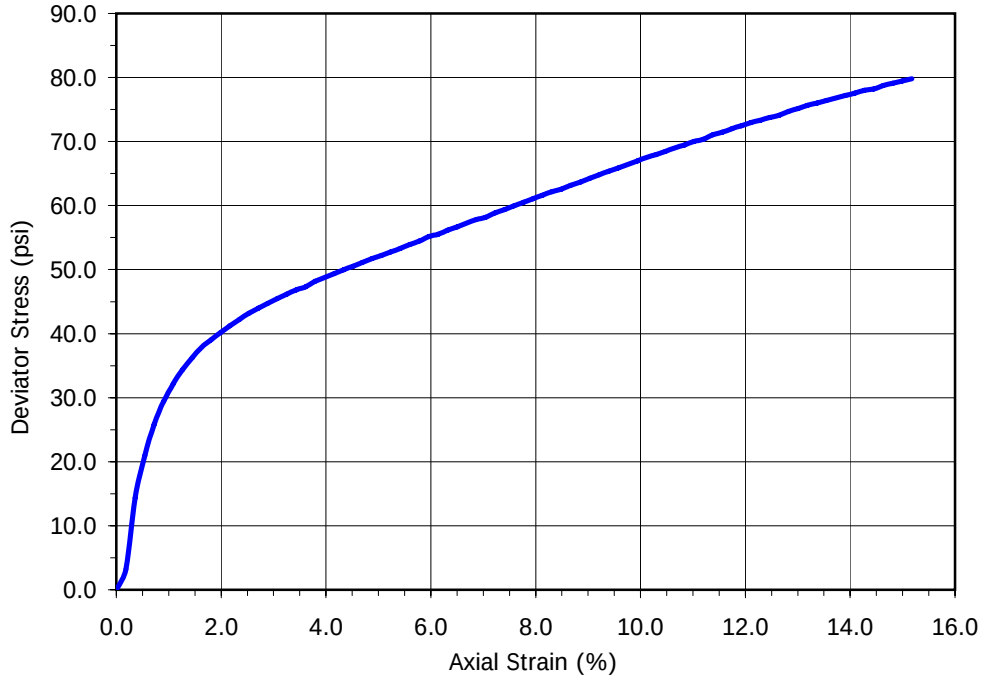
Diameter (in)	1	2.423
	2	2.420
	3	2.418
	Average	2.420
Height (in)	1	5.537
	2	5.534
	3	5.536
	Average	5.536
Weight of Sample + Tube / Rings (g)		886.50
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		993.20
Weight of Dry Sample + Container (g)		857.70
Weight of Container (g)		107.50
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		31.3
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	18.06
Dry Density (pcf)	112.3
Void Ratio	0.500
% Saturation	97.5

At Failure*	
Deviator stress (psi)	**79.82**
Minor principal total stress (psi)	**31.25**
Major principal total stress (psi)	**111.07**
Axial strain (%)	**15.17**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/20/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/21/08
Boring No.:	A-08-025	Sample Type:		Drive	
Sample No.:	D-7	Depth(ft):	35		
Sample Description:	Olive brown lean clay (CL) / some silty sand in the middle				

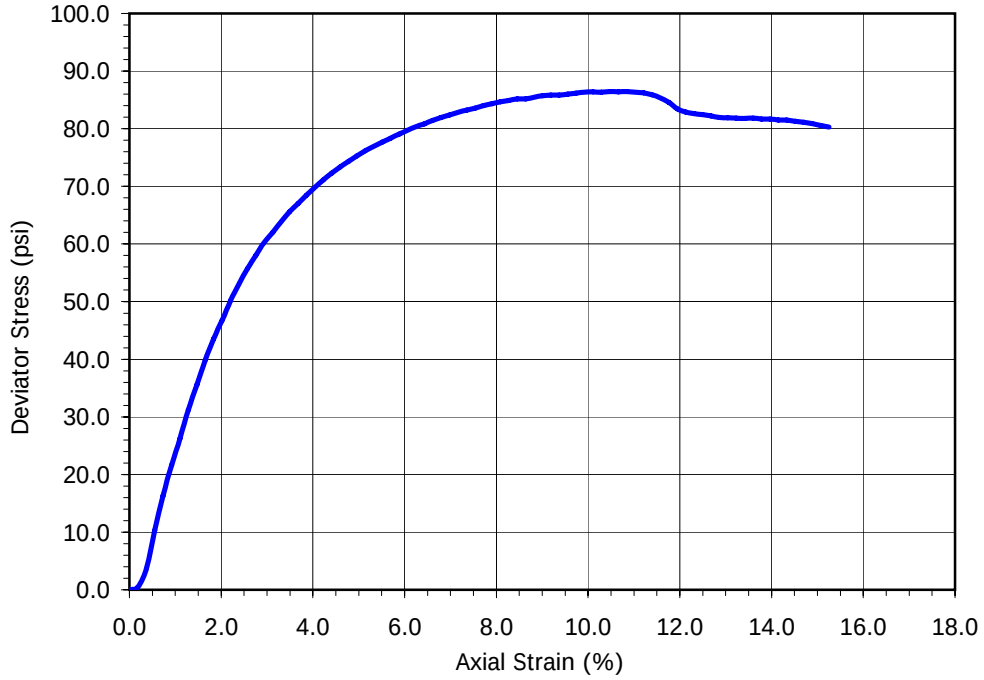
Diameter (in)	1	2.425
	2	2.418
	3	2.416
	Average	2.420
Height (in)	1	5.444
	2	5.442
	3	5.441
	Average	5.442
Weight of Sample + Tube / Rings (g)		837.70
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		947.30
Weight of Dry Sample + Container (g)		828.20
Weight of Container (g)		110.78
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		13.9
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	16.60
Dry Density (pcf)	109.4
Void Ratio	0.541
% Saturation	82.9

At Failure*	
Deviator stress (psi)	**86.46**
Minor principal total stress (psi)	**13.90**
Major principal total stress (psi)	**100.36**
Axial strain (%)	**10.47**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/20/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/21/08
Boring No.:	A-08-025	Sample Type:		Drive	
Sample No.:	D-11	Depth(ft):	55		
Sample Description:	Dark olive sandy lean clay s(CL)				

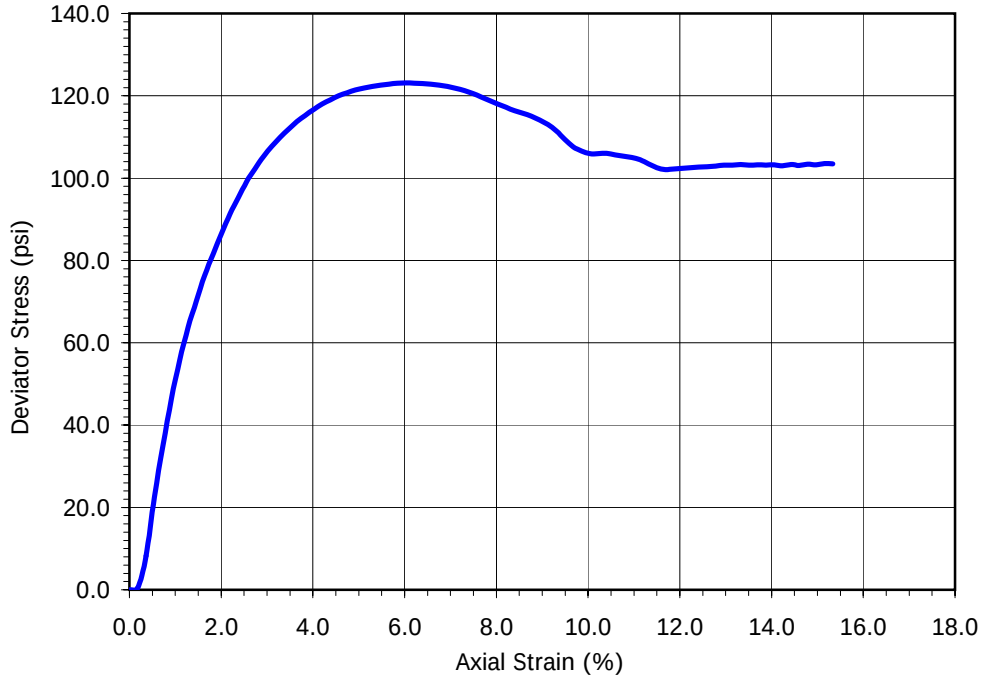
Diameter (in)	1	2.423
	2	2.422
	3	2.420
	Average	2.422
Height (in)	1	5.480
	2	5.477
	3	5.478
	Average	5.478
Weight of Sample + Tube / Rings (g)		872.40
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		977.80
Weight of Dry Sample + Container (g)		890.80
Weight of Container (g)		107.00
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		22.9
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	11.10
Dry Density (pcf)	118.6
Void Ratio	0.421
% Saturation	71.2

At Failure*	
Deviator stress (psi)	**123.09**
Minor principal total stress (psi)	**22.90**
Major principal total stress (psi)	**145.99**
Axial strain (%)	**6.02**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/20/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/21/08
Boring No.:	A-08-025	Sample Type:		Drive	
Sample No.:	D-15	Depth(ft):	75		
Sample Description:	Dark olive brown sandy lean clay s(CL)				

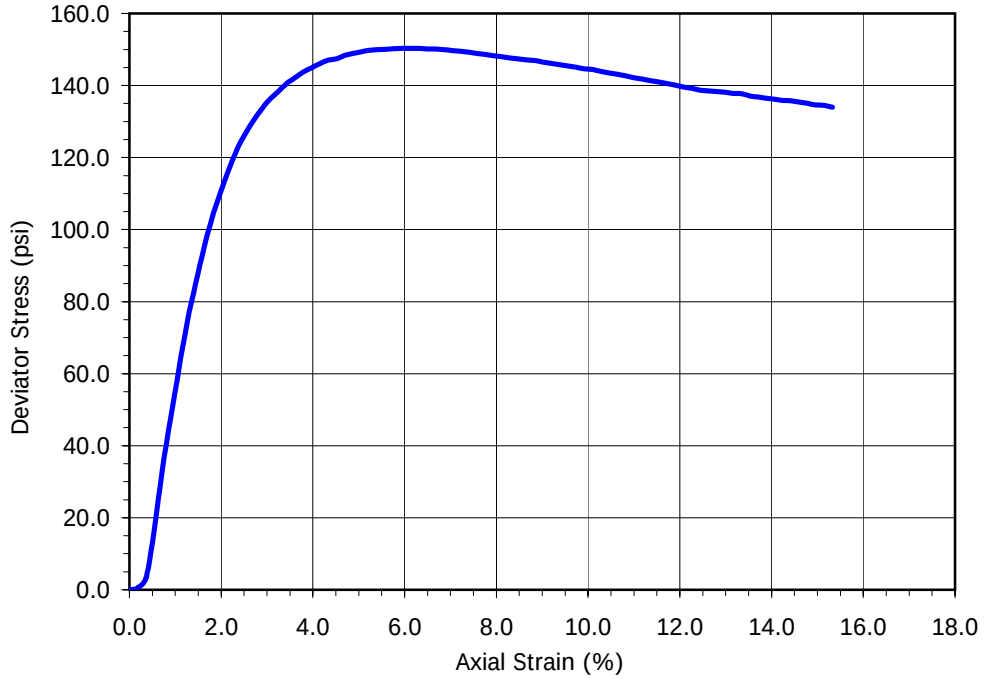
Diameter (in)	1	2.423
	2	2.425
	3	2.426
	Average	2.425
Height (in)	1	5.544
	2	5.547
	3	5.545
	Average	5.545
Weight of Sample + Tube / Rings (g)		881.30
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		989.80
Weight of Dry Sample + Container (g)		884.20
Weight of Container (g)		109.30
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		31.3
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	13.63
Dry Density (pcf)	115.4
Void Ratio	0.460
% Saturation	80.0

At Failure*	
Deviator stress (psi)	**150.34**
Minor principal total stress (psi)	**31.25**
Major principal total stress (psi)	**181.59**
Axial strain (%)	**6.13**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	09/29/08
Project No:	370900.02.GE.0S	Checked by:	J. Ward	Date:	09/30/08
Boring No.:	A-08-026	Sample Type:	Drive		
Sample No.:	D-10	Depth(ft):	50		
Sample Description:	Yellowish brown lean clay (CL)				

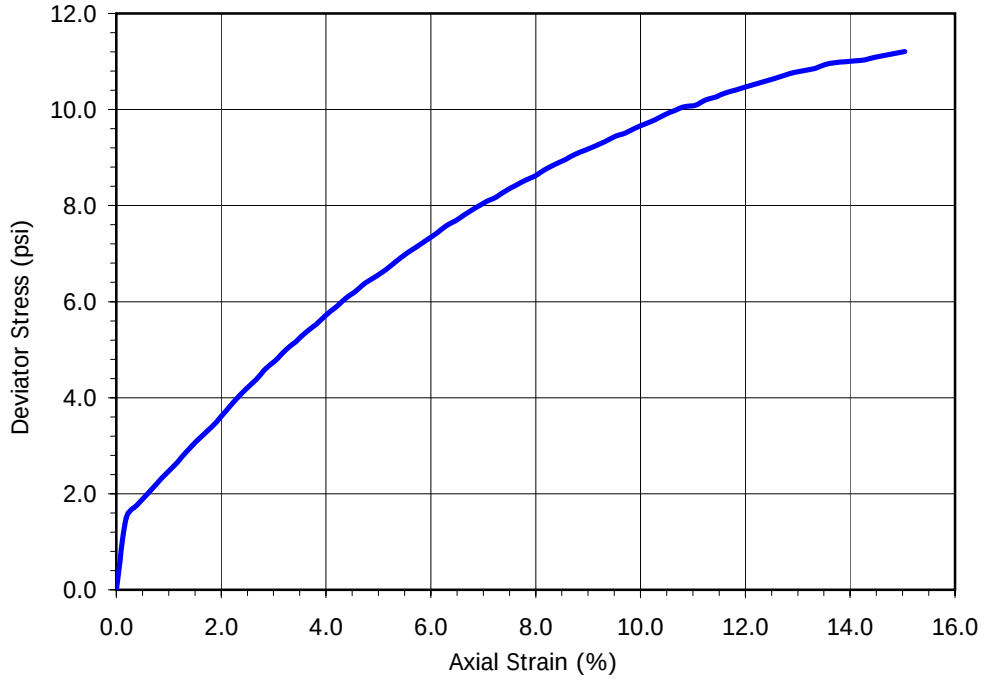
Diameter (in)	1	2.413
	2	2.408
	3	2.416
	Average	2.412
Height (in)	1	5.253
	2	5.254
	3	5.253
	Average	5.253
Weight of Sample + Tube / Rings (g)		753.20
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		855.90
Weight of Dry Sample + Container (g)		673.50
Weight of Container (g)		106.78
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		38.2
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	32.19
Dry Density (pcf)	90.4
Void Ratio	0.864
% Saturation	100.6

At Failure*	
Deviator stress (psi)	**11.20**
Minor principal total stress (psi)	**38.20**
Major principal total stress (psi)	**49.40**
Axial strain (%)	**15.04**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils

ASTM D 2850

Project Name:	SR-57 Widening	Tested by:	A. Santos	Date:	08/13/08
Project No:	370900.02.GE.0S	Checked by:	LF	Date:	08/20/08
Boring No.:	A-08-030	Sample Type:		Drive	
Sample No.:	D-7	Depth(ft):	35		
Sample Description:	Yellowish brown lean clay with sand (CL)s & brown silty sand (SM)				

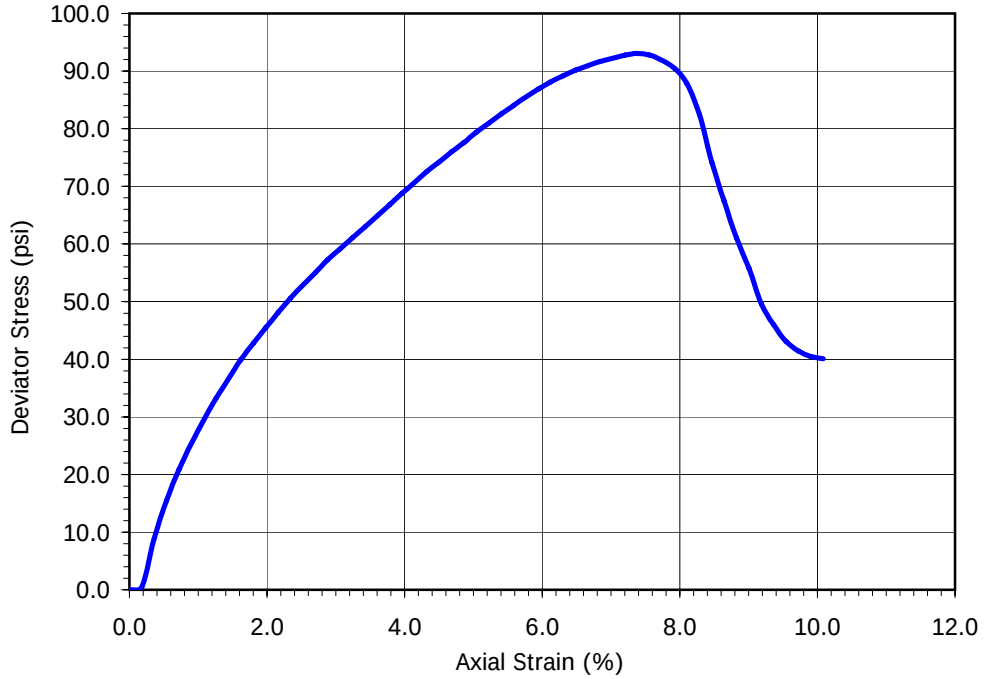
Diameter (in)	1	2.424
	2	2.425
	3	2.427
	Average	2.425
Height (in)	1	
	2	5.553
	3	
	Average	5.553
Weight of Sample + Tube / Rings (g)		811.40
Weight of Tube / Rings (g)		0.00
Weight of Wet Sample + Container (g)		973.30
Weight of Dry Sample + Container (g)		823.40
Weight of Container (g)		108.30
Specific Gravity (assumed)		2.70
Confining Pressure (psi)		15.3
Rate of Deformation (in/min)		0.045

Sample Properties	
Moisture Content (%)	20.96
Dry Density (pcf)	99.6
Void Ratio	0.691
% Saturation	81.9

At Failure*	
Deviator stress (psi)	**93.08**
Minor principal total stress (psi)	**15.30**
Major principal total stress (psi)	**108.38**
Axial strain (%)	**7.38**

* Stress values have been corrected for membrane effects

Stress - Strain Curve



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 08/06/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/13/08

Boring No.	A-08-002	A-08-004	A-08-008	A-08-010
Sample No.	BAG-1	BAG-1	BAG-1	BAG-1
Sample Depth (ft)	2-7	0-7	0-7	0-7
Soil Identification:	s(CL)	(SP-SM)g	(CL)s	SC
Wet Weight of Soil + Container (g)	157.60	154.91	170.21	179.18
Dry Weight of Soil + Container (g)	150.72	151.67	164.37	172.73
Weight of Container (g)	58.45	57.19	39.87	39.92
Moisture Content (%)	7.46	3.43	4.69	4.86
Weight of Soaked Soil (g)	100.85	100.19	100.46	100.25

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	6	8	9	10
Crucible No.	6	7	21	23
Furnace Temperature (°C)	840	840	840	840
Time In / Time Out	8:40 / 9:25	8:40 / 9:25	8:40 / 9:25	8:40 / 9:25
Duration of Combustion (min)	45	45	45	45
Wt. of Crucible + Residue (g)	19.7688	18.2394	18.8011	18.4145
Wt. of Crucible (g)	19.7672	18.2376	18.7989	18.4117
Wt. of Residue (g) (A)	0.0016	0.0018	0.0022	0.0028
PPM of Sulfate (A) x 41150	65.84	74.07	90.53	115.22
PPM of Sulfate, Dry Weight Basis	**71**	**77**	**95**	**121**

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30	30	30
ml of AgNO3 Soln. Used in Titration (C)	0.9	0.5	0.5	1.3
PPM of Chloride (C -0.2) * 100 * 30 / B	70	30	30	110
PPM of Chloride, Dry Wt. Basis	**76**	**31**	**31**	**116**

pH TEST, DOT California Test 532/643

pH Value	**6.93**	**7.90**	**8.05**	**7.82**
Temperature °C	22.0	21.9	21.9	22.0

Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

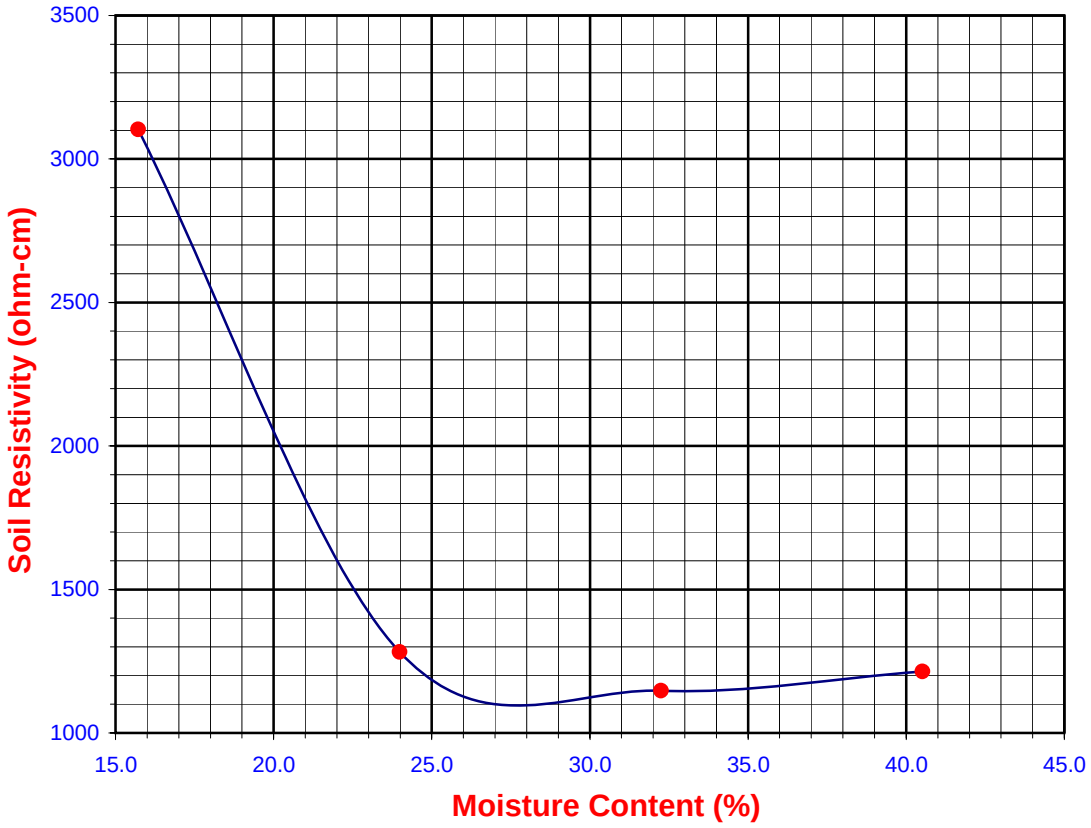
Project Name: SR-57 Widening
Project No. : 370900.02.GE.0S
Boring No.: A-08-002
Sample No. : BAG-1
Soil Identification: s(CL)

Tested By : V. Juliano Date: 08/06/08
Data Input By: LF Date: 08/13/08
Depth (ft.) : 2-7

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	15.72	460	3103
2	200	23.99	190	1282
3	300	32.25	170	1147
4	400	40.52	180	1214
5				

Moisture Content (%) (MCi)	7.46
Wet Wt. of Soil + Cont. (g)	157.60
Dry Wt. of Soil + Cont. (g)	150.72
Wt. of Container (g)	58.45
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	
1100	**28.0**	**71**	**76**	**6.93**	**22.0**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: SR-57 Widening

Project No. : 370900.02.GE.0S

Boring No.: A-08-004

Sample No. : BAG-1

Soil Identification: (SP-SM)g

Tested By : V. Juliano Date: 08/06/08

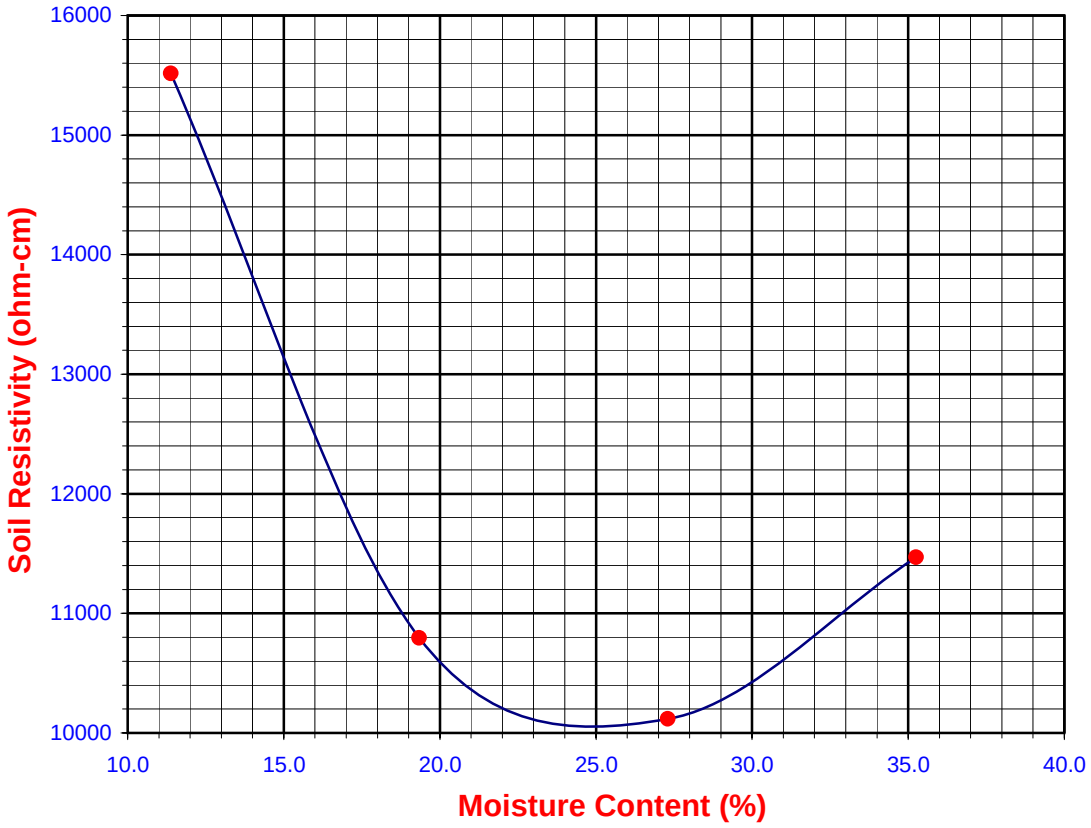
Data Input By: LF Date: 08/13/08

Depth (ft.) : 0-7

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	11.39	2300	15516
2	200	19.34	1600	10794
3	300	27.30	1500	10119
4	400	35.25	1700	11468
5				

Moisture Content (%) (MCi)	3.43
Wet Wt. of Soil + Cont. (g)	154.91
Dry Wt. of Soil + Cont. (g)	151.67
Wt. of Container (g)	57.19
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	
10080	**25.0**	**77**	**31**	**7.90**	**21.9**



Leighton

SOIL RESISTIVITY TEST

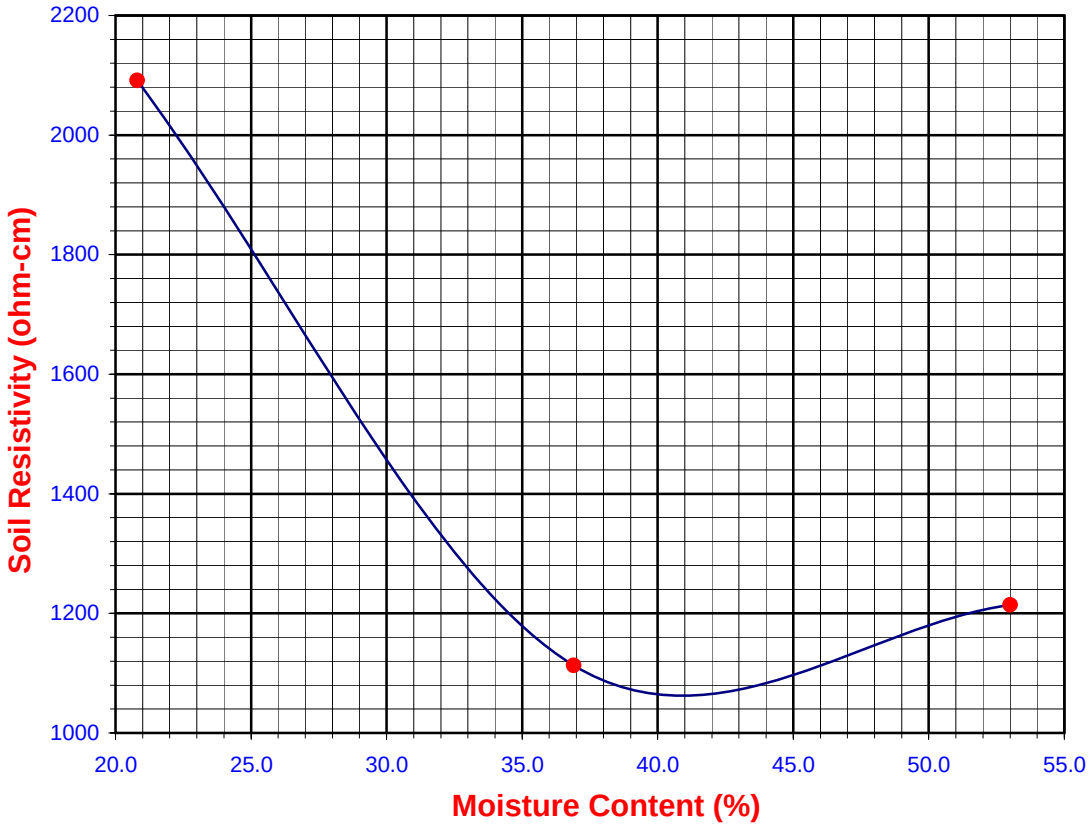
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/06/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/13/08
Boring No.:	A-08-008	Depth (ft.) :	0-7		
Sample No. :	BAG-1				
Soil Identification:	(CL)s				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	200	20.80	310	2091
2	400	36.90	165	1113
3	600	53.01	180	1214
4				
5				

Moisture Content (%) (MCi)	4.69
Wet Wt. of Soil + Cont. (g)	170.21
Dry Wt. of Soil + Cont. (g)	164.37
Wt. of Container (g)	39.87
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	
1070	**41.0**	**95**	**31**	**8.05**	**21.9**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: SR-57 Widening

Project No. : 370900.02.GE.0S

Boring No.: A-08-010

Sample No. : BAG-1

Soil Identification: SC

Tested By : V. Juliano Date: 08/06/08

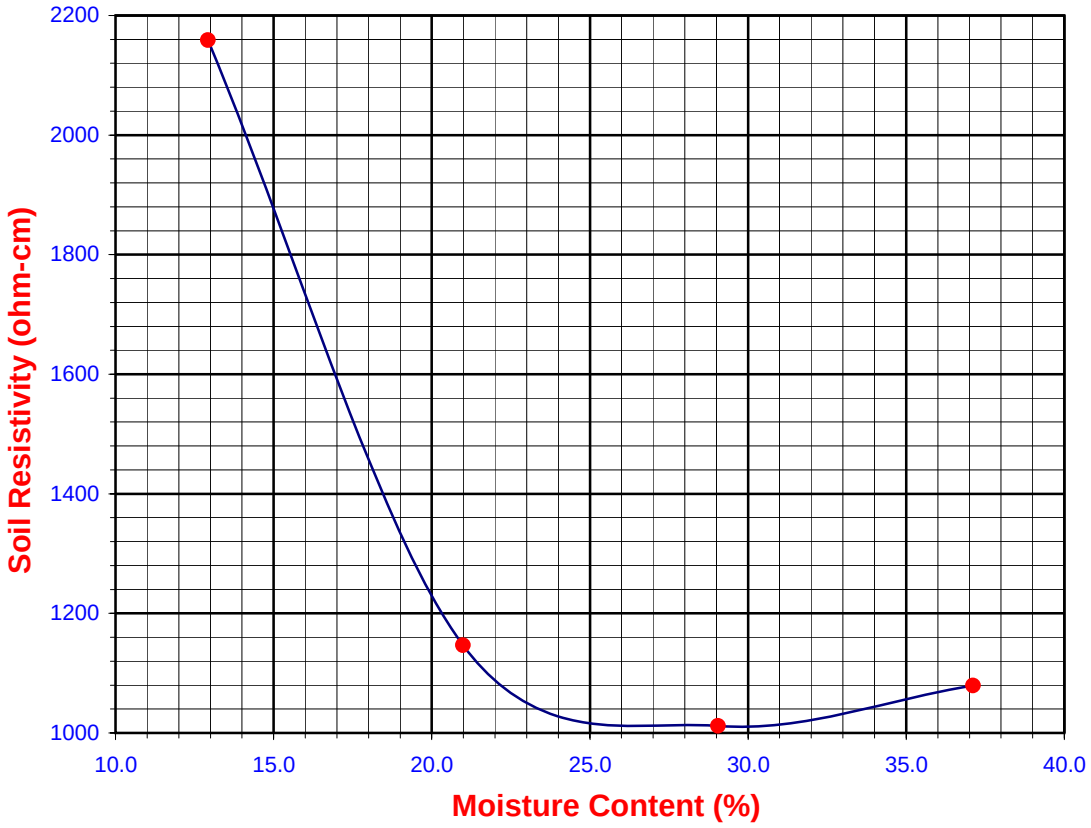
Data Input By: LF Date: 08/13/08

Depth (ft.) : 0-7

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	12.92	320	2159
2	200	20.99	170	1147
3	300	29.05	150	1012
4	400	37.12	160	1079
5				

Moisture Content (%) (MCi)	4.86
Wet Wt. of Soil + Cont. (g)	179.18
Dry Wt. of Soil + Cont. (g)	172.73
Wt. of Container (g)	39.92
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	
1012	**29.1**	**121**	**116**	**7.82**	**22.0**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 08/12/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/15/08

Boring No.	A-08-009	A-08-022		
Sample No.	Bag-1	Bag-1		
Sample Depth (ft)	0 - 7	2 - 7		
Soil Identification:	SC	SC		
Wet Weight of Soil + Container (g)	195.25	202.14		
Dry Weight of Soil + Container (g)	185.41	193.41		
Weight of Container (g)	64.62	61.94		
Moisture Content (%)	8.15	6.64		
Weight of Soaked Soil (g)	100.51	100.41		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	6	8		
Crucible No.	23	26		
Furnace Temperature (°C)	840	840		
Time In / Time Out	7:15 / 8:00	7:15 / 8:00		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	18.4134	18.8770		
Wt. of Crucible (g)	18.4110	18.8736		
Wt. of Residue (g) (A)	0.0024	0.0034		
PPM of Sulfate (A) x 41150	98.76	139.91		
PPM of Sulfate, Dry Weight Basis	**108**	**150**		

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30		
ml of AgNO3 Soln. Used in Titration (C)	0.9	1.2		
PPM of Chloride (C -0.2) * 100 * 30 / B	70	100		
PPM of Chloride, Dry Wt. Basis	**76**	**107**		

pH TEST, DOT California Test 532/643

pH Value	**7.86**	**8.22**		
Temperature °C	21.9	21.9		

Leighton

SOIL RESISTIVITY TEST

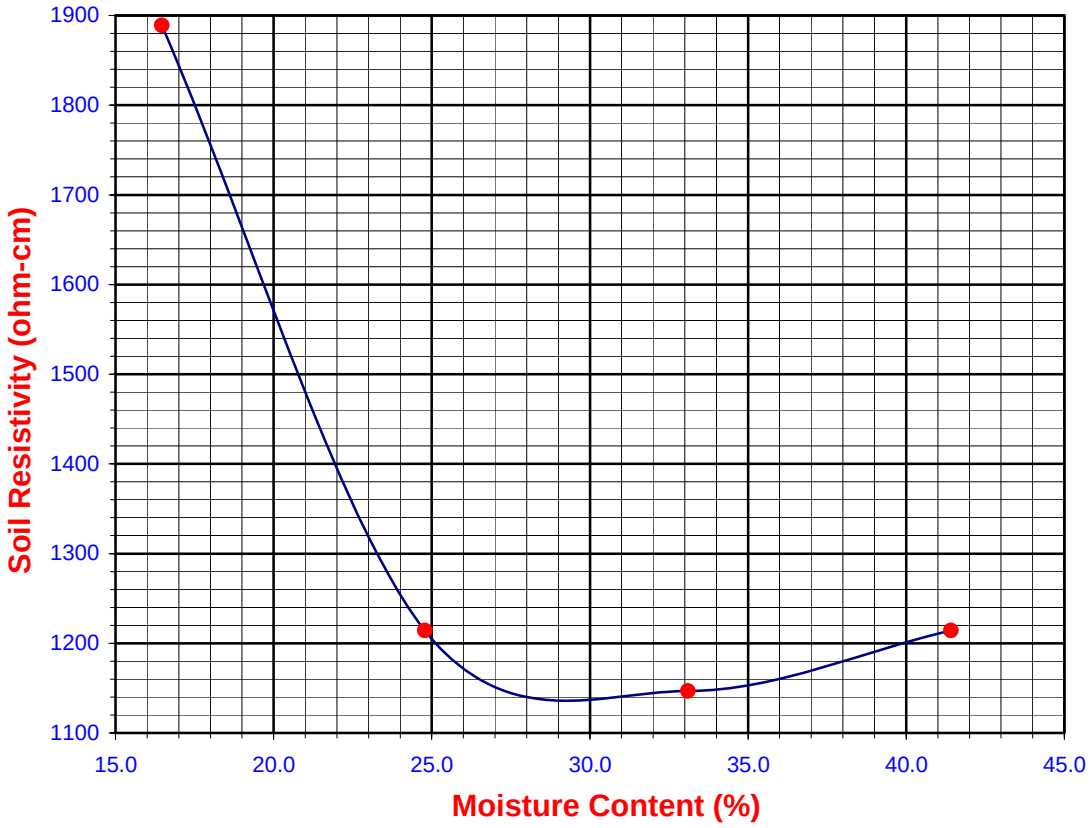
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/12/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/15/08
Boring No.:	A-08-009	Depth (ft.) :	0 - 7		
Sample No. :	Bag-1				
Soil Identification:	SC				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	16.47	280	1889
2	200	24.78	180	1214
3	300	33.10	170	1147
4	400	41.42	180	1214
5				

Moisture Content (%) (MCi)	8.15
Wet Wt. of Soil + Cont. (g)	195.25
Dry Wt. of Soil + Cont. (g)	185.41
Wt. of Container (g)	64.62
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	
1140	**29.0**	**108**	**76**	**7.86**	**21.9**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: SR-57 Widening

Project No. : 370900.02.GE.0S

Boring No.: A-08-022

Sample No. : Bag-1

Soil Identification: SC

Tested By : V. Juliano Date: 08/12/08

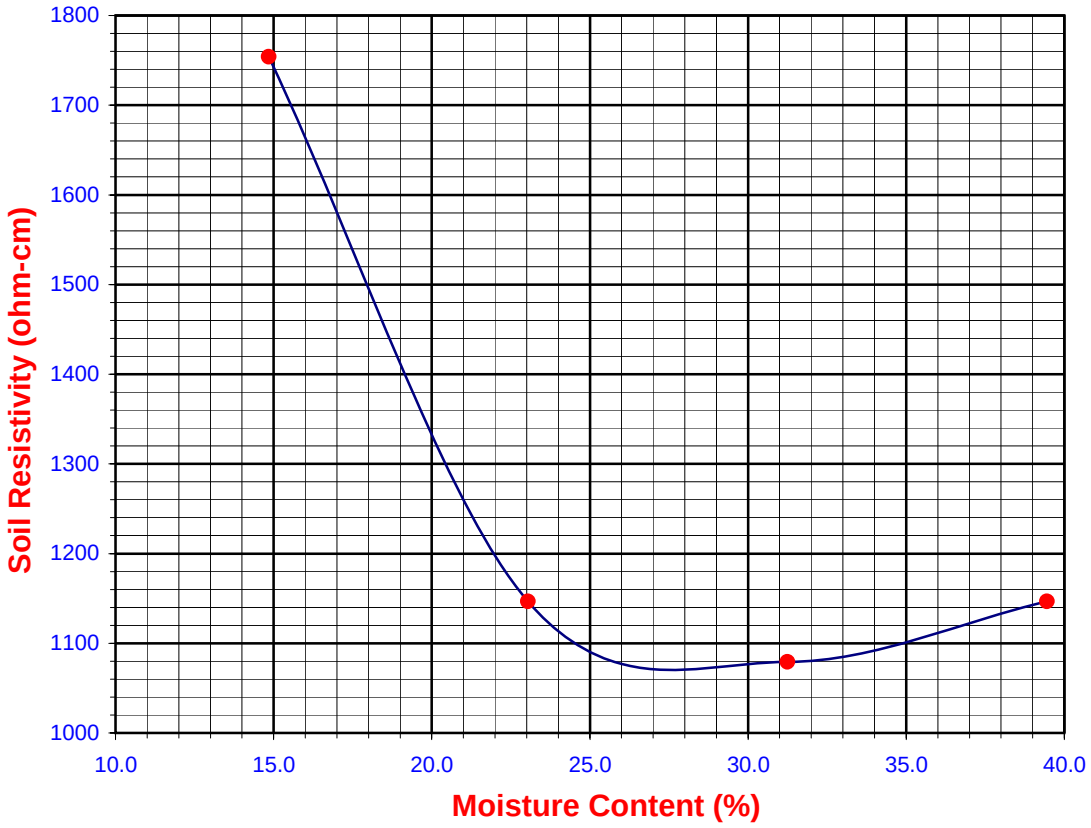
Data Input By: LF Date: 08/15/08

Depth (ft.) : 2 - 7

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	14.84	260	1754
2	200	23.05	170	1147
3	300	31.25	160	1079
4	400	39.45	170	1147
5				

Moisture Content (%) (MCi)	6.64
Wet Wt. of Soil + Cont. (g)	202.14
Dry Wt. of Soil + Cont. (g)	193.41
Wt. of Container (g)	61.94
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	
1075	**28.0**	**150**	**107**	**8.22**	**21.9**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 08/26/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/28/08

Boring No.	A-08-011	A-08-024	A-08-003	
Sample No.	Bag-1	Bag-1	Bag-1	
Sample Depth (ft)	0-7	2-7	0-7	
Soil Identification:	SC	(CL)s	s(CL)	
Wet Weight of Soil + Container (g)	161.38	183.78	194.62	
Dry Weight of Soil + Container (g)	151.28	170.10	183.08	
Weight of Container (g)	68.17	65.19	58.72	
Moisture Content (%)	12.15	13.04	9.28	
Weight of Soaked Soil (g)	100.23	100.27	100.66	

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	11	13	14	
Crucible No.	27	31	32	
Furnace Temperature (°C)	830	830	830	
Time In / Time Out	7:15 / 8:00	7:15 / 8:00	7:15 / 8:00	
Duration of Combustion (min)	45	45	45	
Wt. of Crucible + Residue (g)	17.6386	18.9797	19.1630	
Wt. of Crucible (g)	17.6368	18.9744	19.1614	
Wt. of Residue (g) (A)	0.0018	0.0053	0.0016	
PPM of Sulfate (A) x 41150	74.07	218.10	65.84	
PPM of Sulfate, Dry Weight Basis	**84**	**251**	**73**	

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	1.2	0.7	
PPM of Chloride (C -0.2) * 100 * 30 / B	30	100	50	
PPM of Chloride, Dry Wt. Basis	**34**	**115**	**55**	

pH TEST, DOT California Test 532/643

pH Value	**7.48**	**7.19**	**7.53**	
Temperature °C	20.3	20.4	20.4	

Leighton

SOIL RESISTIVITY TEST

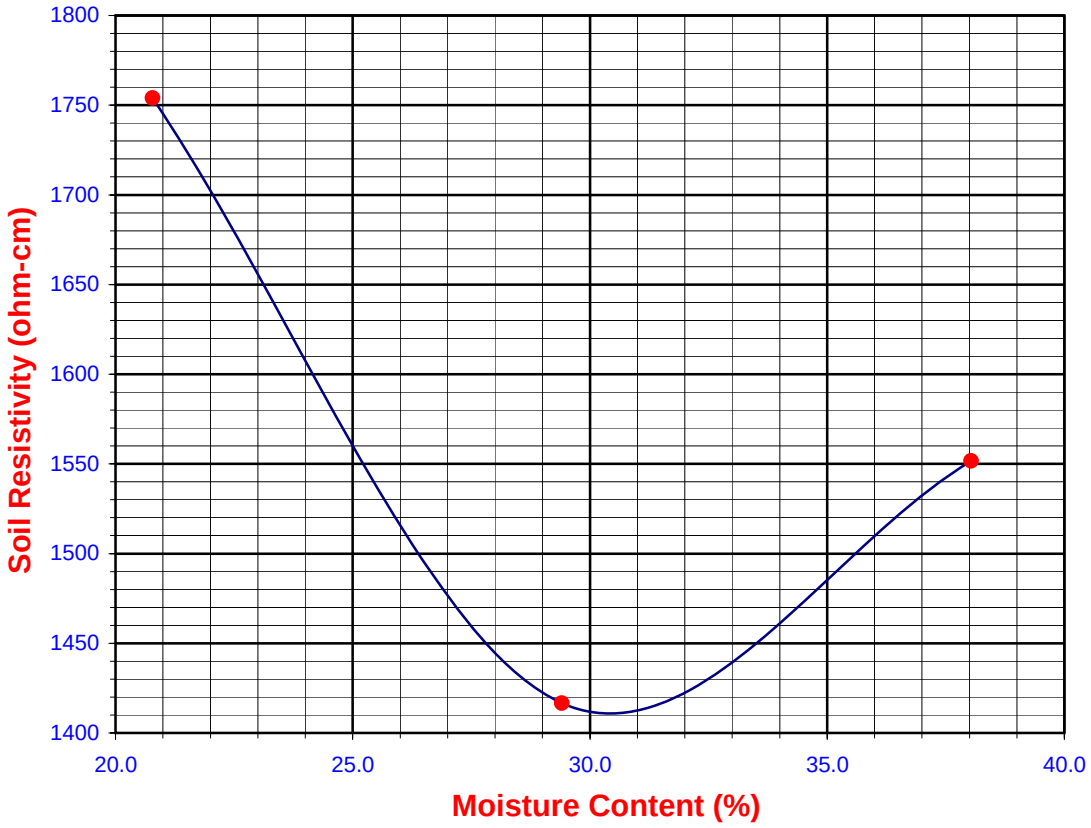
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/28/08
Boring No.:	A-08-011	Depth (ft.) :	0-7		
Sample No. :	Bag-1				
Soil Identification:	SC				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	20.78	260	1754
2	200	29.41	210	1417
3	300	38.03	230	1552
4				
5				

Moisture Content (%) (MCi)	12.15
Wet Wt. of Soil + Cont. (g)	161.38
Dry Wt. of Soil + Cont. (g)	151.28
Wt. of Container (g)	68.17
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	
1410	**30.5**	**84**	**34**	**7.48**	**20.3**



Leighton

SOIL RESISTIVITY TEST

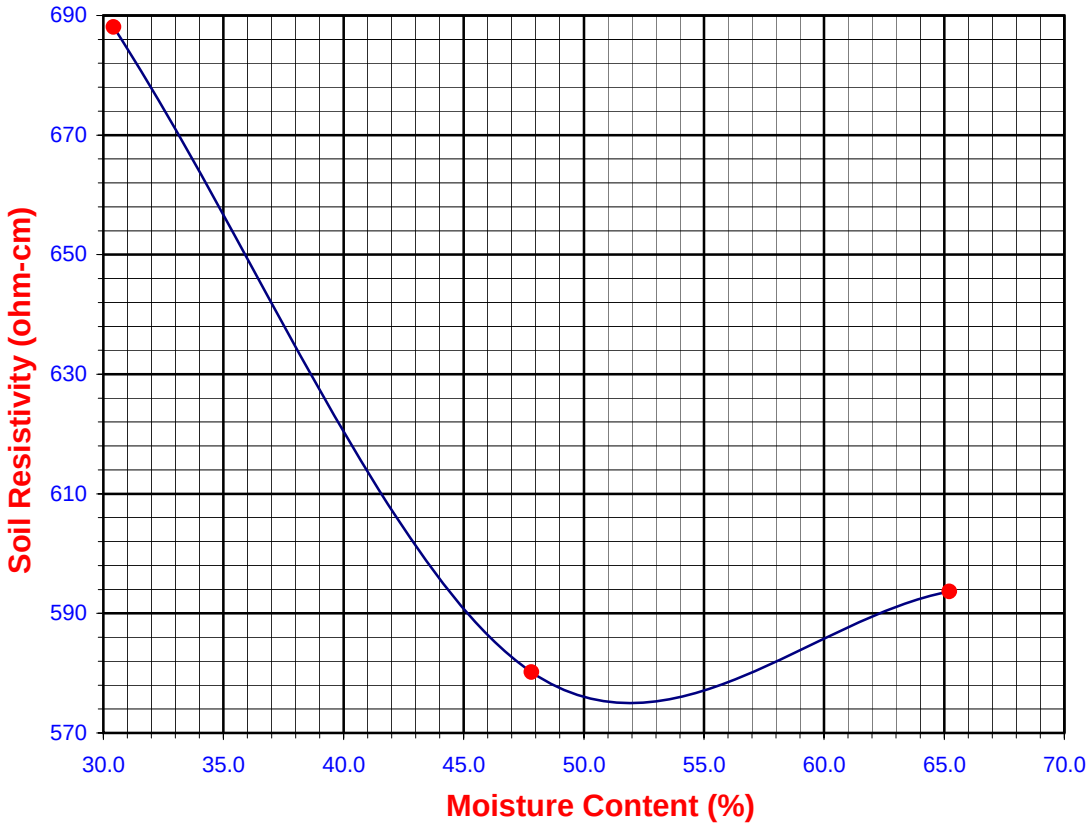
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/28/08
Boring No.:	A-08-024	Depth (ft.) :	2-7		
Sample No. :	Bag-1				
Soil Identification:	(CL)s				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	200	30.43	102	688
2	400	47.82	86	580
3	600	65.21	88	594
4				
5				

Moisture Content (%) (MCi)	13.04
Wet Wt. of Soil + Cont. (g)	183.78
Dry Wt. of Soil + Cont. (g)	170.10
Wt. of Container (g)	65.19
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	
575	**52.0**	**251**	**115**	**7.19**	**20.4**



Leighton

SOIL RESISTIVITY TEST

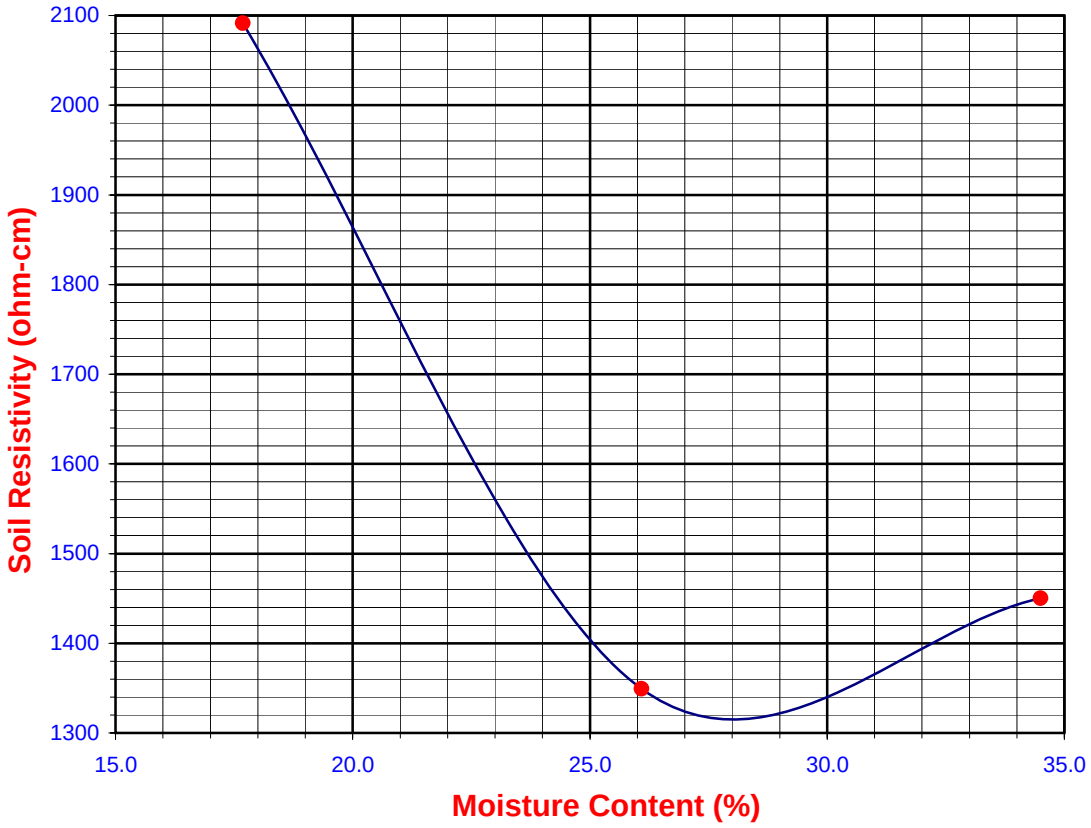
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/28/08
Boring No.:	A-08-003	Depth (ft.) :	0-7		
Sample No. :	Bag-1				
Soil Identification:	s(CL)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	17.69	310	2091
2	200	26.09	200	1349
3	300	34.50	215	1450
4				
5				

Moisture Content (%) (MCi)	9.28
Wet Wt. of Soil + Cont. (g)	194.62
Dry Wt. of Soil + Cont. (g)	183.08
Wt. of Container (g)	58.72
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	
1315	**28.0**	**73**	**55**	**7.53**	**20.4**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 08/12/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/15/08

Boring No.	A-08-012	A-08-013	A-08-015	A-08-021
Sample No.	Bag-1	Bag-1	Bag-1	Bag-1
Sample Depth (ft)	35-40	15-20	0-7	2-7
Soil Identification:	(CL)s	(CH)s	(CL)s	s(CL)
Wet Weight of Soil + Container (g)	184.79	171.33	170.43	162.16
Dry Weight of Soil + Container (g)	174.19	159.99	160.58	148.65
Weight of Container (g)	61.64	58.32	36.68	57.61
Moisture Content (%)	9.42	11.15	7.95	14.84
Weight of Soaked Soil (g)	100.34	100.18	100.83	100.67

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	9	10	14	16
Crucible No.	21	23	26	27
Furnace Temperature (°C)	830	830	830	830
Time In / Time Out	7:15 / 8:00	7:15 / 8:00	7:15 / 8:00	7:15 / 8:00
Duration of Combustion (min)	45	45	45	45
Wt. of Crucible + Residue (g)	18.7989	18.4120	18.8744	17.6378
Wt. of Crucible (g)	18.7980	18.4110	18.8734	17.6364
Wt. of Residue (g) (A)	0.0009	0.0010	0.0010	0.0014
PPM of Sulfate (A) x 41150	37.04	41.15	39.50	57.61
PPM of Sulfate, Dry Weight Basis	**41**	**46**	**43**	**68**

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30	30	30
ml of AgNO3 Soln. Used in Titration (C)	4.3	1.8	0.7	1.0
PPM of Chloride (C -0.2) * 100 * 30 / B	410	160	50	80
PPM of Chloride, Dry Wt. Basis	**453**	**180**	**54**	**94**

pH TEST, DOT California Test 532/643

pH Value	**7.88**	**7.83**	**7.96**	**8.02**
Temperature °C	21.4	21.6	21.6	21.6

Leighton

SOIL RESISTIVITY TEST

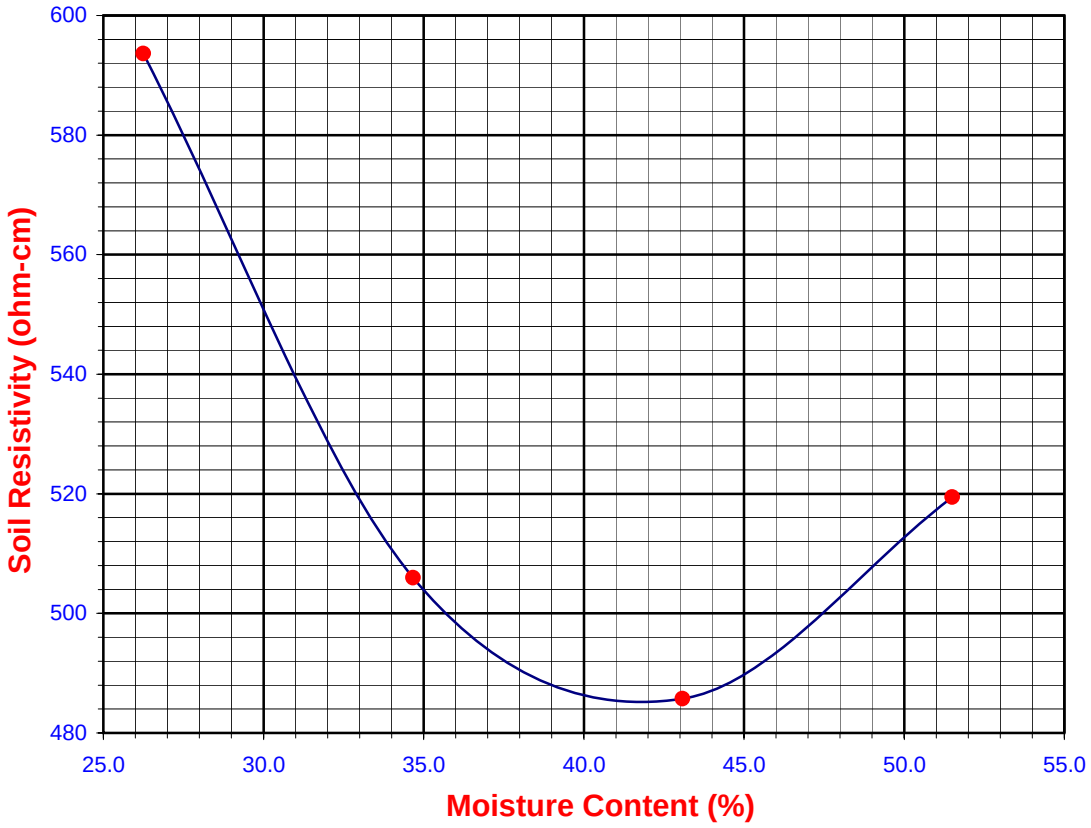
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/12/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/15/08
Boring No.:	A-08-012	Depth (ft.) :	35-40		
Sample No. :	Bag-1				
Soil Identification:	(CL)s				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	200	26.25	88	594
2	300	34.67	75	506
3	400	43.09	72	486
4	500	51.50	77	519
5				

Moisture Content (%) (MCi)	9.42
Wet Wt. of Soil + Cont. (g)	184.79
Dry Wt. of Soil + Cont. (g)	174.19
Wt. of Container (g)	61.64
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	
484	**42.0**	**41**	**453**	**7.88**	**21.4**



Leighton

SOIL RESISTIVITY TEST

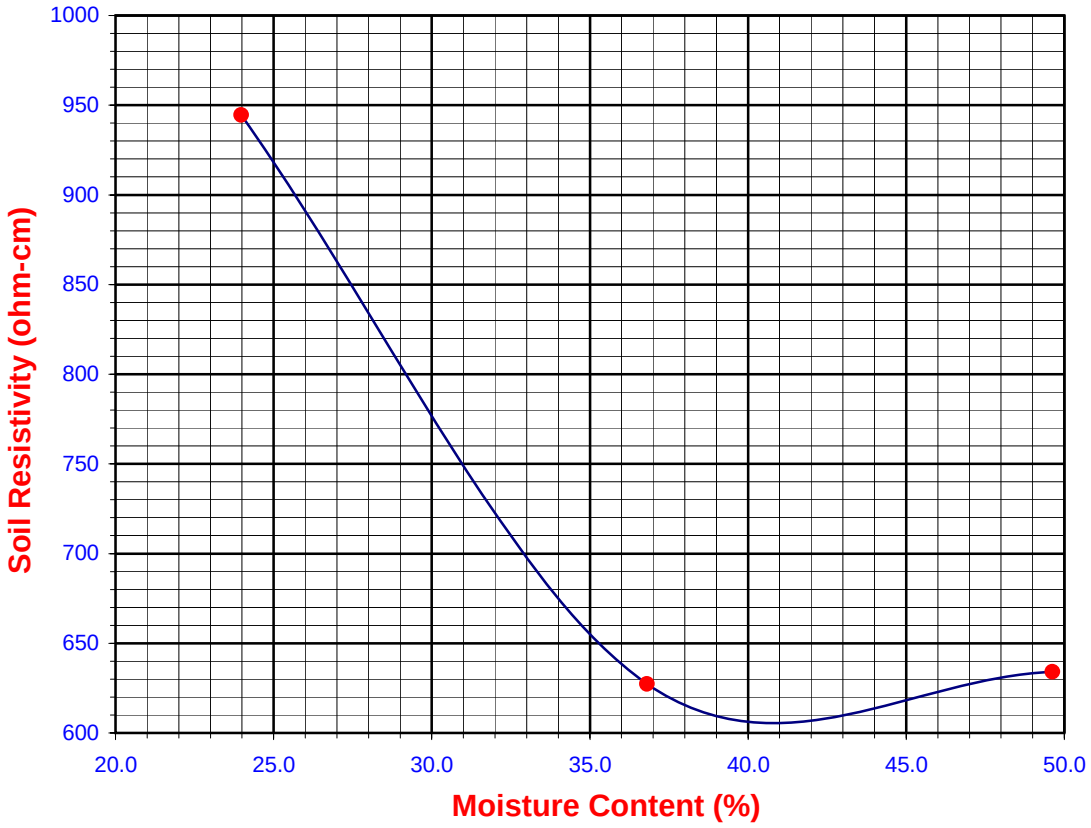
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/12/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/15/08
Boring No.:	A-08-013	Depth (ft.) :	15-20		
Sample No. :	Bag-1				
Soil Identification:	(CH)s				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	150	23.98	140	944
2	300	36.80	93	627
3	450	49.63	94	634
4				
5				

Moisture Content (%) (MCi)	11.15
Wet Wt. of Soil + Cont. (g)	171.33
Dry Wt. of Soil + Cont. (g)	159.99
Wt. of Container (g)	58.32
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	
606	**41.0**	**46**	**180**	**7.83**	**21.6**



Leighton

SOIL RESISTIVITY TEST

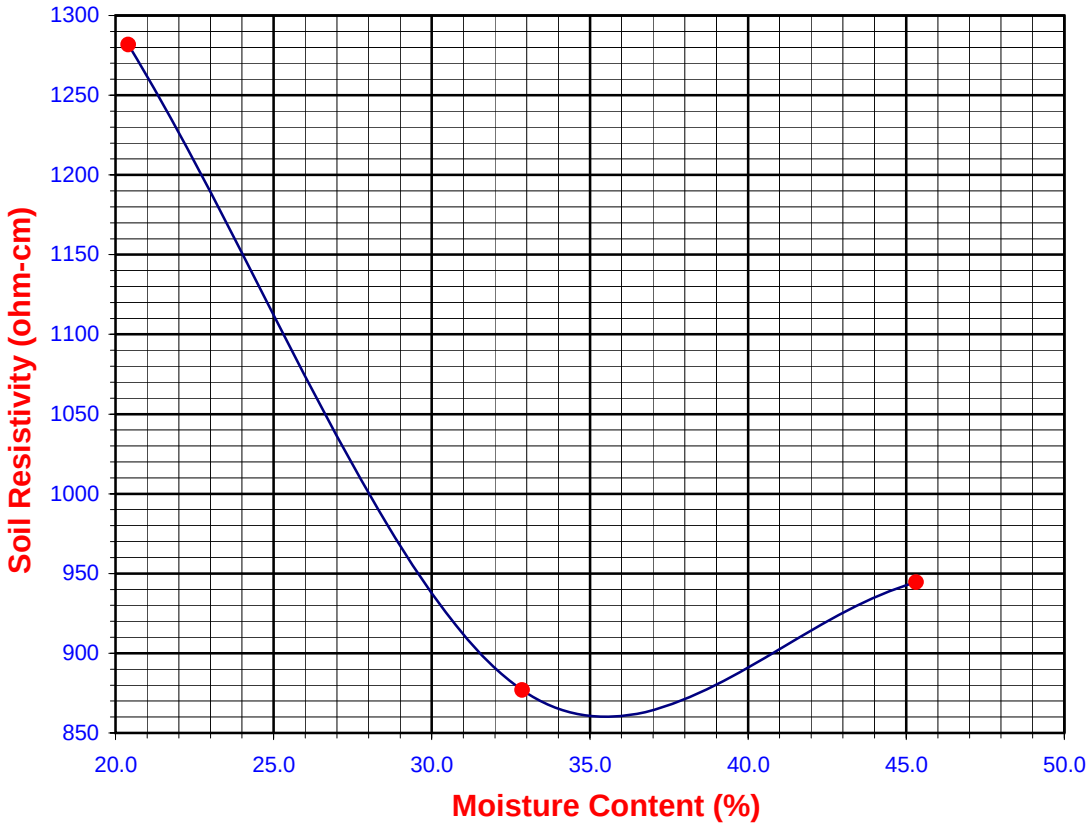
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/12/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/15/08
Boring No.:	A-08-015	Depth (ft.) :	0-7		
Sample No. :	Bag-1				
Soil Identification:	(CL)s				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	150	20.41	190	1282
2	300	32.86	130	877
3	450	45.32	140	944
4				
5				

Moisture Content (%) (MCi)	7.95
Wet Wt. of Soil + Cont. (g)	170.43
Dry Wt. of Soil + Cont. (g)	160.58
Wt. of Container (g)	36.68
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	
860	**35.5**	**43**	**54**	**7.96**	**21.6**



Leighton

SOIL RESISTIVITY TEST

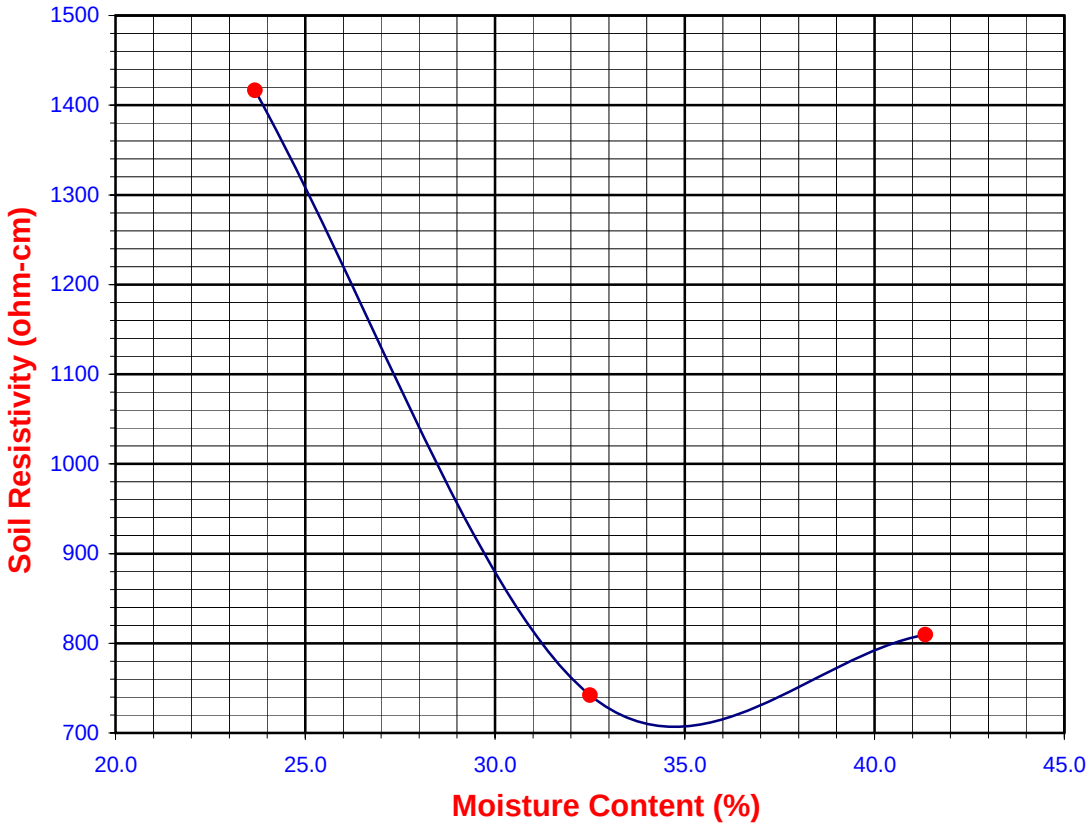
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/12/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/15/08
Boring No.:	A-08-021	Depth (ft.) :	2-7		
Sample No. :	Bag-1				
Soil Identification:	s(CL)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	23.67	210	1417
2	200	32.51	110	742
3	300	41.34	120	810
4				
5				

Moisture Content (%) (MCi)	14.84
Wet Wt. of Soil + Cont. (g)	162.16
Dry Wt. of Soil + Cont. (g)	148.65
Wt. of Container (g)	57.61
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	
705	**34.7**	**68**	**94**	**8.02**	**21.6**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 08/06/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/12/08

Boring No.	A-08-013	A-08-016	A-08-023	
Sample No.	Bag-2	Bag-2	Bag-1	
Sample Depth (ft)	25-30	25-30	20-25	
Soil Identification:	CH	(CL)s	sc	
Wet Weight of Soil + Container (g)	161.02	184.34	159.58	
Dry Weight of Soil + Container (g)	155.19	178.67	147.88	
Weight of Container (g)	58.72	56.94	61.95	
Moisture Content (%)	6.04	4.66	13.62	
Weight of Soaked Soil (g)	100.68	100.51	100.28	

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	11	13	14	
Crucible No.	26	27	31	
Furnace Temperature (°C)	840	840	840	
Time In / Time Out	8:40 / 9:25	8:40 / 9:25	8:40 / 9:25	
Duration of Combustion (min)	45	45	45	
Wt. of Crucible + Residue (g)	18.8762	17.6386	18.9759	
Wt. of Crucible (g)	18.8740	17.6367	18.9742	
Wt. of Residue (g) (A)	0.0022	0.0019	0.0017	
PPM of Sulfate (A) x 41150	90.53	78.18	69.95	
PPM of Sulfate, Dry Weight Basis	**96**	**82**	**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)	0.8	1.8	0.6	
PPM of Chloride (C -0.2) * 100 * 30 / B	60	160	40	
PPM of Chloride, Dry Wt. Basis	**64**	**168**	**46**	

pH TEST, DOT California Test 532/643

pH Value	**8.17**	**7.86**	**8.14**	
Temperature °C	22.0	21.9	21.9	

Leighton

SOIL RESISTIVITY TEST

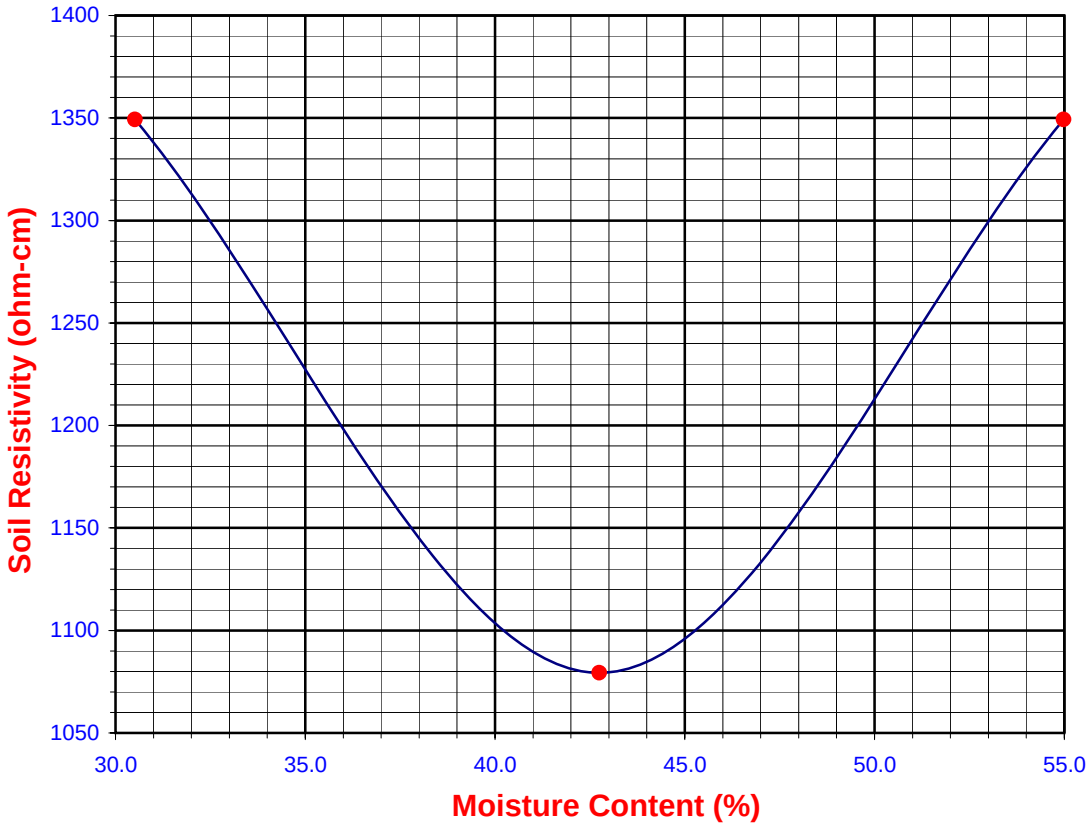
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/06/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/12/08
Boring No.:	A-08-013	Depth (ft.) :	25-30		
Sample No. :	Bag-2				
Soil Identification:	CH				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	300	30.51	200	1349
2	450	42.75	160	1079
3	600	54.99	200	1349
4				
5				

Moisture Content (%) (MCi)	6.04
Wet Wt. of Soil + Cont. (g)	161.02
Dry Wt. of Soil + Cont. (g)	155.19
Wt. of Container (g)	58.72
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	
1079	**42.8**	**96**	**64**	**8.17**	**22.0**



Leighton

SOIL RESISTIVITY TEST

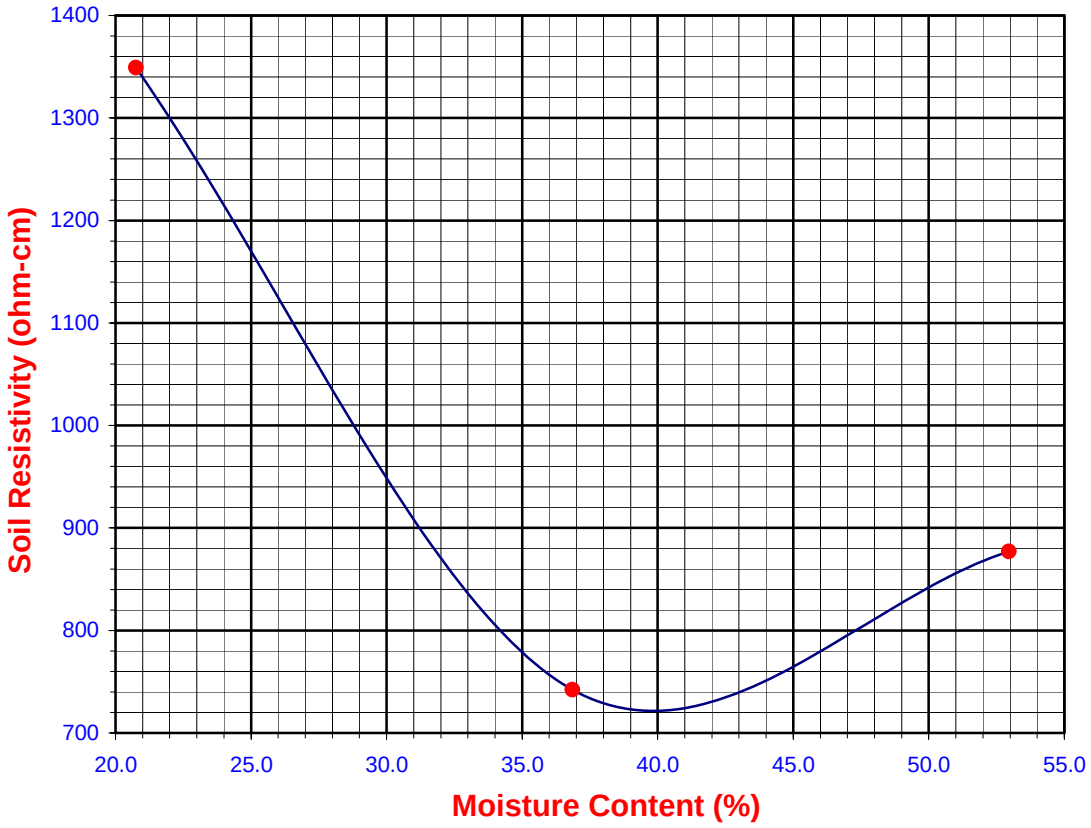
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/06/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/12/08
Boring No.:	A-08-016	Depth (ft.) :	25-30		
Sample No. :	Bag-2				
Soil Identification:	(CL)s				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	200	20.76	200	1349
2	400	36.86	110	742
3	600	52.96	130	877
4				
5				

Moisture Content (%) (MCi)	4.66
Wet Wt. of Soil + Cont. (g)	184.34
Dry Wt. of Soil + Cont. (g)	178.67
Wt. of Container (g)	56.94
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	
720	**40.0**	**82**	**168**	**7.86**	**21.9**



Leighton

SOIL RESISTIVITY TEST

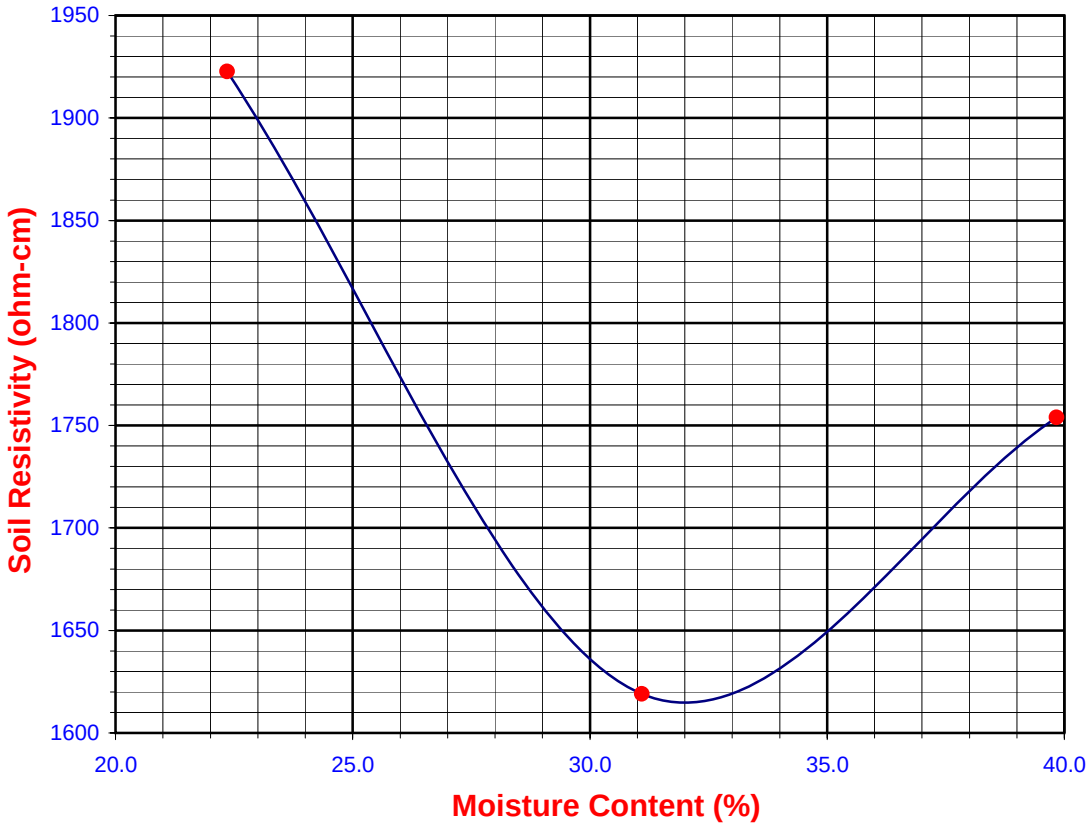
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/06/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/12/08
Boring No.:	A-08-023	Depth (ft.) :	20-25		
Sample No. :	Bag-1				
Soil Identification:	sc				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	22.36	285	1923
2	200	31.10	240	1619
3	300	39.83	260	1754
4				
5				

Moisture Content (%) (MCi)	13.62
Wet Wt. of Soil + Cont. (g)	159.58
Dry Wt. of Soil + Cont. (g)	147.88
Wt. of Container (g)	61.95
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	
1615	**32.0**	**81**	**46**	**8.14**	**21.9**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 08/26/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/28/08

Boring No.	A-08-014	A-08-016	A-08-001	A-08-005
Sample No.	Bag-1	Bag-1	Bag-1	Bag-1
Sample Depth (ft)	0-7	15-20	0-7	0-7
Soil Identification:	SC	(CL)s	s(CL)	s(CL)
Wet Weight of Soil + Container (g)	219.22	162.16	190.08	153.84
Dry Weight of Soil + Container (g)	209.10	156.02	180.63	149.68
Weight of Container (g)	76.34	59.18	69.52	36.80
Moisture Content (%)	7.62	6.34	8.51	3.69
Weight of Soaked Soil (g)	100.23	100.26	100.11	100.71

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	6	8	9	10
Crucible No.	20	21	23	26
Furnace Temperature (°C)	830	830	830	830
Time In / Time Out	7:15 / 8:00	7:15 / 8:00	7:15 / 8:00	7:15 / 8:00
Duration of Combustion (min)	45	45	45	45
Wt. of Crucible + Residue (g)	21.2256	18.8006	18.4125	18.8754
Wt. of Crucible (g)	21.2237	18.7988	18.4116	18.8740
Wt. of Residue (g) (A)	0.0019	0.0018	0.0009	0.0014
PPM of Sulfate (A) x 41150	78.18	74.07	37.04	57.61
PPM of Sulfate, Dry Weight Basis	**85**	**79**	**40**	**60**

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30	30	30
ml of AgNO3 Soln. Used in Titration (C)	1.0	2.2	0.9	0.6
PPM of Chloride (C -0.2) * 100 * 30 / B	80	200	70	40
PPM of Chloride, Dry Wt. Basis	**87**	**214**	**77**	**42**

pH TEST, DOT California Test 532/643

pH Value	**7.19**	**7.22**	**7.55**	**7.46**
Temperature °C	20.5	20.3	20.4	20.3

Leighton

SOIL RESISTIVITY TEST

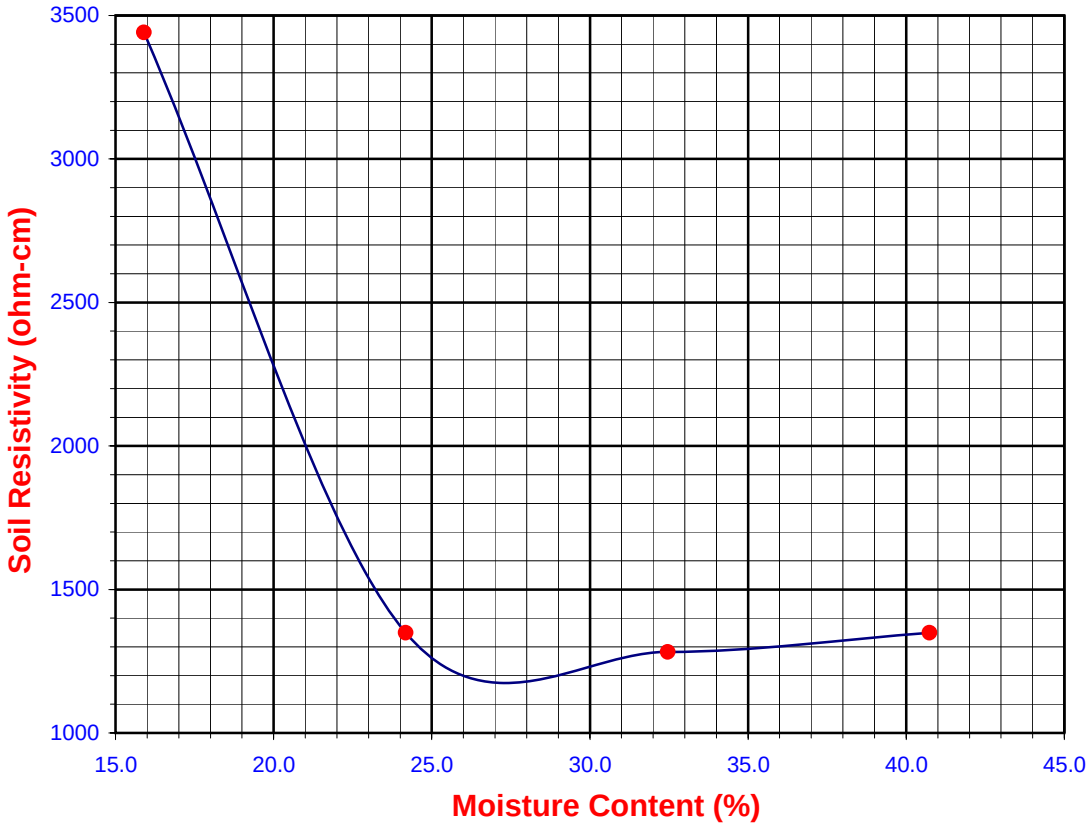
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/28/08
Boring No.:	A-08-014	Depth (ft.) :	0-7		
Sample No. :	Bag-1				
Soil Identification:	SC				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	15.90	510	3440
2	200	24.18	200	1349
3	300	32.46	190	1282
4	400	40.74	200	1349
5				

Moisture Content (%) (MCi)	7.62
Wet Wt. of Soil + Cont. (g)	219.22
Dry Wt. of Soil + Cont. (g)	209.10
Wt. of Container (g)	76.34
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	
1180	**27.5**	**85**	**87**	**7.19**	**20.5**



Leighton

SOIL RESISTIVITY TEST

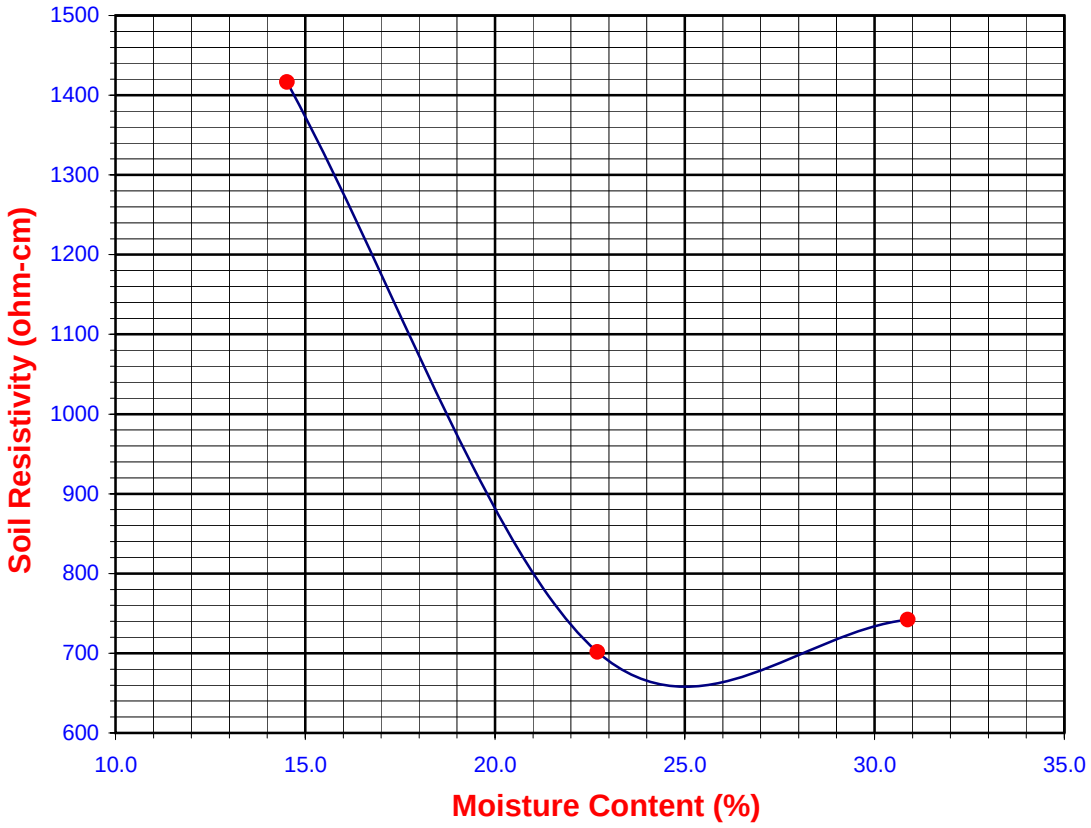
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/28/08
Boring No.:	A-08-016	Depth (ft.) :	15-20		
Sample No. :	Bag-1				
Soil Identification:	(CL)s				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	14.52	210	1417
2	200	22.70	104	702
3	300	30.88	110	742
4				
5				

Moisture Content (%) (MCi)	6.34
Wet Wt. of Soil + Cont. (g)	162.16
Dry Wt. of Soil + Cont. (g)	156.02
Wt. of Container (g)	59.18
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	
660	**25.0**	**79**	**214**	**7.22**	**20.3**



Leighton

SOIL RESISTIVITY TEST

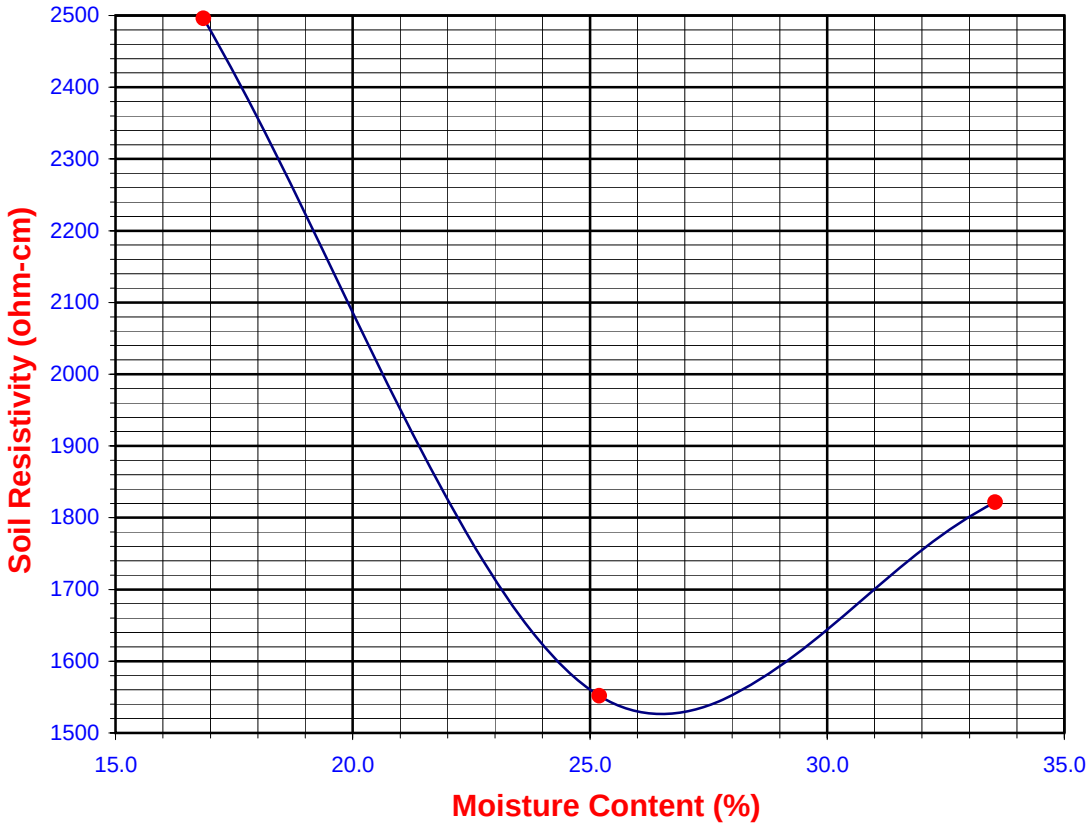
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/28/08
Boring No.:	A-08-001	Depth (ft.) :	0-7		
Sample No. :	Bag-1				
Soil Identification:	s(CL)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	16.85	370	2496
2	200	25.20	230	1552
3	300	33.54	270	1821
4				
5				

Moisture Content (%) (MCi)	8.51
Wet Wt. of Soil + Cont. (g)	190.08
Dry Wt. of Soil + Cont. (g)	180.63
Wt. of Container (g)	69.52
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	
1525	**26.5**	**40**	**77**	**7.55**	**20.4**



Leighton

SOIL RESISTIVITY TEST

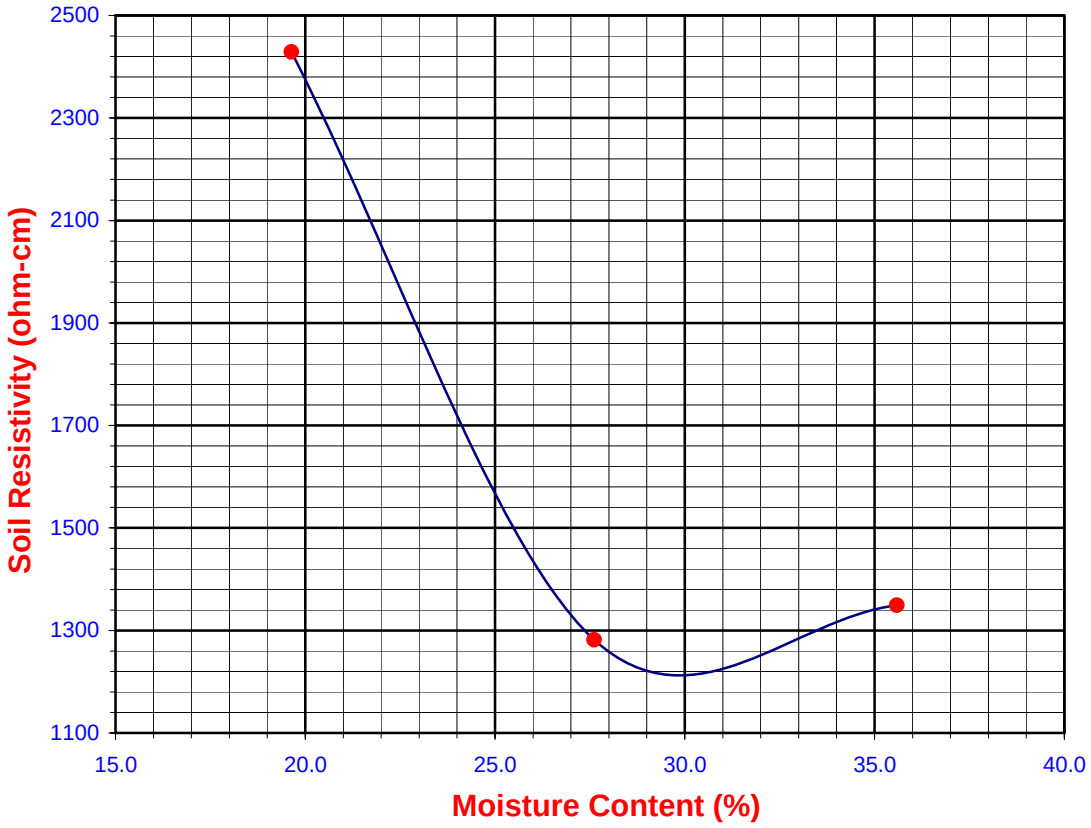
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/26/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/28/08
Boring No.:	A-08-005	Depth (ft.) :	0-7		
Sample No. :	Bag-1				
Soil Identification:	s(CL)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	200	19.64	360	2429
2	300	27.61	190	1282
3	400	35.59	200	1349
4				
5				

Moisture Content (%) (MCi)	3.69
Wet Wt. of Soil + Cont. (g)	153.84
Dry Wt. of Soil + Cont. (g)	149.68
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	
1218	**29.8**	**60**	**42**	**7.46**	**20.3**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 08/12/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/15/08

Boring No.	A-08-025	A-08-025		
Sample No.	Bag-1	Bag-2		
Sample Depth (ft)	20-25	25-30		
Soil Identification:	CL	(CL)s		
Wet Weight of Soil + Container (g)	196.43	162.42		
Dry Weight of Soil + Container (g)	185.96	149.49		
Weight of Container (g)	58.98	69.15		
Moisture Content (%)	8.25	16.09		
Weight of Soaked Soil (g)	100.18	100.43		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	17	18		
Crucible No.	31	32		
Furnace Temperature (°C)	830	830		
Time In / Time Out	7:15 / 8:00	7:15 / 8:00		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	18.9770	19.1625		
Wt. of Crucible (g)	18.9737	19.1608		
Wt. of Residue (g) (A)	0.0033	0.0017		
PPM of Sulfate (A) x 41150	135.79	69.96		
PPM of Sulfate, Dry Weight Basis	**148**	**83**		

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30		
ml of AgNO3 Soln. Used in Titration (C)	0.9	0.9		
PPM of Chloride (C -0.2) * 100 * 30 / B	70	70		
PPM of Chloride, Dry Wt. Basis	**76**	**83**		

pH TEST, DOT California Test 532/643

pH Value	**7.79**	**7.96**		
Temperature °C	21.6	21.5		

Leighton

SOIL RESISTIVITY TEST

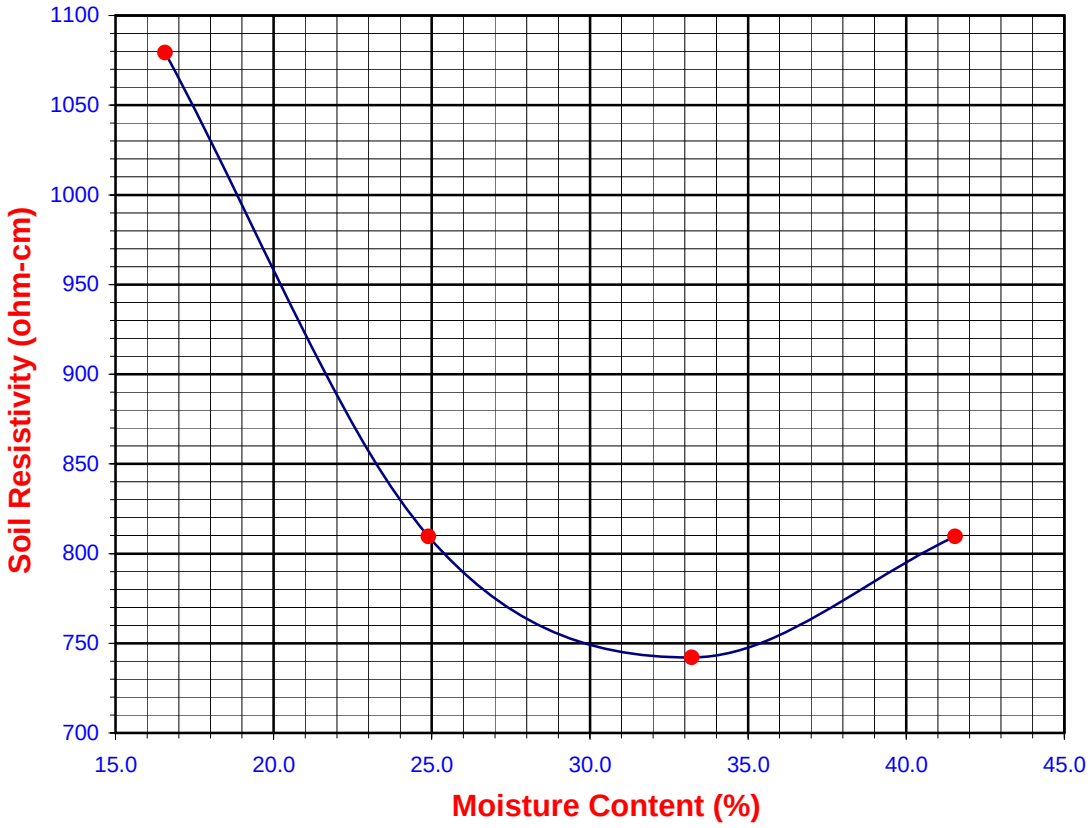
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/12/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/15/08
Boring No.:	A-08-025	Depth (ft.) :	20-25		
Sample No. :	Bag-1				
Soil Identification:	CL				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	16.57	160	1079
2	200	24.90	120	810
3	300	33.23	110	742
4	400	41.55	120	810
5				

Moisture Content (%) (MCi)	8.25
Wet Wt. of Soil + Cont. (g)	196.43
Dry Wt. of Soil + Cont. (g)	185.96
Wt. of Container (g)	58.98
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	
742	**33.2**	**148**	**76**	**7.79**	**21.6**



Leighton

SOIL RESISTIVITY TEST

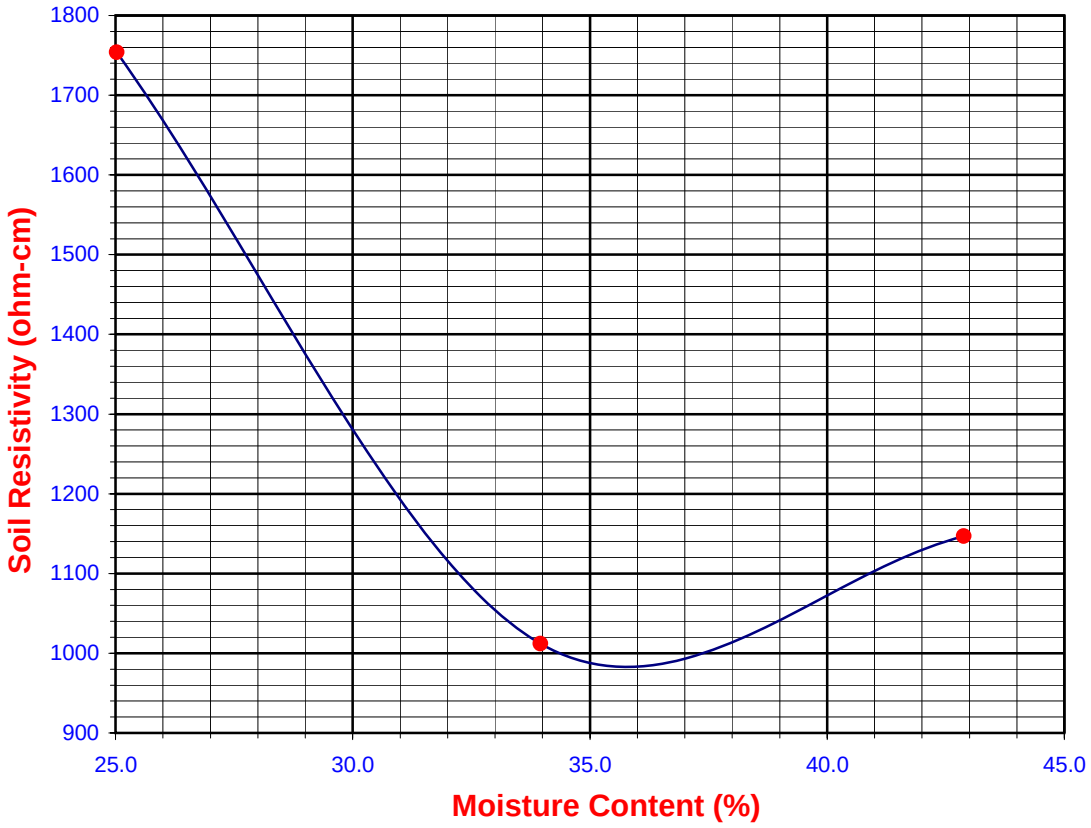
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/12/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/15/08
Boring No.:	A-08-025	Depth (ft.) :	25-30		
Sample No. :	Bag-2				
Soil Identification:	(CL)s				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	25.02	260	1754
2	200	33.95	150	1012
3	300	42.89	170	1147
4				
5				

Moisture Content (%) (MCi)	16.09
Wet Wt. of Soil + Cont. (g)	162.42
Dry Wt. of Soil + Cont. (g)	149.49
Wt. of Container (g)	69.15
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	
980	**35.7**	**83**	**83**	**7.96**	**21.5**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 09/22/08

Project No. : 370900.02.GE.0S | Data Input By: J. Ward | Date: 09/30/08

Boring No.	A-08-026			
Sample No.	Bag-1			
Sample Depth (ft)	5-10			
Soil Identification:	s(CL)			
Wet Weight of Soil + Container (g)	161.08			
Dry Weight of Soil + Container (g)	149.78			
Weight of Container (g)	60.69			
Moisture Content (%)	12.68			
Weight of Soaked Soil (g)	100.57			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	8			
Crucible No.	18			
Furnace Temperature (°C)	840			
Time In / Time Out	7:25 / 8:10			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	19.7369			
Wt. of Crucible (g)	19.7342			
Wt. of Residue (g) (A)	0.0027			
PPM of Sulfate (A) x 41150	111.10			
PPM of Sulfate, Dry Weight Basis	**127**			

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30			
ml of AgNO3 Soln. Used in Titration (C)	0.7			
PPM of Chloride (C -0.2) * 100 * 30 / B	50			
PPM of Chloride, Dry Wt. Basis	**57**			

pH TEST, DOT California Test 532/643

pH Value	**7.87**			
Temperature °C	20.9			

Leighton

SOIL RESISTIVITY TEST

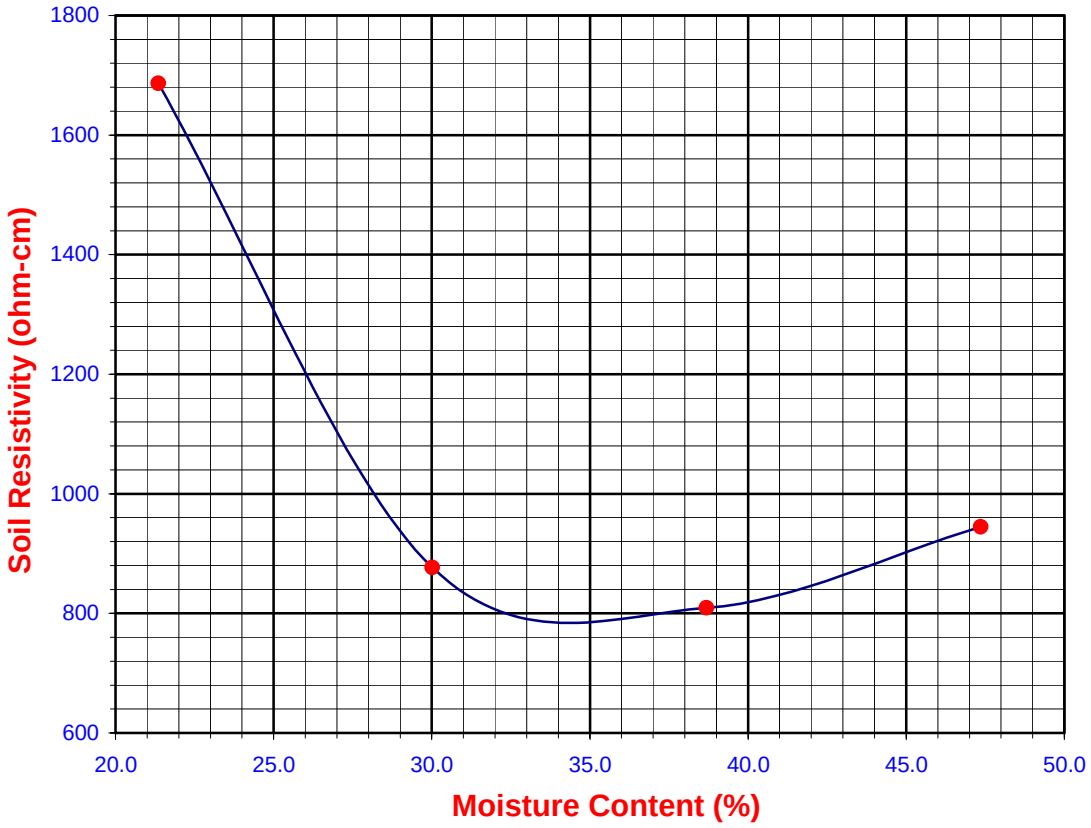
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	09/26/08
Project No. :	370900.02.GE.0S	Data Input By:	J. Ward	Date:	09/30/08
Boring No.:	A-08-026	Depth (ft.) :	5-10		
Sample No. :	Bag-1				
Soil Identification:	s(CL)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	21.35	250	1687
2	200	30.02	130	877
3	300	38.69	120	810
4	400	47.36	140	944
5				

Moisture Content (%) (MCi)	12.68
Wet Wt. of Soil + Cont. (g)	161.08
Dry Wt. of Soil + Cont. (g)	149.78
Wt. of Container (g)	60.69
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	
780	**34.4**	**127**	**57**	**7.87**	**20.9**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 08/12/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/14/08

Boring No.	A-08-027	A-08-028		
Sample No.	Bag-1	Bag-1		
Sample Depth (ft)	0-7	0-7		
Soil Identification:	s(CL)	s(CL)g		
Wet Weight of Soil + Container (g)	186.48	196.77		
Dry Weight of Soil + Container (g)	174.37	185.81		
Weight of Container (g)	60.68	59.20		
Moisture Content (%)	10.65	8.66		
Weight of Soaked Soil (g)	100.68	100.51		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	6	8		
Crucible No.	15	20		
Furnace Temperature (°C)	830	830		
Time In / Time Out	7:15 / 8:00	7:15 / 8:00		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	20.3184	21.2240		
Wt. of Crucible (g)	20.3137	21.2231		
Wt. of Residue (g) (A)	0.0047	0.0009		
PPM of Sulfate (A) x 41150	193.40	37.04		
PPM of Sulfate, Dry Weight Basis	**216**	**41**		

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30	30		
ml of AgNO3 Soln. Used in Titration (C)	0.9	0.8		
PPM of Chloride (C -0.2) * 100 * 30 / B	70	60		
PPM of Chloride, Dry Wt. Basis	**78**	**66**		

pH TEST, DOT California Test 532/643

pH Value	**7.32**	**7.80**		
Temperature °C	21.8	21.8		

Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: SR-57 Widening

Project No. : 370900.02.GE.0S

Boring No.: A-08-027

Sample No. : Bag-1

Soil Identification: s(CL)

Tested By : V. Juliano Date: 08/12/08

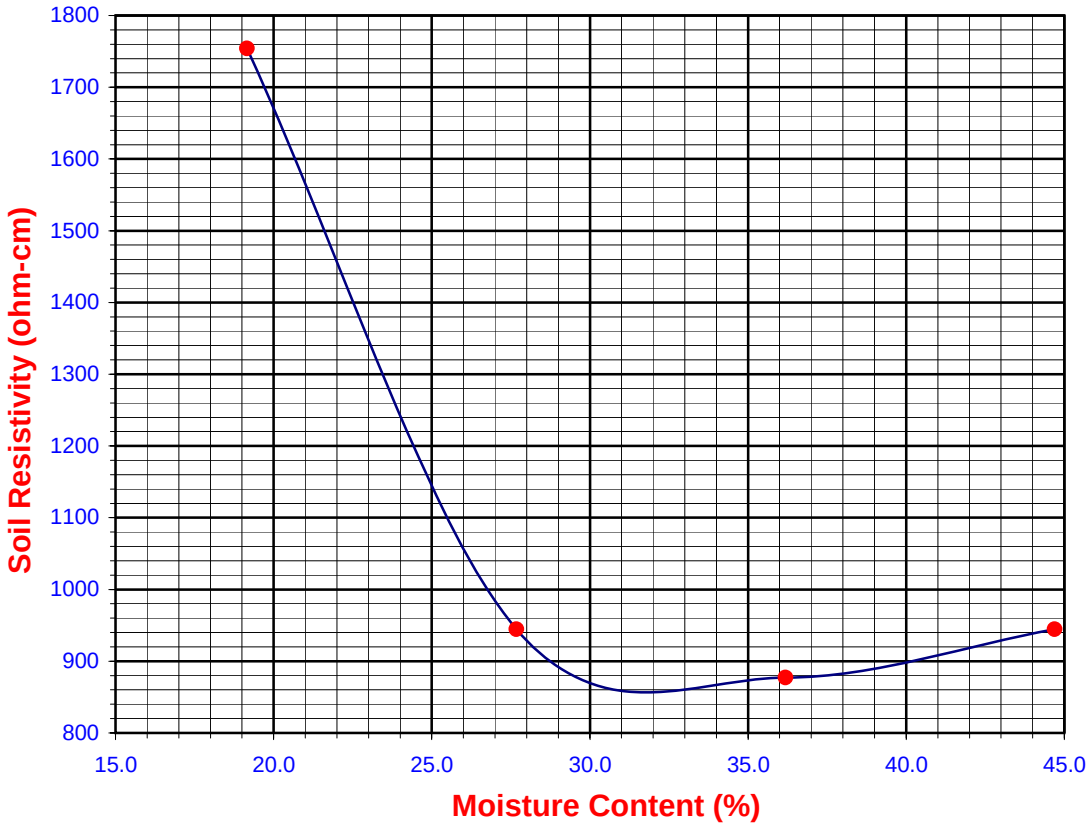
Data Input By: LF Date: 08/14/08

Depth (ft.) : 0-7

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	19.16	260	1754
2	200	27.68	140	944
3	300	36.19	130	877
4	400	44.70	140	944
5				

Moisture Content (%) (MCi)	10.65
Wet Wt. of Soil + Cont. (g)	186.48
Dry Wt. of Soil + Cont. (g)	174.37
Wt. of Container (g)	60.68
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	
860	**32.0**	**216**	**78**	**7.32**	**21.8**



Leighton

SOIL RESISTIVITY TEST

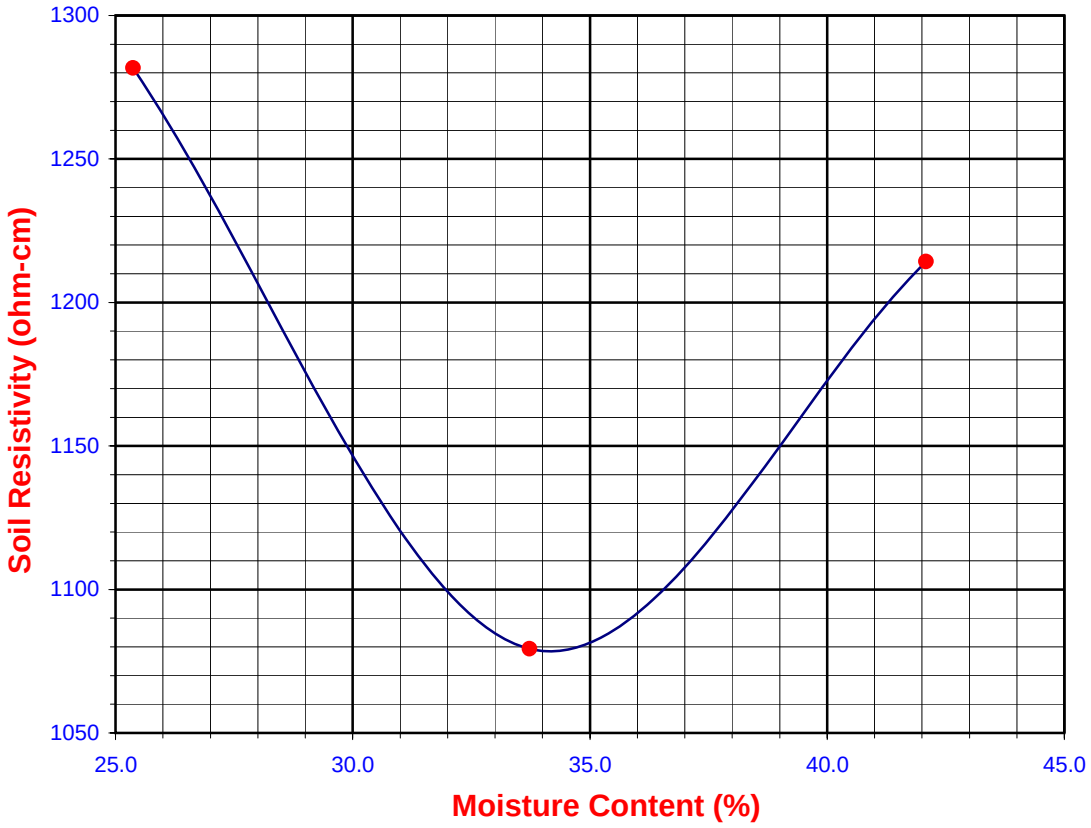
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/12/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/14/08
Boring No.:	A-08-028	Depth (ft.) :	0-7		
Sample No. :	Bag-1				
Soil Identification:	s(CL)g				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	200	25.37	190	1282
2	300	33.73	160	1079
3	400	42.09	180	1214
4				
5				

Moisture Content (%) (MCi)	8.66
Wet Wt. of Soil + Cont. (g)	196.77
Dry Wt. of Soil + Cont. (g)	185.81
Wt. of Container (g)	59.20
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	
1079	**33.7**	**41**	**66**	**7.80**	**21.8**



Leighton

TESTS for SULFATE CONTENT
CHLORIDE CONTENT and pH of SOILS

Project Name: SR-57 Widening | Tested By : V. Juliano | Date: 08/06/08

Project No. : 370900.02.GE.0S | Data Input By: LF | Date: 08/13/08

Boring No.	A-08-030			
Sample No.	BAG-2			
Sample Depth (ft)	25-30			
Soil Identification:	s(CL)			
Wet Weight of Soil + Container (g)	170.77			
Dry Weight of Soil + Container (g)	164.87			
Weight of Container (g)	64.61			
Moisture Content (%)	5.88			
Weight of Soaked Soil (g)	100.22			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	16			
Crucible No.	32			
Furnace Temperature (°C)	840			
Time In / Time Out	8:40 / 9:25			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	19.1629			
Wt. of Crucible (g)	19.1613			
Wt. of Residue (g) (A)	0.0016			
PPM of Sulfate (A) x 41150	65.84			
PPM of Sulfate, Dry Weight Basis	**70**			

CHLORIDE CONTENT, DOT California Test 422

ml of Chloride Soln. For Titration (B)	30			
ml of AgNO3 Soln. Used in Titration (C)	0.9			
PPM of Chloride (C -0.2) * 100 * 30 / B	70			
PPM of Chloride, Dry Wt. Basis	**74**			

pH TEST, DOT California Test 532/643

pH Value	**8.21**			
Temperature °C	22.0			

Leighton

SOIL RESISTIVITY TEST

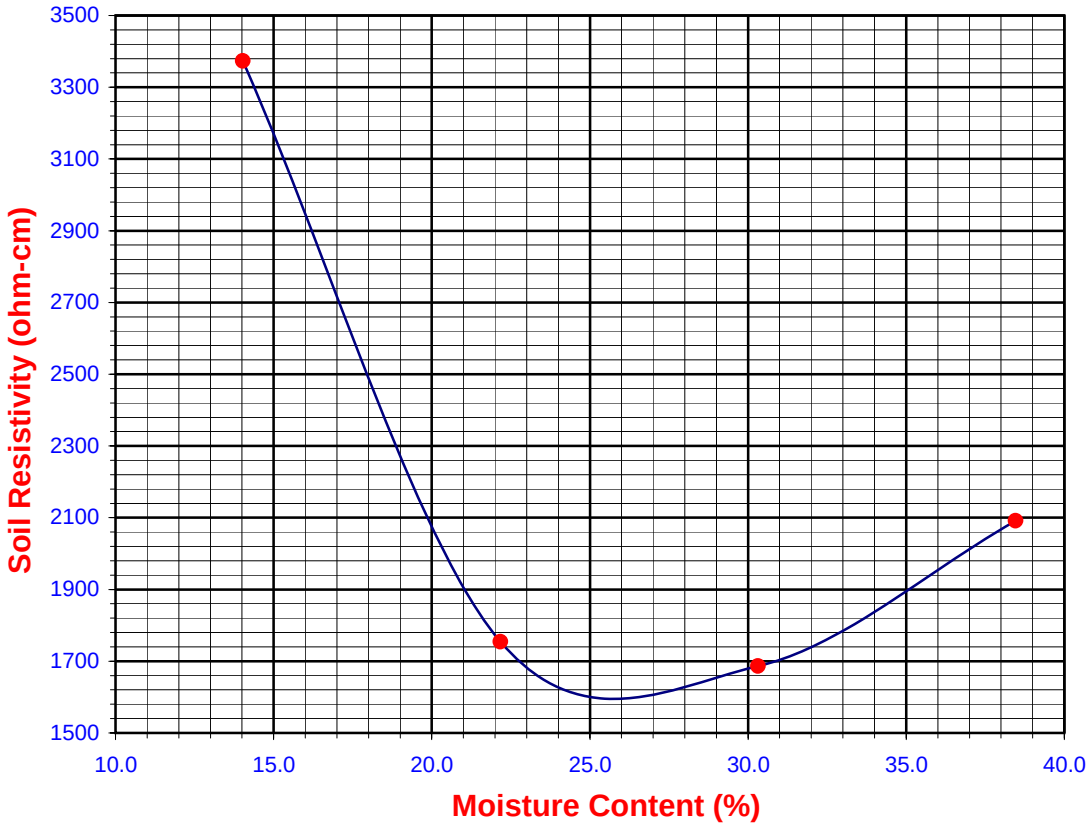
DOT CA TEST 532 / 643

Project Name:	SR-57 Widening	Tested By :	V. Juliano	Date:	08/06/08
Project No. :	370900.02.GE.0S	Data Input By:	LF	Date:	08/13/08
Boring No.:	A-08-030	Depth (ft.) :	25-30		
Sample No. :	BAG-2				
Soil Identification:	s(CL)				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	14.03	500	3373
2	200	22.17	260	1754
3	300	30.32	250	1687
4	400	38.46	310	2091
5				

Moisture Content (%) (MCi)	5.88
Wet Wt. of Soil + Cont. (g)	170.77
Dry Wt. of Soil + Cont. (g)	164.87
Wt. of Container (g)	64.61
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	
1600	**26.0**	**70**	**74**	**8.21**	**22.0**



APPENDIX E

Engineering Calculations

APPENDIX E.1

Shear Strength Plots

DIRECT SHEAR TESTS RESULTS FOR SR-57 NORTHBOUND WIDENING PROJECT
Last Update 5-Feb-09

Summary Table

	Investigator	Year	Phase	Structure[1]	Boring Number	Sample ID	Depth (ft)	Sample Type	USCS	Description	Geologic Unit	Category[2]	Average Dry Density (pcf)	Average Moisture (%)	Normal Stress (ksf)			Peak Shear Stress (ksf)			Ultimate Shear Stress (ksf)			Residual Shear Stress (ksf)			Effective Shear Strength Parameters					
																											Peak		Ultimate		Residual	
															1	2	3	1	2	3	1	2	3	1	2	3	c' (ksf)	ϕ' (degree)	c' (ksf)	ϕ' (degree)	c' (ksf)	ϕ' (degree)
1	CH2M HILL	2008	PS&E	2	A-08-001	D-1	5	DRIVE	s(CL)	Sandy Lean Clay	Qvof	2	107.2	4.3	1	2	4	0.701	1.289	2.656	0.685	1.280	2.656				0.02	33	0.00	33		
2	CH2M HILL	2008	PS&E	2	A-08-001	D-5	25	DRIVE	SP-SM	Sand with silt	Qvof	1	101.2	1.9	2	4	8	1.336	2.839	5.451	1.144	2.524	4.672				0.03	34	0.07	30		
3	CH2M HILL	2008	PS&E	2	A-08-002	Bag-1	2-7	BULK	s(CL)	Sandy Lean Clay	Af	22	114.6	12.0	1	2	4	0.899	1.515	2.474	0.704	1.308	2.455				0.42	27	0.13	30		
4	CH2M HILL	2008	PS&E	2	A-08-003	D-1	5	DRIVE	(CL-ML)	Sandy Silty Clay	Qvof	2	94.7	8.0	1	2	4	0.761	1.283	2.638	0.704	1.188	2.572				0.08	32	0.01	32		
5	CH2M HILL	2008	PS&E	2	A-08-004	D-1	5	DRIVE	(SW-SM)g	Sand with silt and gravel	Qvof	1	112.7	4.8	1	2	4	1.261	4.077	5.700	0.789	3.593	5.700				0.45	54	0.00	56		
6	CH2M HILL	2008	PS&E	2	A-08-004	D-5	25	DRIVE	(CL)s	Lean Clay with Sand	Qvof	2	107.8	18.2	1	2	4	1.638	1.701	3.188	0.663	1.160	2.402				0.89	29	0.04	30		
7	CH2M HILL	2008	PS&E	2	A-08-004	Bag-1	2-7	BULK	(SP-SM)g	Sand with silt and gravel	Af	11	111.7	11.5	1	2	4	1.081	2.069	3.725	0.701	1.393	2.694				0.25	41	0.05	34		
8	CH2M HILL	2008	PS&E	2	A-08-005	D-1	5	DRIVE	s(ML)	Sandy Silt	Qvof	1	108.8	8.2	1	2	4	0.758	2.037	3.562	0.569	1.374	2.767				0.00	42	0.00	35		
9	CH2M HILL	2008	PS&E	2	A-08-005	D-3	15	DRIVE	SM	Silty Sand	Qvof	1	102.6	8.7	1	2	4	0.739	1.481	2.977	0.682	1.393	2.578				0.00	37	0.09	32		
10	CH2M HILL	2008	PS&E	2	A-08-005	D-5	25	DRIVE	CL	Lean Clay	Qvof	2	115.3	16.5	2	4	8	2.543	4.015	6.300	1.289	2.370	4.807				1.40	32	0.07	31		
11	CH2M HILL	2008	PS&E	2	A-08-005	Bag-1	0-7	BULK	s(CL)	Sandy Lean Clay	Af	22	108.9	13.5	1	2	4	0.965	1.484	2.600	0.732	1.361	2.594				0.41	29	0.12	32		
12	CH2M HILL	2008	PS&E	1	A-08-007	D-1	5	DRIVE	SM	Silty fine Sand	Qvof	1	99.2	3.2	1	2	4	0.751	1.770	3.153	0.638	1.355	2.644				0.06	38	0.00	34		
13	CH2M HILL	2008	PS&E	2	A-08-008	D-1	5	DRIVE	(CL)s	Lean Clay with sand	Qvof	2	109.2	22.0	1	2	4	1.525	2.377	3.942	0.588	1.081	2.125				0.74	39	0.07	27		
14	CH2M HILL	2008	PS&E	2	A-08-008	D-3	15	DRIVE	CL	Lean Clay	Qvof	2	121.6	14.1	1	2	4	2.021	2.245	4.373	0.657	1.336	2.550				0.96	39	0.05	32		
15	CH2M HILL	2008	PS&E	2	A-08-008	Bag-1	0-7	BULK	(CL)s	Lean Clay with Sand	Af	22	107.4	13.5	1	2	4	0.597	1.078	2.113	0.409	0.959	1.943				0.08	27	0.00	26		
16	CH2M HILL	2008	PS&E	2	A-08-009	D-1	5	DRIVE	SC-SM	Silty Clayey Sand	Qvof	1	111.7	7.0	1	2	4	0.987	2.065	3.892	0.660	1.361	2.726				0.07	44	0.00	34		
17	CH2M HILL	2008	PS&E	2	A-08-010	D-3	15	DRIVE	CL	Lean Clay	Qvof	2	124.6	12.4	1	2	4	1.254	2.301	3.172	0.720	1.430	2.490				0.82	31	0.19	30		
18	CH2M HILL	2008	PS&E	2	A-08-010	Bag-1	0-7	BULK	SC	Clayey Sand	Af	11	116.5	10.5	1	2	4	0.805	1.575	2.807	0.679	1.358	2.622				0.19	33	0.05	33		
19	CH2M HILL	2008	PS&E	2	A-08-011	D-1	5	DRIVE	SM	Silty Sand	Qvof	1	109.4	7.7	1	2	4	0.736	1.578	2.848	0.626	1.289	2.546				0.10	35	0.00	33		
20	CH2M HILL	2008	PS&E	2	A-08-011	D-3	15	DRIVE	SC-SM	Silty Clayey Sand	Qvof	1	121.2	9.9	1	2	4	0.701	1.937	2.873	0.387	1.163	2.065				0.23	35	0.00	28		
21	CH2M HILL	2008	PS&E	2	A-08-011	Bag-1	0-7	BULK	SC	Clayey Sand	Af	11	115.5	10.0	1	2	4	0.993	1.540	2.597	0.723	1.358	2.565				0.46	28	0.12	31		
22	CH2M HILL	2008	PS&E	1	A-08-012	D-3	15	DRIVE	Claystone	Lean Clay	Qlh	2	112.1	12.9	1	2	4	0.836	2.043	3.653	0.626	1.166	2.235				0.03	43	0.09	28		
23	CH2M HILL	2008	PS&E	1	A-08-012	D-7	35	DRIVE	Claystone	Lean Clay	Qlh	2	117.7	16.8	2	4	8	3.414	3.914	6.844	1.474	2.314	4.332				1.95	31	0.47	26		
24	CH2M HILL	2008	PS&E	1	A-08-013	D-3	15	DRIVE	Claystone	Lean Clay	Qlh	2	102.1	23.8	1	2	4	0.887	2.336	3.741	0.641	1.110	1.955				0.18	42	0.22	24		
25	CH2M HILL	2008	PS&E	1	A-08-013	D-5	25	DRIVE	Claystone	High plasticity Clay with sand	Qlh	2	110.6	19.0	4	8	16	4.999	6.784	9.730	2.210	4.524	7.246				3.53	21	0.85	22		
26	CH2M HILL	2008	PS&E	1	A-08-013	D-7	35	DRIVE	Claystone	Lean Clay	Qlh	2	113.5	19.1	2	4	8	3.358	4.609	6.992	1.229	2.226	3.857				2.17	31	0.41	23		
27	CH2M HILL	2008	PS&E	1	A-08-013	D-11	55	DRIVE	Claystone	Silty Clay	Qlh	2	115.0	17.0	3	6	12	2.826	4.090	8.441	2.125	3.659	7.426				0.65	33	0.24	31		
28	CH2M HILL	2008	PS&E	2	A-08-014	D-3	15	DRIVE	(SP-SM)g	Sand with silt and gravel	Qvof	1	109.2	7.8	1	2	4	0.786	1.544	5.555	0.720	1.430	5.555				0.00	51	0.00	51		
29	CH2M HILL	2008	PS&E	2	A-08-014	Bag-1	0-7	BULK	SC	Clayey Sand	Af	11	112.2	12.0	1	2	4	0.761	1.182	2.694	0.468	1.088	2.477				0.00	33	0.00	31		
30	CH2M HILL	2008	PS&E	2	A-08-015	D-1	5	DRIVE	CH	High Plasticity Clay	Af	2	100.7	20.6	1	2	4	0.984	1.638	3.229	0.588	1.157	1.518				0.19	37	0.41	16		
31	CH2M HILL	2008	PS&E	2	A-08-015	D-3	15	DRIVE	CL	Lean Clay	Qvof	2	117.4	14.5	1	2	4	1.280	3.119	4.917	0.739	1.339	2.497				0.38	49	0.16	30		
32	CH2M HILL	2008	PS&E	2	A-08-015	Bag-1	0-7	BULK	(CL)s	Lean Clay with Sand	Af	22	106.5	13.5	1	2	4	0.861	1.446	3.141	0.616	1.393	3.141				0.01	38	0.00	37		
33	CH2M HILL	2008	PS&E	1	A-08-016	D-3	15	DRIVE	(CL)s	Lean Clay with Sand	Af	2	112.6	16.3	1	2	4	1.584	2.028	3.603	0.468	1.088	2.235				0.80	35	0.00	29		
34	CH2M HILL	2008	PS&E	1	A-08-016	D-5	25	DRIVE	(CL)s	Lean Clay with Sand	Af	2	121.5	11.0	2	4	8	2.135	3.405	5.835	1.427	2.468	5.203				0.92	32	0.06	33		
35	CH2M HILL	2008	PS&E	1	A-08-016	D-9	45	DRIVE	CL	Lean Clay	Qyf	2	110.6	20.5	3	6	12	1.987	2.965	4.288	1.657	2.634	4.024				1.33	14	0.96	14		
36	CH2M HILL	2008	PS&E	1	A-08-016	D-13	65	DRIVE	SC	Clayey Sand	Qvof	1	104.6	22.5	3	6	12	2.267	3.707	7.234	1.899	3.266	6.791				0.50	29	0.14	29		
37	CH2M HILL	2008	PS&E	1	A-08-016	Bag-1	15-20	BULK	(CL)s	Lean Clay with Sand	Af	22	111.7	11.0	1	2	4	0.748	1.276	2.370	0.566	1.223	2.342				0.20	28	0.01	30		
38	CH2M HILL	2008	PS&E	1	A-08-017	D-2	10	DRIVE	(CL)s	Lean Clay with Sand and Caliche	Qyf	2	104.2	22.0	1	2	4	1.531	1.676	2.933	1.059	1.383	2.330				0.90	26	0.59	23		
39	CH2M HILL	2008	PS&E	1	A-08-017	D-8	40	DRIVE	CL	Lean Clay	Qvof	2	106.1	22.7	2	4	8	1.386	2.892	4.870	1.000	2.175	4.140				0.40	30	0.02	27		
40	CH2M HILL	2008	PS&E	2	A-08-018	Bag-1	0-7'	BULK	s(CL)	Sandy Lean Clay	Af	22	112.2	9.5	1	2	4	0.714	1.239	2.345	0.648	1.229	2.333				0.16	29	0.10	29		
41	CH2M HILL	2008	PS&E	2	A-08-019	D-2	10	DRIVE	CL	Lean Clay	Qvof	2	115.0	17.5	1	2	4	1.990	2.936	3.606	0.670	1.437	2.779				1.66	27	0.00	35		
42	CH2M HILL	2008	PS&E	2	A-08-019	D-4	20	DRIVE	CL	Lean Clay	Qvof	2	103.9	18.6	2	4	8	1.591	3.150	6.231	1.113	2.411	4.631				0.05	38	0.00	30		
43	CH2M HILL	2008	PS&E	2	A-08-019	D-8	40	DRIVE	CH	High plasticity Clay	Qvof	2	95.2	29.3	3	6	12	2.304	3.961	7.199	1.770	2.936	5.618				0.69	29	0.43	23		
44	CH2M HILL	2008	PS&E	2	A-08-019	Bag-1	15-20	BULK	s(CL)	Sandy Lean Clay	Af	22	106.5	15.0	1	2	4	1.003	1.776	2.807	0.657	1.298	2.594				0.49	31	0.01	33		
45	CH2M HILL	2008	PS&E	2	A-08-020	D-1	5	DRIVE	CH	High plasticity Clay	Qvof	2	96.5	25.0	1	2	4	1.107	2.304	4.087	0.572	1.085	1.877				0.22	44	0.18	23		
46	CH2M HILL	2008	PS&E	2	A-08-020	Bag-1	15-20	BULK	(CL)s	Lean Clay with Sand	Af	22	109.3	11.0	1	2	4	0.588	0.990	2.091	0.453	0.956	2.084				0.04	27	0.00	27		
47	CH2M HILL	2008	PS&E	2	A-08-021	D-1	5	DRIVE	(CL)s	Lean Clay with Sand	Qvof	2	114.6	12.6	1	2	4	0.871	3.040	4.719	0.710	1.245	2.524				0.03	51	0.07	31		
48	CH2M HILL	2008	PS&E	2	A-08-022	D-1	5	DRIVE	SC	Clayey Sand	Af	1	121.8	13.6	1	2	4	1.745	2.628	4.197	0.805	1.544	2.763				0.96	39	0.20	33		
49	CH2M HILL	2008	PS&E	1	A-08-023	D-5	25	DRIVE	SC	Clayey Sand	Af	1	119.0	11.7	2	4	8	2.568	3.961	7.130	1.327	2.961	5.838				0.98	37	0.00	36		
50	CH2M HILL	2008	PS&E	1	A-08-023	D-9	45	DRIVE	SM	Silty Sand	Qvof	1	116.0	9.5	2	4	8	2.065	4.084	8.102	1.355	2.974	5.602				0.06	45	0.04	35		
51	CH2M HILL	2008	PS&E	1	A-08-023	D-13	65	DRIVE	CL	Lean Clay	Qvof	2	106.2	22.5	3	6	12	3.222	3.989	5.803	1.515	2.399	5.021				2.32	16	0.20	22		
52	CH2M HILL	2008	PS&E	2	A-08-024	Bag-1	2-7	BULK	(CL)s	Lean Clay with Sand	Af	22	107.4	11.0	1	2	4	0.522	1.037	1.968	0.472	0.990	1.905				0.06	26	0.01	25		
53	CH2M HILL	2008	PS&E	2	A-08-024	D-1	5	DRIVE	s(CL)	Sandy Lean Clay	Af	2	123.0	11.5	1	2	4	1.940	3.229	5.228	0.751	1.273	2.204				0.94	47	0.29	26		
54	CH2M HILL	2008	PS&E	1	A-08-025	D-5	25	DRIVE	CL	Lean Clay	Af	2	109.0	18.2	2	4	8	2.286	3.606	5.675	1.097	2.320	4.172				1.25	29	0.17	27		
55	CH2M HILL	2008	PS&E	1	A-08-025	D-9	45	DRIVE	(SW-SM)g	Sand with silt and gravel	Qvof	1	123.9	2.0	2	4	8	2.603	6.379	11.252	1.811	5.932	11.195				0.17	55	0.00	54		
56	CH2M HILL	2008	PS&E	1	A-08-025	D-13	65	DRIVE	s(CL)	Sandy Lean Clay	Qvof	2	123.4	10.5	3	6	12	2.153	5.241	9.287	2.021	4.351	8.454				0.13	38	0.00	35		
57	CH2M HILL	2008	PS&E	1	A-08-026	D-6	30	DRIVE	CL	Lean Clay	Qvof	2	122.4	13.1	2	4	8	1.490	3.898	6.850	1.298	2.666	4.961				0.01	41	0.15	31		
58	CH2M HILL	2008	PS&E	1	A-08-026	D-8	40	DRIVE	SC	Clayey Sand	Qvof	1	111.8	16.9	2	4	8	1.132	2.716	5.873	0.987	2.330	5.074				0.00	36	0.00	32		
59	CH2M HILL	2008	PS&E	1	A-08-026	D-12	60	DRIVE	CL	Lean Clay	Qvof	2	102.0	24.6	3	6	12	1.751	3.354	6.313	1.739	3.213	6.313				0.27	27	0.19	27		
60	CH2M HILL	2008	PS&E	2	A-08-027	D-3	15	DRIVE	s(CL)	Sandy Lean Clay	Af	2	123.6	9.9	1	2	4	1.069	2.348	4.250	0.707	1.618	3.317				0.12	46	0.00	39		
61	CH2M HILL	2008	PS&E	2	A-08-027	D-5	25	DRIVE	s(CL)g	Sandy Lean Clay with Gravel	Af	2	119.7	13.3	1	2	4	1.713	1.981	3.040	0.846	1.195	2.738				1.18	24	0.07	33		
62	CH2M HILL	2008	PS&E	2	A-08-027	Bag-1	0-7	BULK	s(CL)	Sandy Lean Clay	Af	22	113.6	12.0	1	2	4	0.758	1.289	2.493	0.666	1.217	2.446				0.16	30	0.05	31		
63	CH2M HILL	2008	PS&E	2	A-08-028	D-3	15	DRIVE	SC	Clayey Sand	Af	1	116.9	12.3	1	2	4	1.154	2.625	5.414	0.710	1.632	2.630				0.00	53	0.21	32		
64	CH2M HILL	2008	PS&E	2	A-08-028	Bag-1	0-7	BULK	s(CL)g	Sandy Lean Clay with Gravel	Af	22	111.7	10.5	1	2	4	0.720	1.135	2.075	0.597	1.125	2.065				0.25	24	0.13	26		
65	CH2M HILL	2008	PS&E	1	A-08-030	D-3	15	DRIVE	SC	Clayey Sand	Qvof	1	116.1	14.9	1	2	4	0.934	2.207	3.644	0.638	1.191	2.556				0.22	41	0.00	32		
66	CH2M HILL	2008	PS&E	1	A-08-030	D-9	45	DRIVE	s(CL)	Sandy Lean Clay	Qvof	2	110.5	16.6	3	6	12	2.191	4.342	8.300	1.572	2.578	6.725				0.21	34	0.00	28		
67	CH2M HILL	2008	PS&E	1	A-08-030	D-11	55	DRIVE	(CL)s	Lean Clay with sand	Qvof	2	111.0	18.6	3	6	12	2.358	5.423	8.328	1.924	3.842	6.932				0.91	33	0.38	29		

Notes:
[1] Structure: (1) Bridge, (2) Retaining Wall/Soundwall
[2] Category: (1) Native Sandy Material, (2) Native Clayey Material, (11) Remolded Sandy Material, (22) Remolded Clayey Material

FIGURE E-1

SR-57 NORTHBOUND WIDENING PROJECT

VERY OLD ALLUVIUM FAN DEPOSITS **(Qvof)**

PEAK SHEAR STRENGTH - **CLAY**

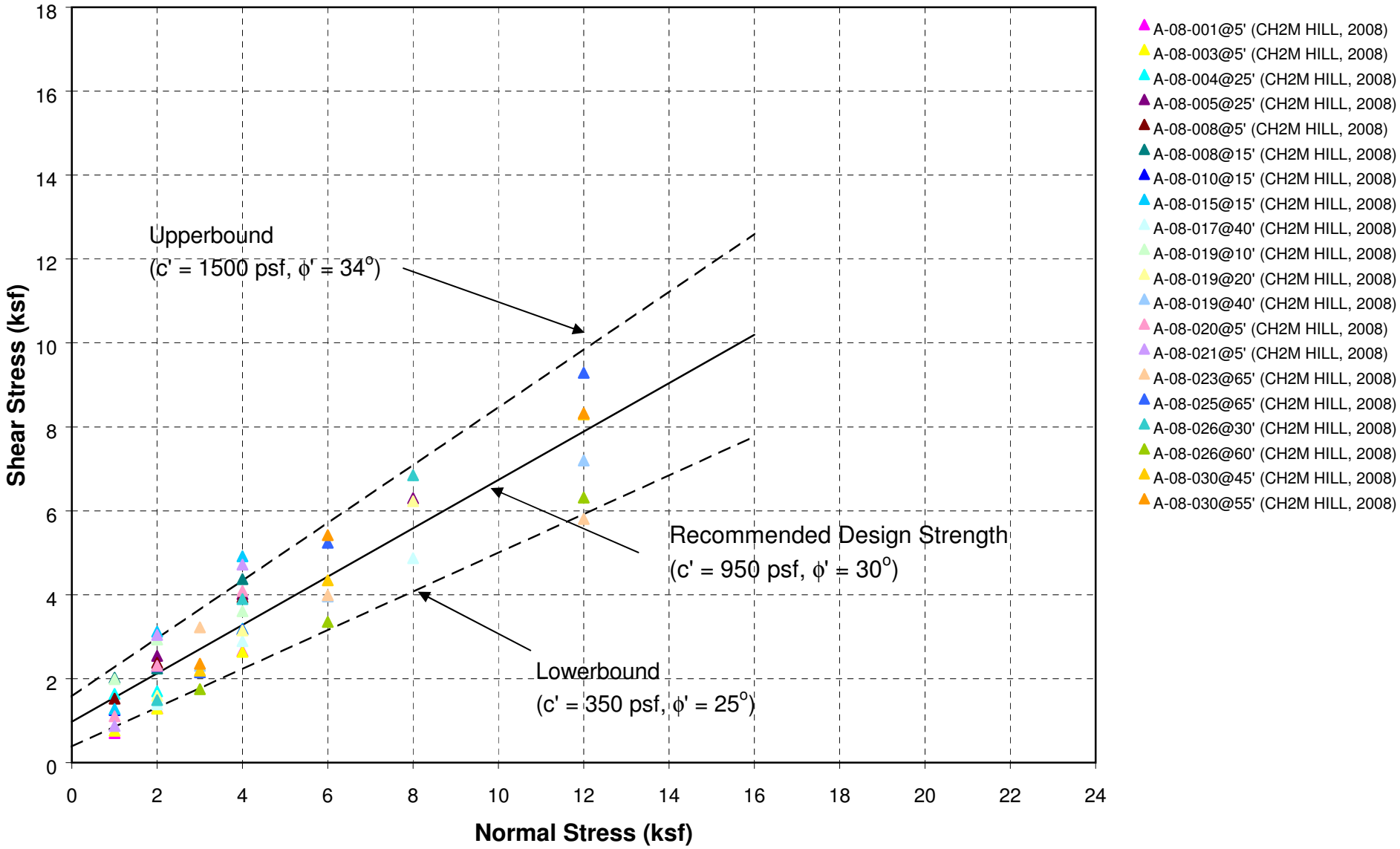


FIGURE E-2

SR-57 NORTHBOUND WIDENING PROJECT

VERY OLD ALLUVIUM FAN DEPOSITS **(Qvof)**

ULTIMATE SHEAR STRENGTH - **CLAY**

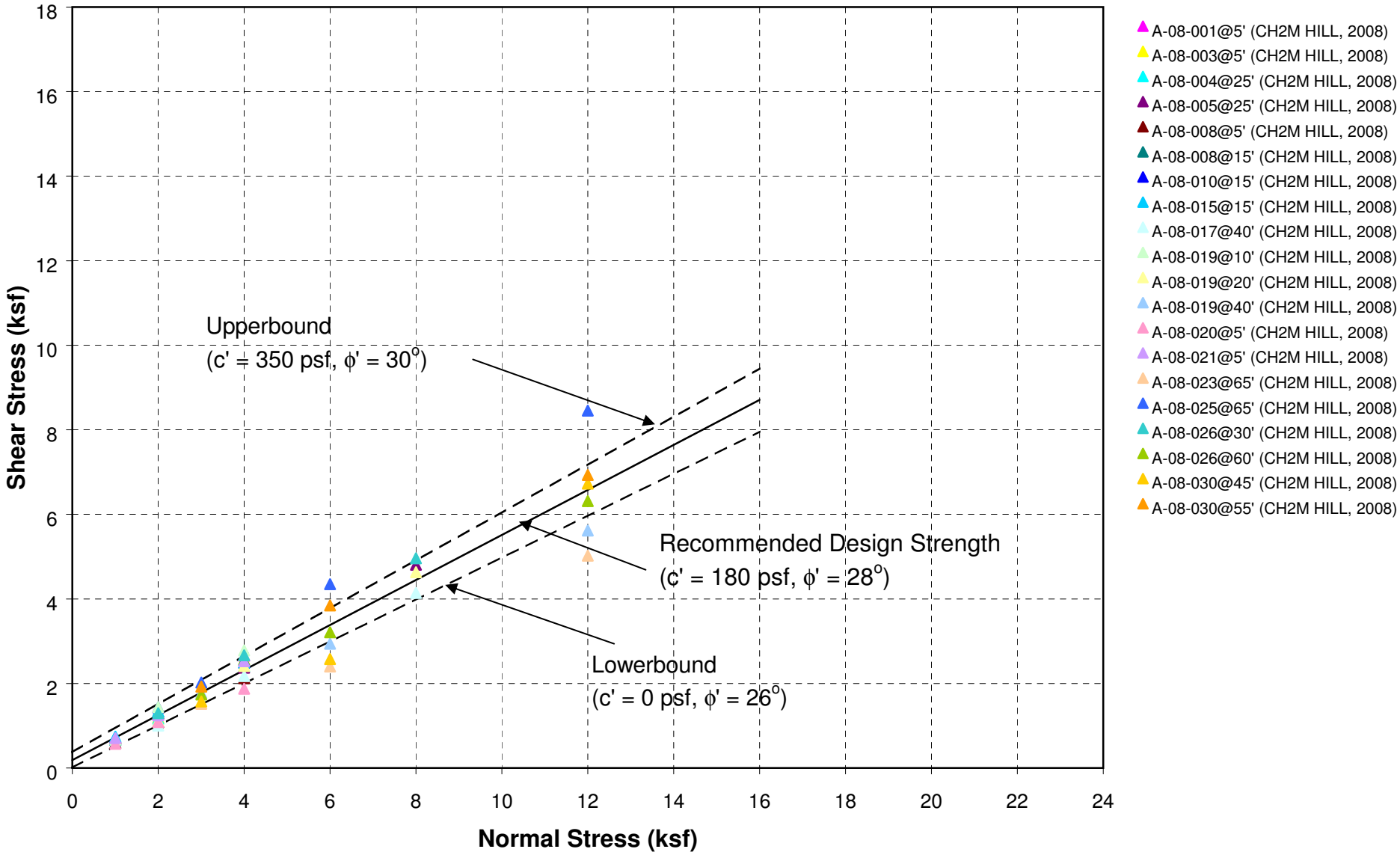


FIGURE E-3

SR-57 NORTHBOUND WIDENING PROJECT

VERY OLD ALLUVIUM FAN DEPOSITS **(Qvof)**

PEAK SHEAR STRENGTH - **SAND**

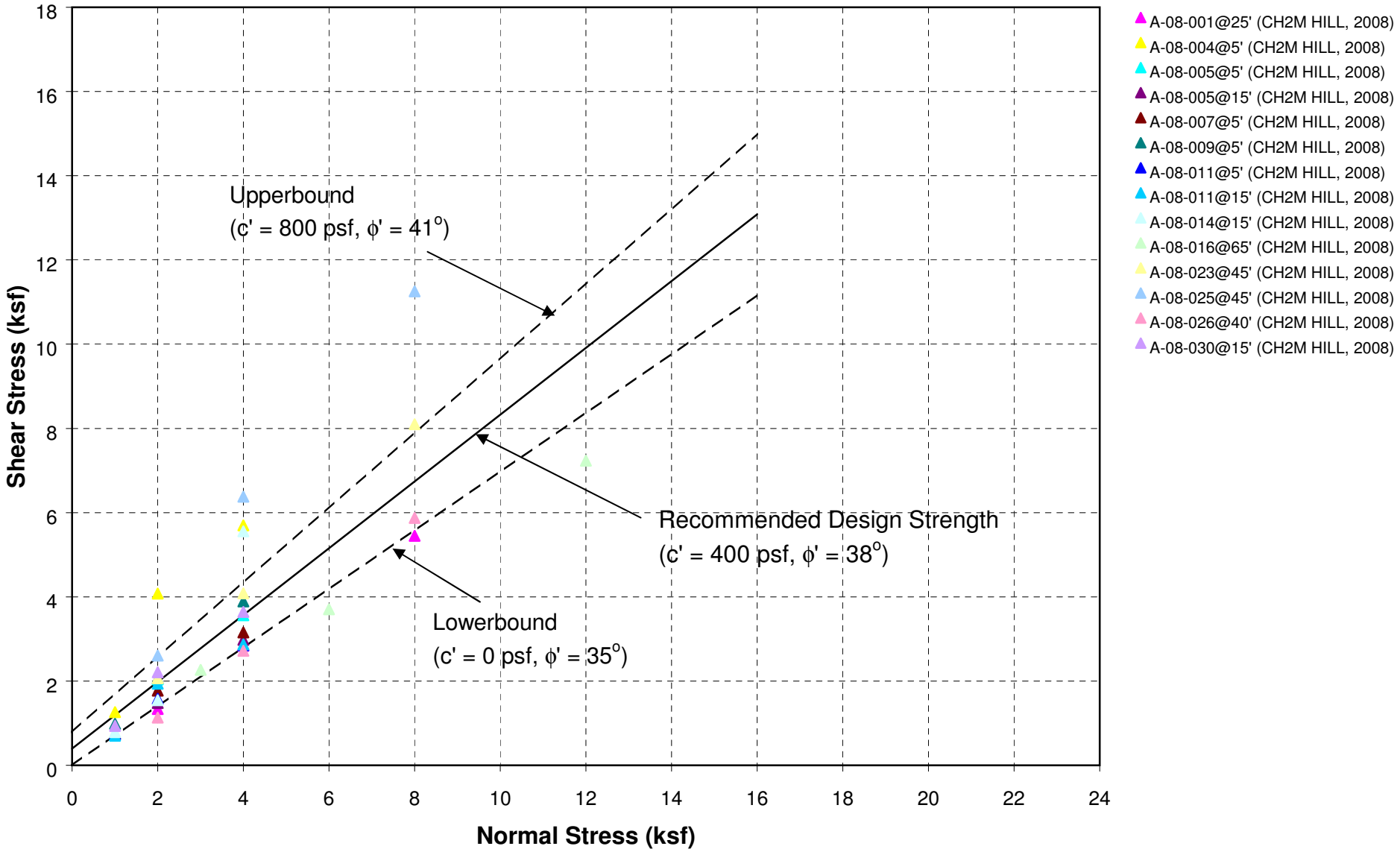


FIGURE E-4

SR-57 NORTHBOUND WIDENING PROJECT

VERY OLD ALLUVIUM FAN DEPOSITS **(Qvof)**

ULTIMATE SHEAR STRENGTH - **SAND**

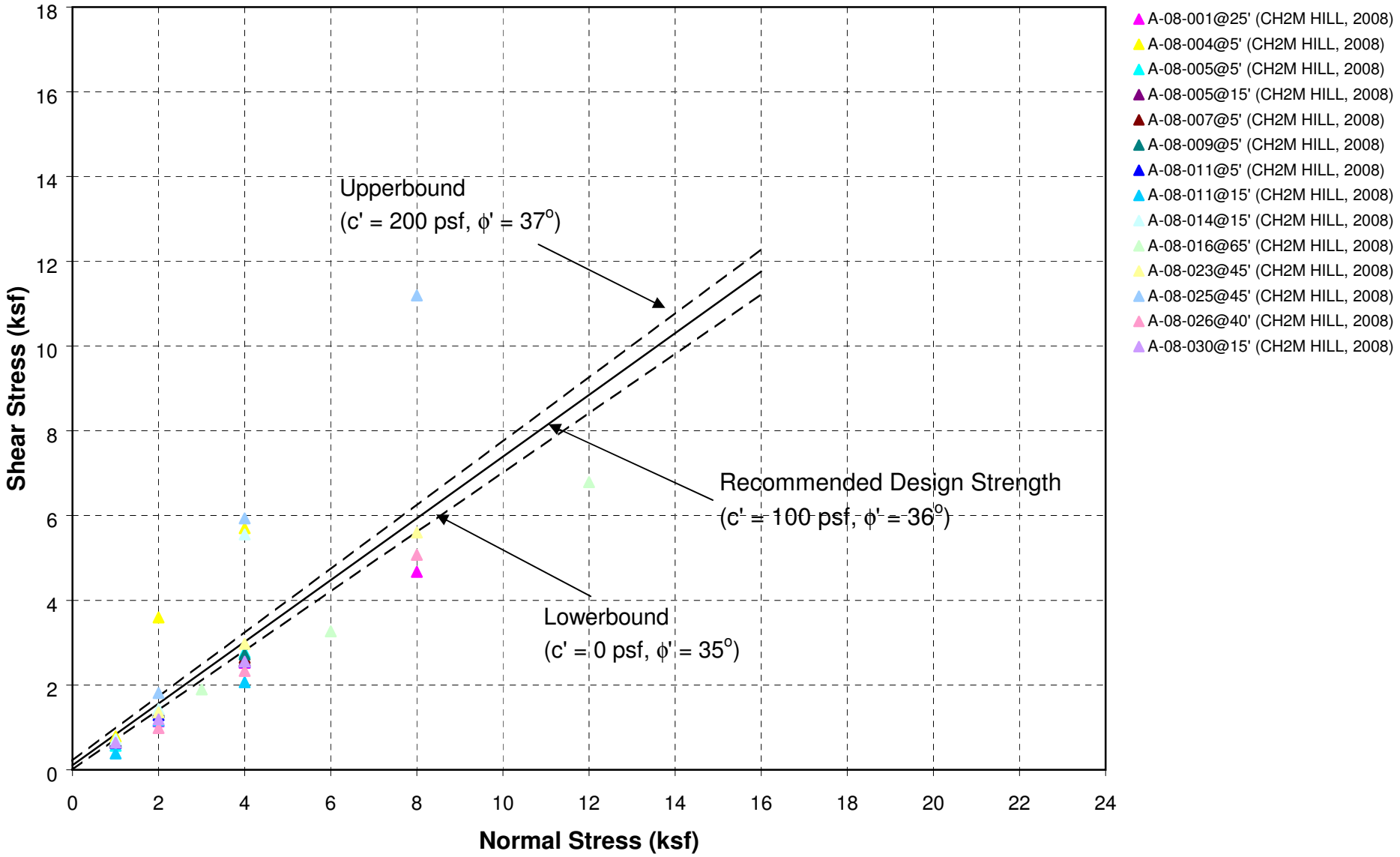


FIGURE E-5

SR-57 NORTHBOUND WIDENING PROJECT

YOUNG ALLUVIUM FAN DEPOSITS (**Qyf**)

PEAK SHEAR STRENGTH - **CLAY**

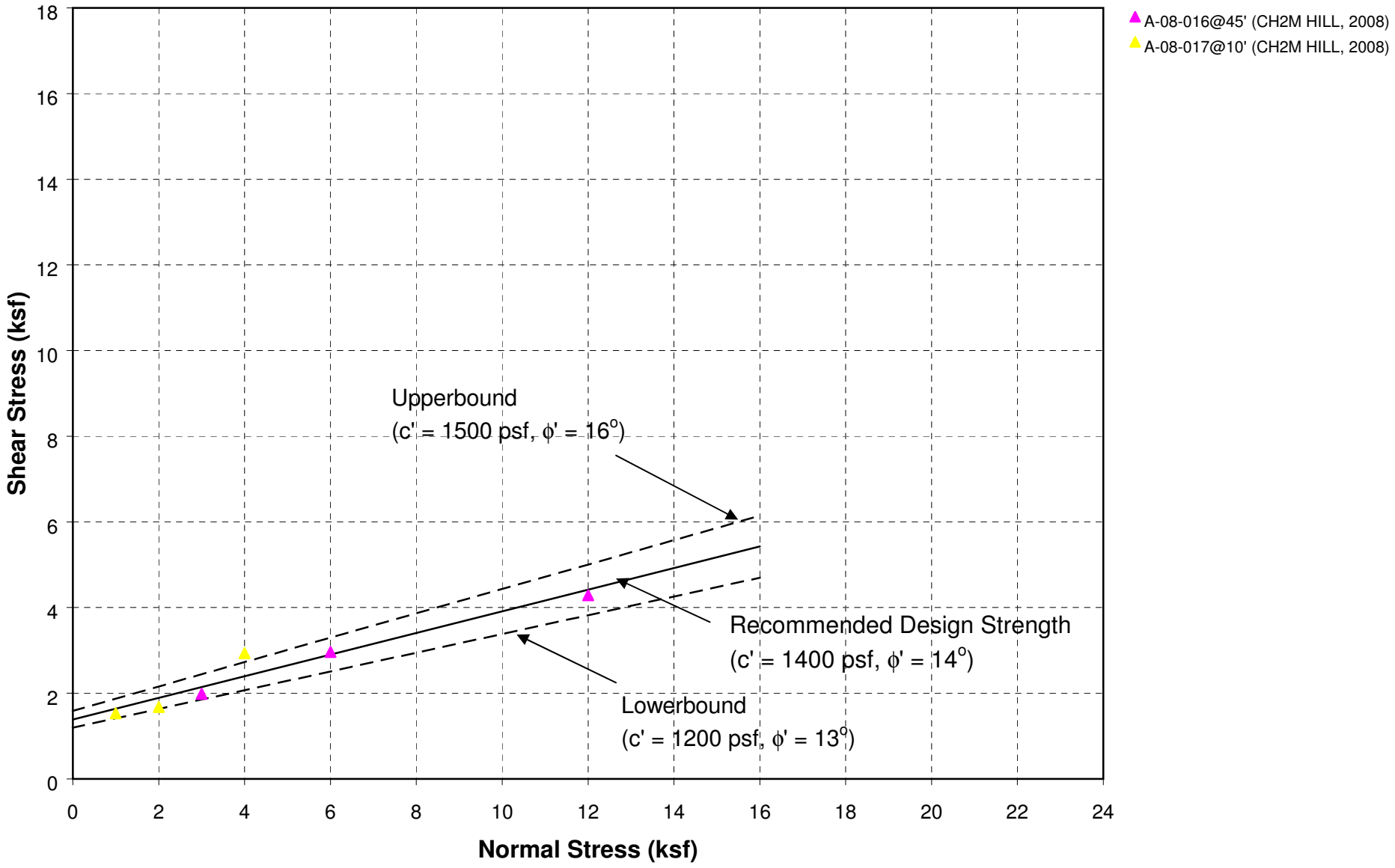


FIGURE E-6

SR-57 NORTHBOUND WIDENING PROJECT

YOUNG ALLUVIUM FAN DEPOSITS (**Qyf**)

ULTIMATE SHEAR STRENGTH - **CLAY**

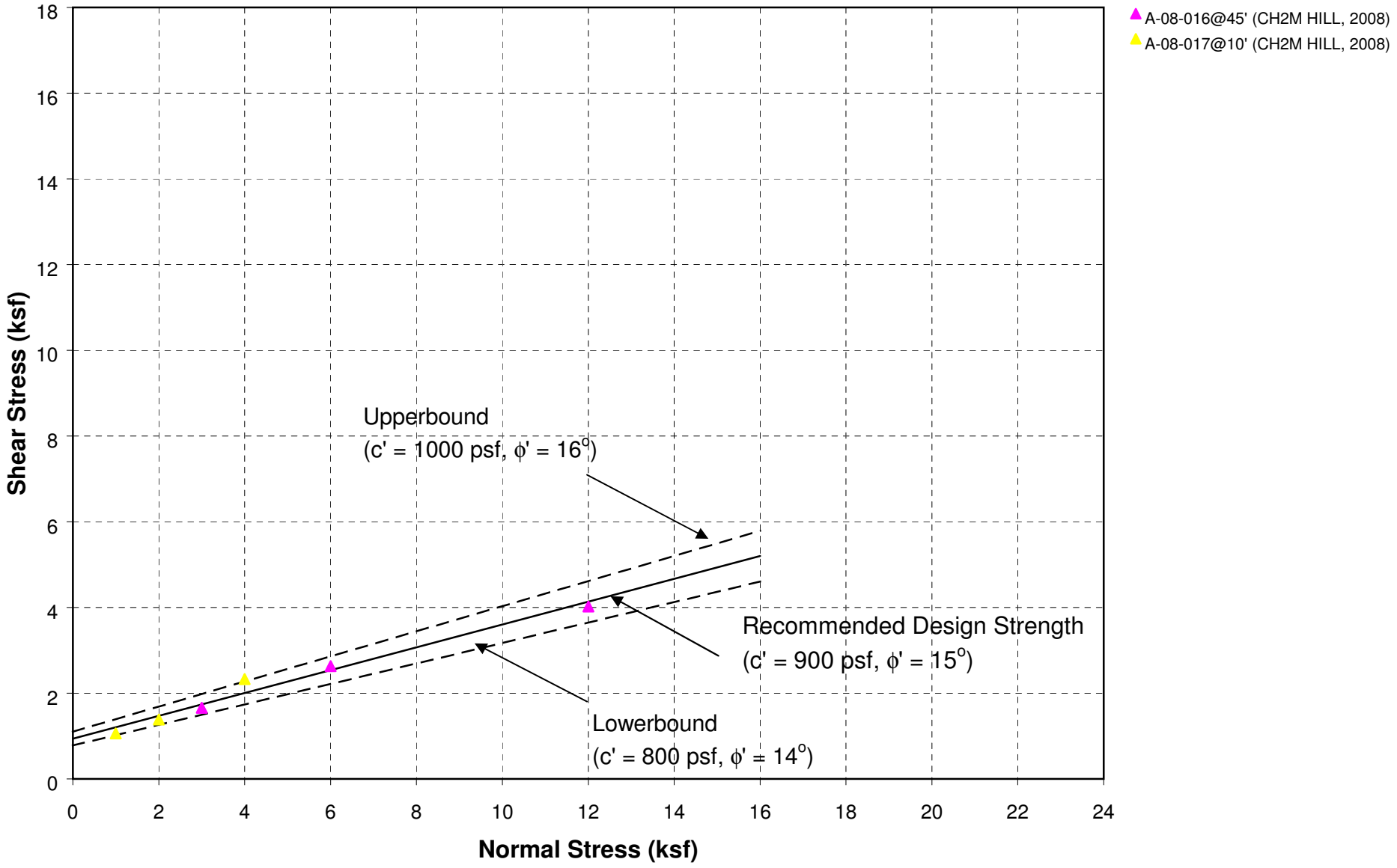


FIGURE E-7

SR-57 NORTHBOUND WIDENING PROJECT

LA HABRA FORMATION (**Qlh**)

PEAK SHEAR STRENGTH - **CLAY**

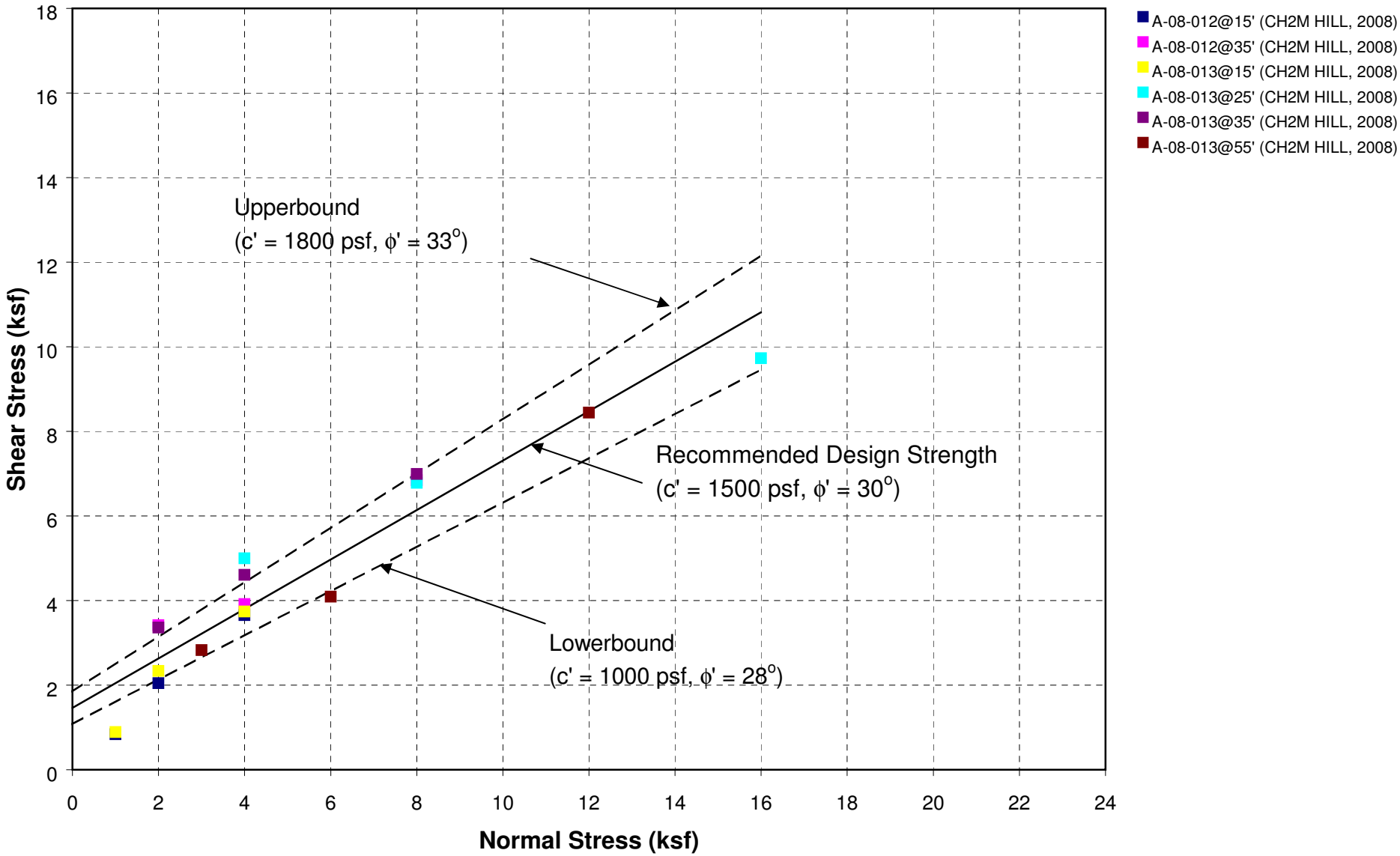


FIGURE E-8

SR-57 NORTHBOUND WIDENING PROJECT

LA HABRA FORMATION (**Qlh**)

ULTIMATE SHEAR STRENGTH - **CLAY**

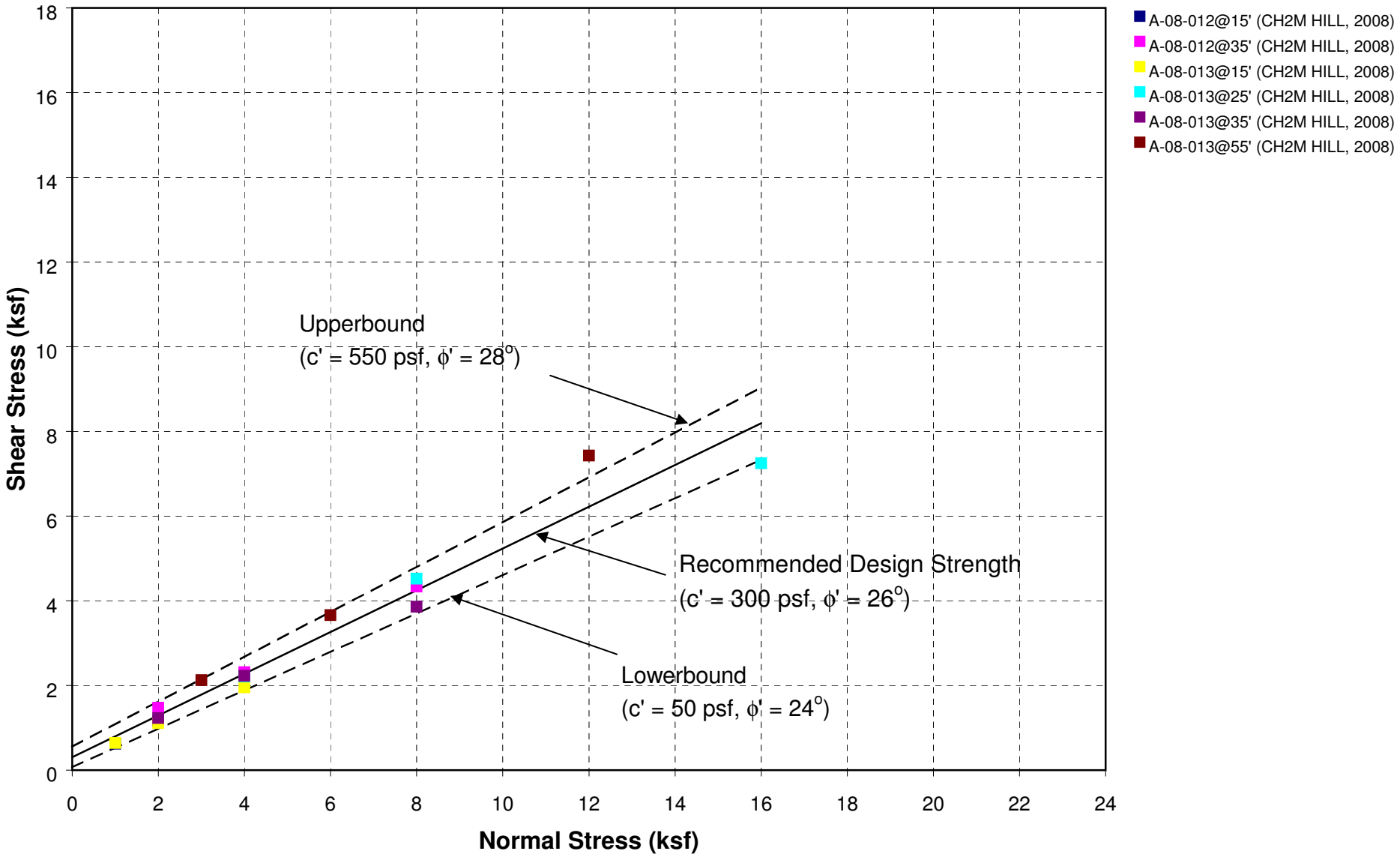


FIGURE E-9

SR-57 NORTHBOUND WIDENING PROJECT

COMPACTED FILL **(Af)** - EXISTING
PEAK SHEAR STRENGTH - **CLAY**

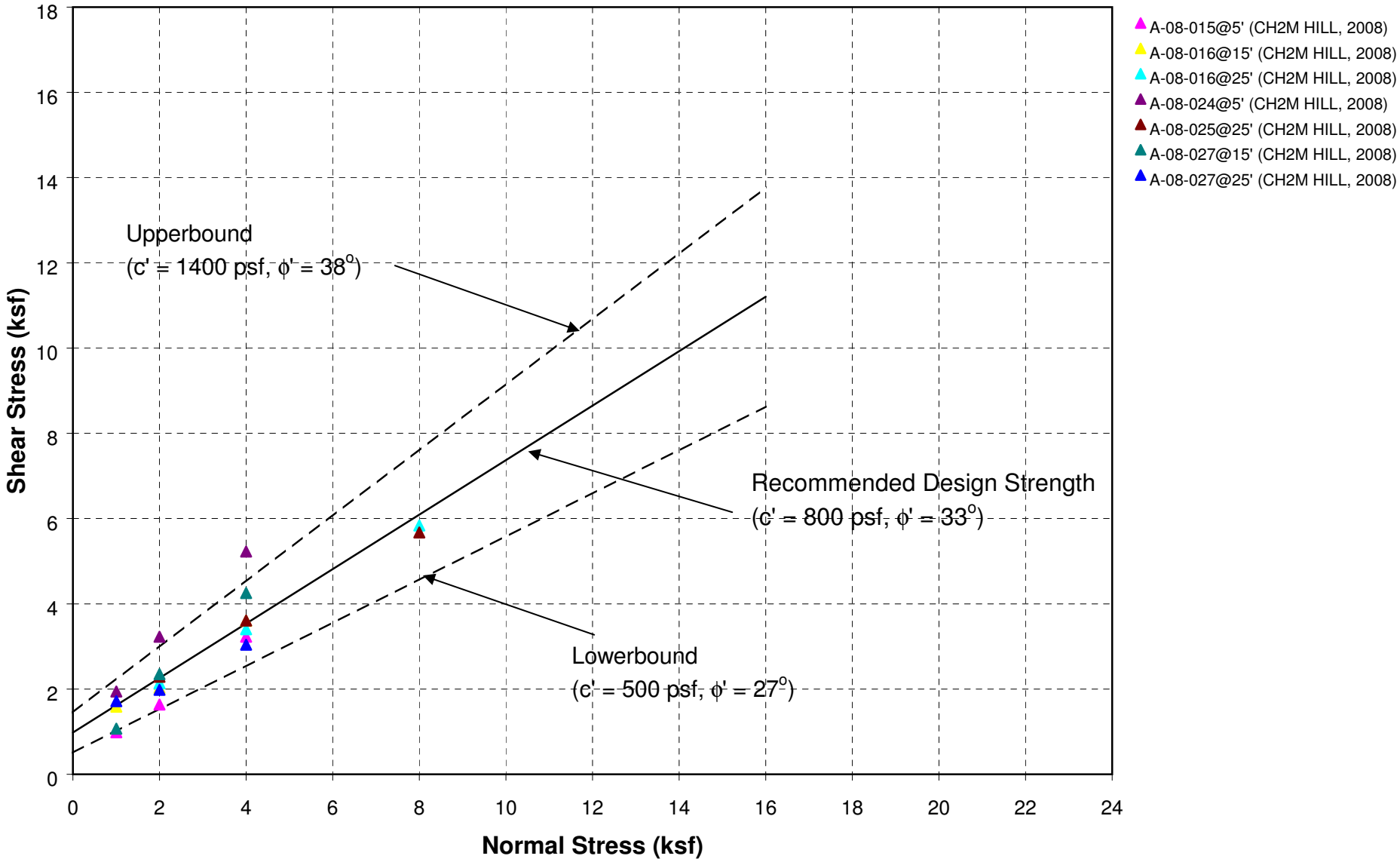


FIGURE E-10

SR-57 NORTHBOUND WIDENING PROJECT

COMPACTED FILL **(Af)** - EXISTING
ULTIMATE SHEAR STRENGTH - **CLAY**

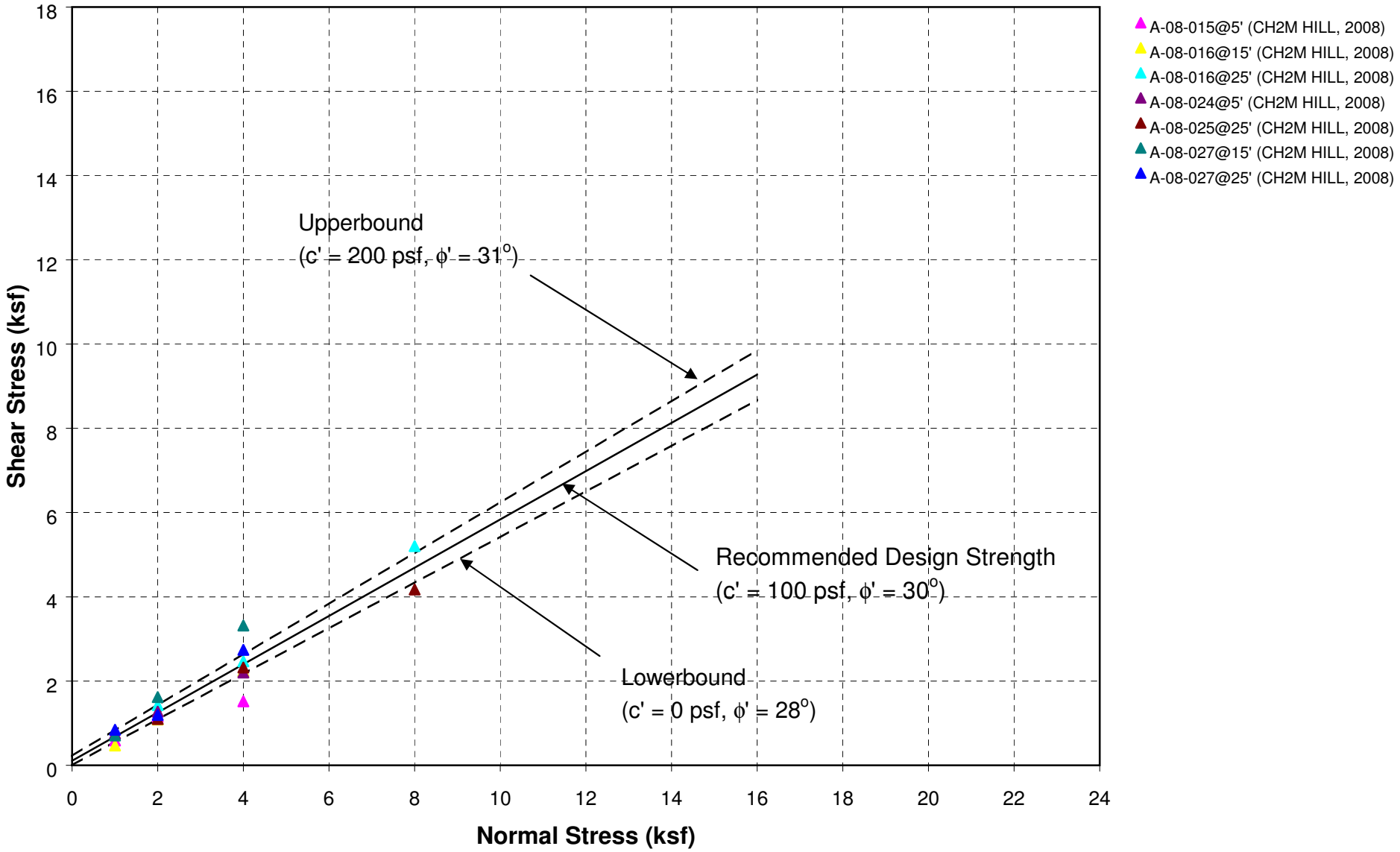


FIGURE E-11

SR-57 NORTHBOUND WIDENING PROJECT

COMPACTED FILL **(Af)** - EXISTING
PEAK SHEAR STRENGTH - **SAND**

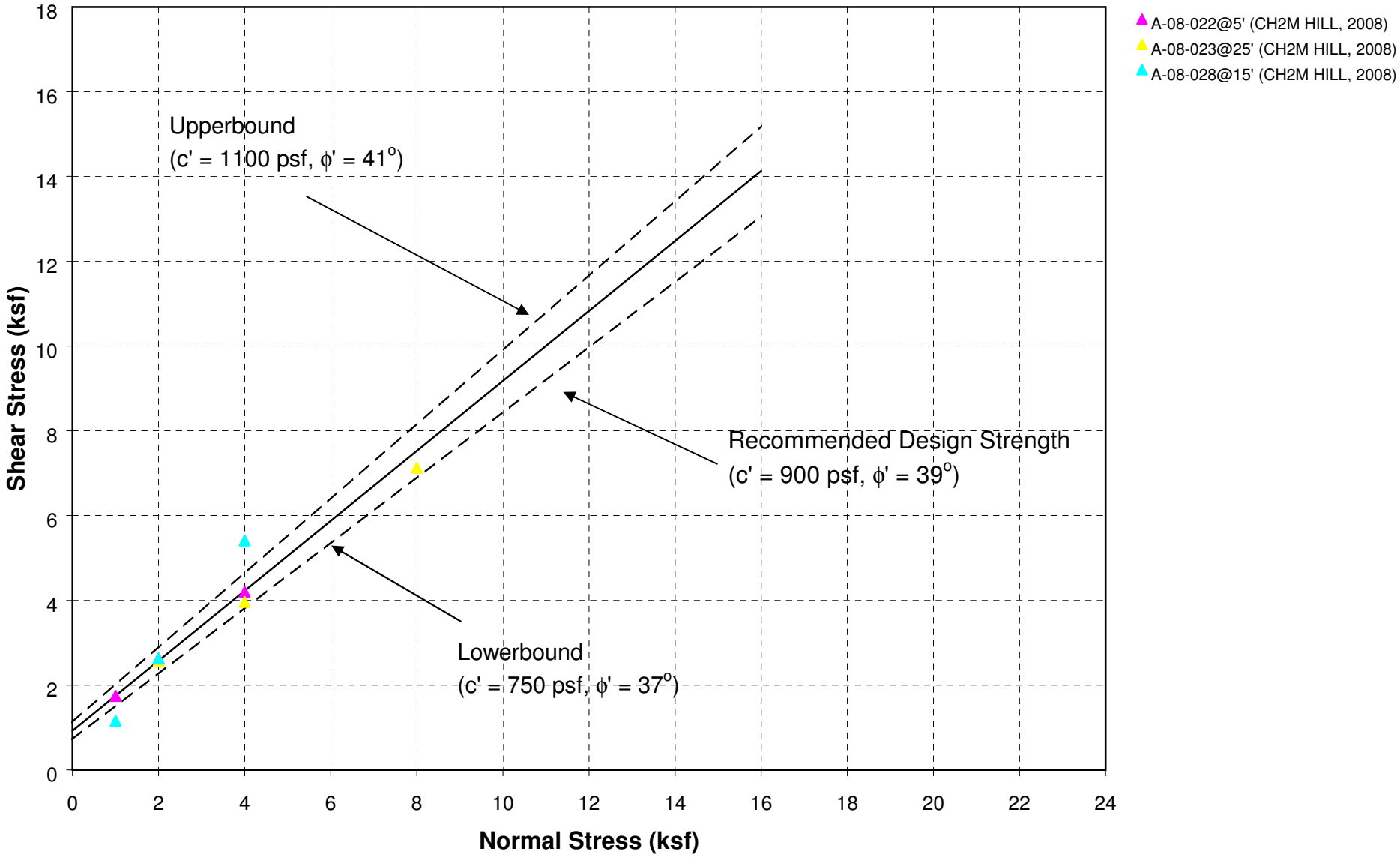


FIGURE E-12

SR-57 NORTHBOUND WIDENING PROJECT

COMPACTED FILL **(Af)** - EXISTING

ULTIMATE SHEAR STRENGTH - **SAND**

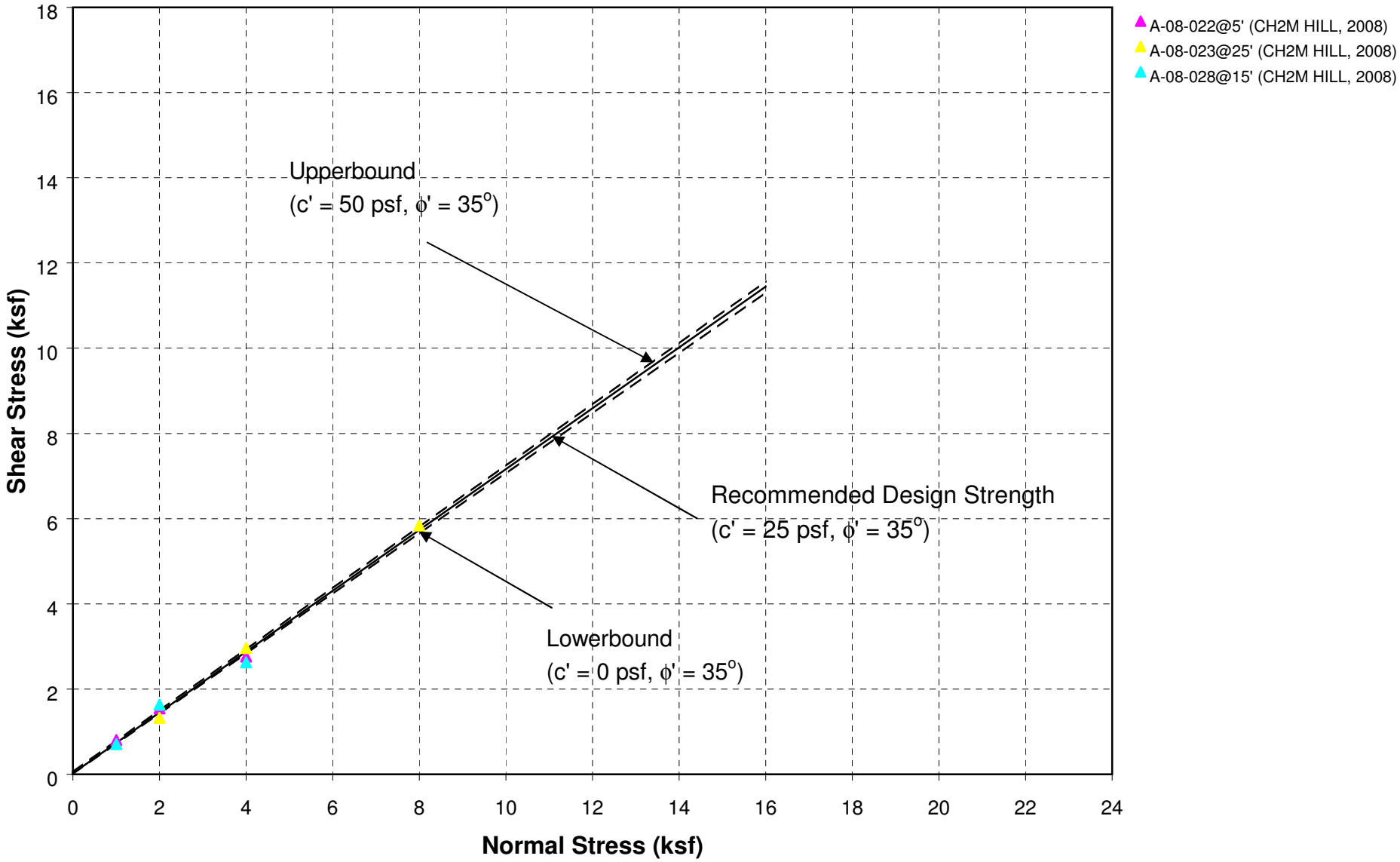


FIGURE E-13

SR-57 NORTHBOUND WIDENING PROJECT

COMPACTED FILL (**Af**) - REMOLDED
PEAK SHEAR STRENGTH - **CLAY**

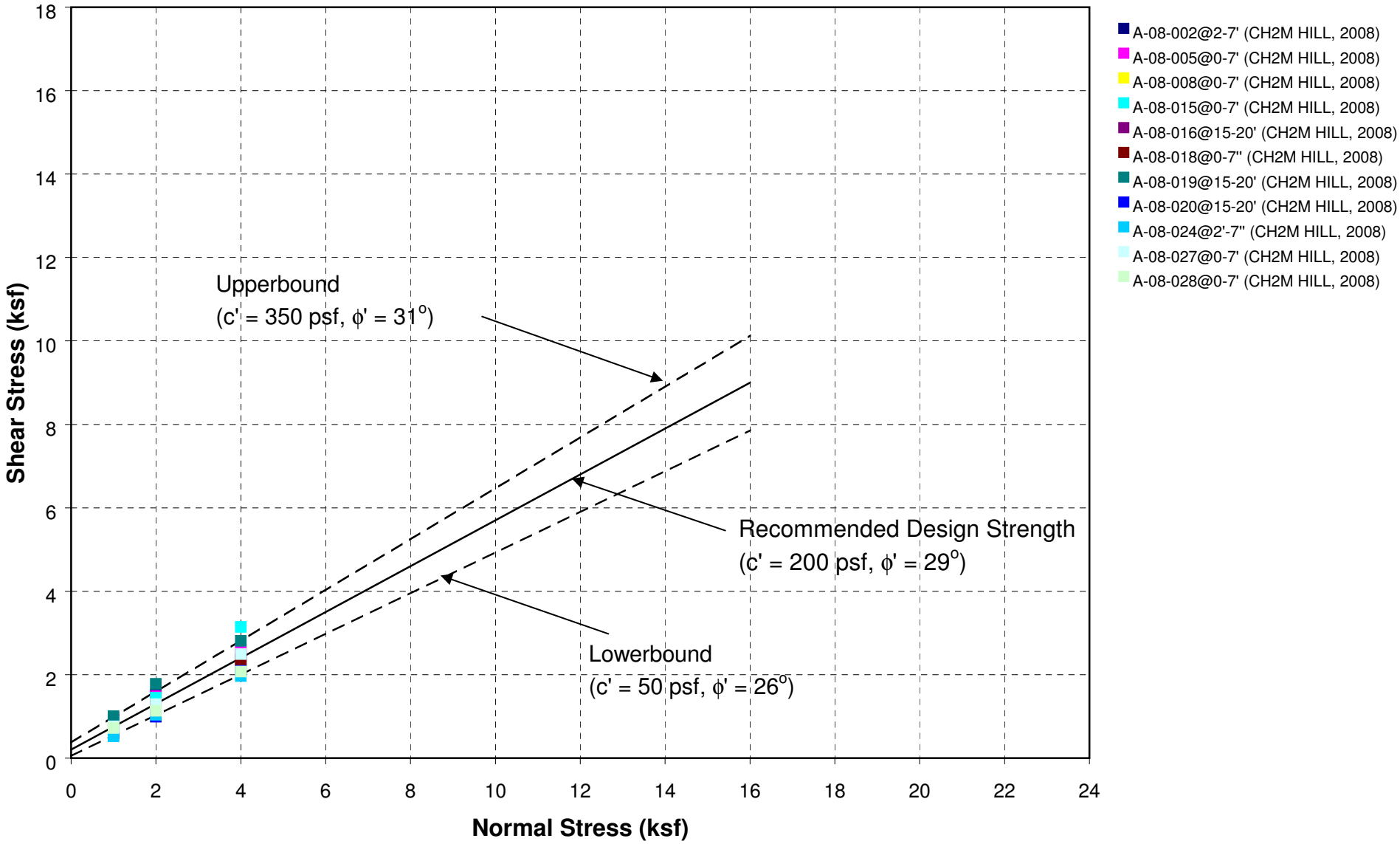


FIGURE E-14

SR-57 NORTHBOUND WIDENING PROJECT

COMPACTED FILL (**Af**) - REMOLDED

ULTIMATE SHEAR STRENGTH - **CLAY**

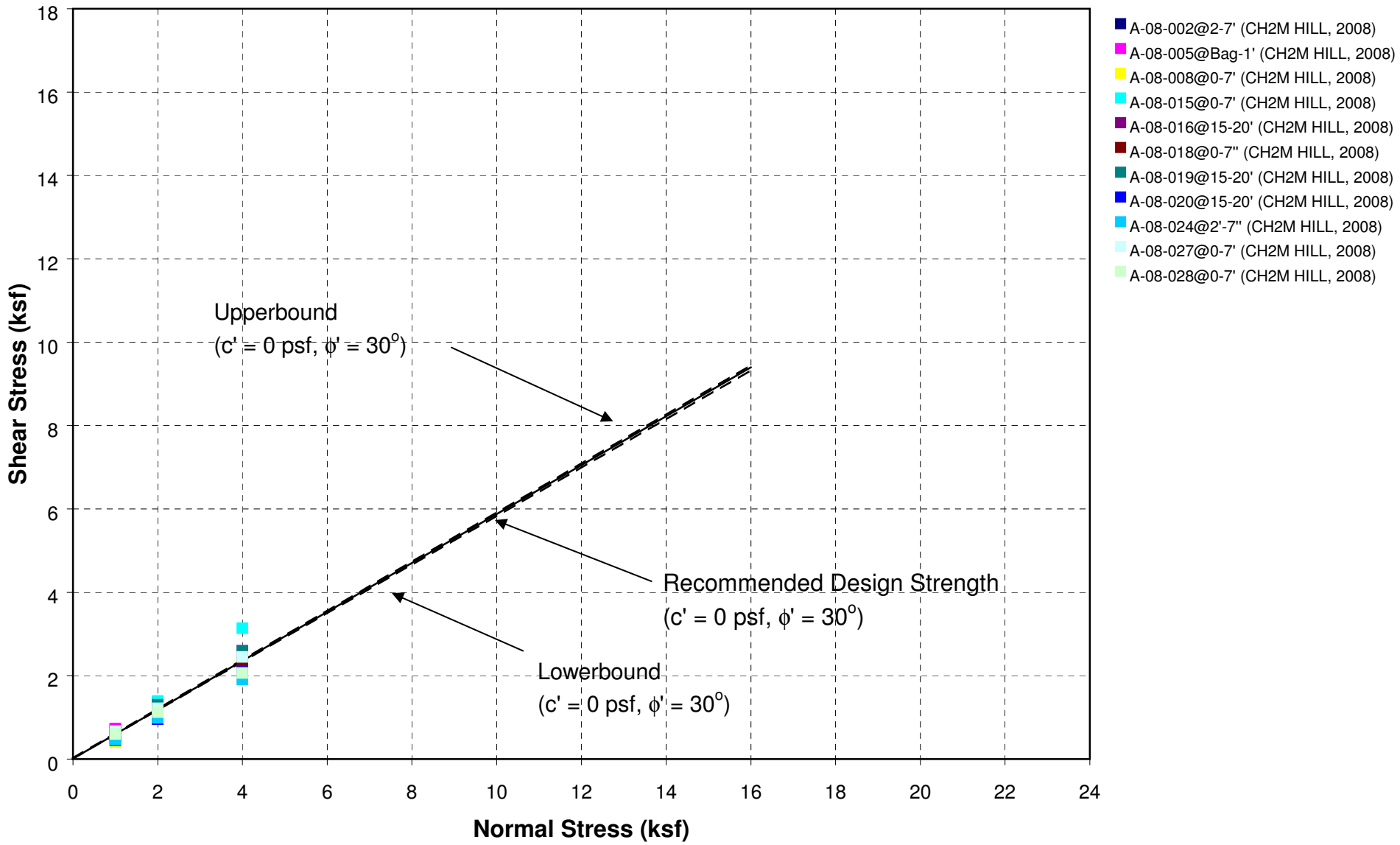


FIGURE E-15

SR-57 NORTHBOUND WIDENING PROJECT

COMPACTED FILL (**Af**) - REMOLDED

PEAK SHEAR STRENGTH - **SAND**

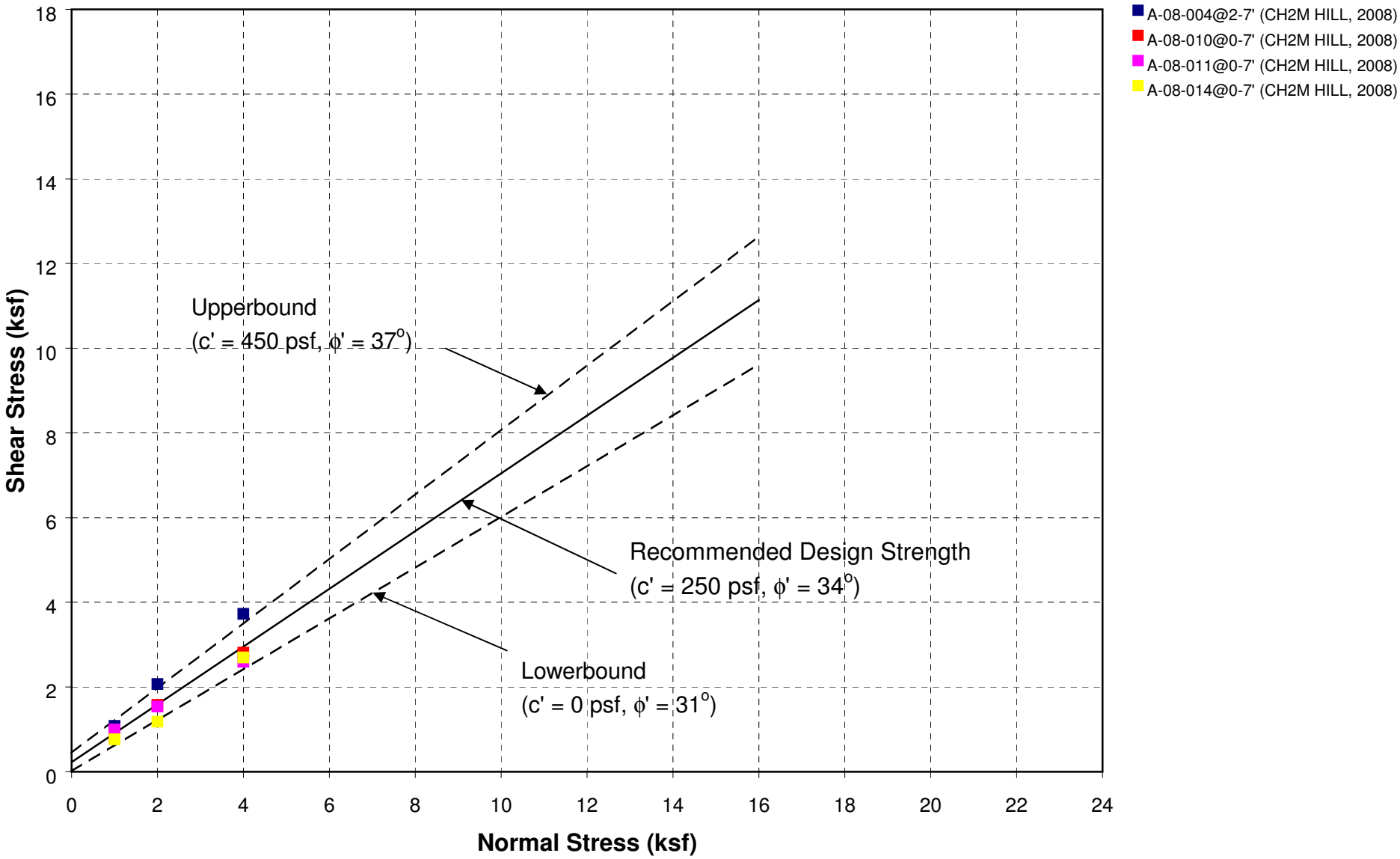
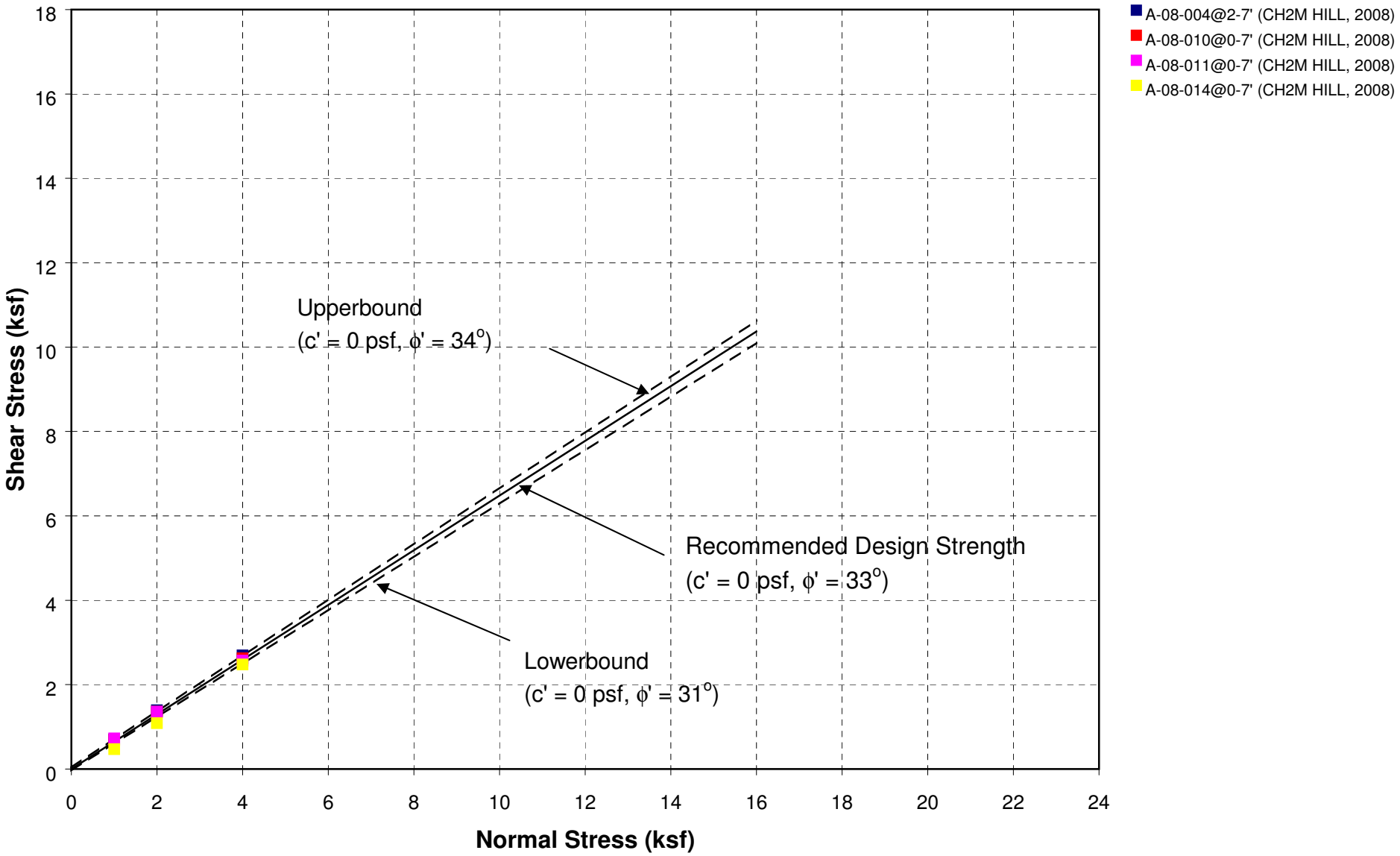


FIGURE E-16

SR-57 NORTHBOUND WIDENING PROJECT

COMPACTED FILL (**Af**) - REMOLDED
ULTIMATE SHEAR STRENGTH - **SAND**



APPENDIX E.2

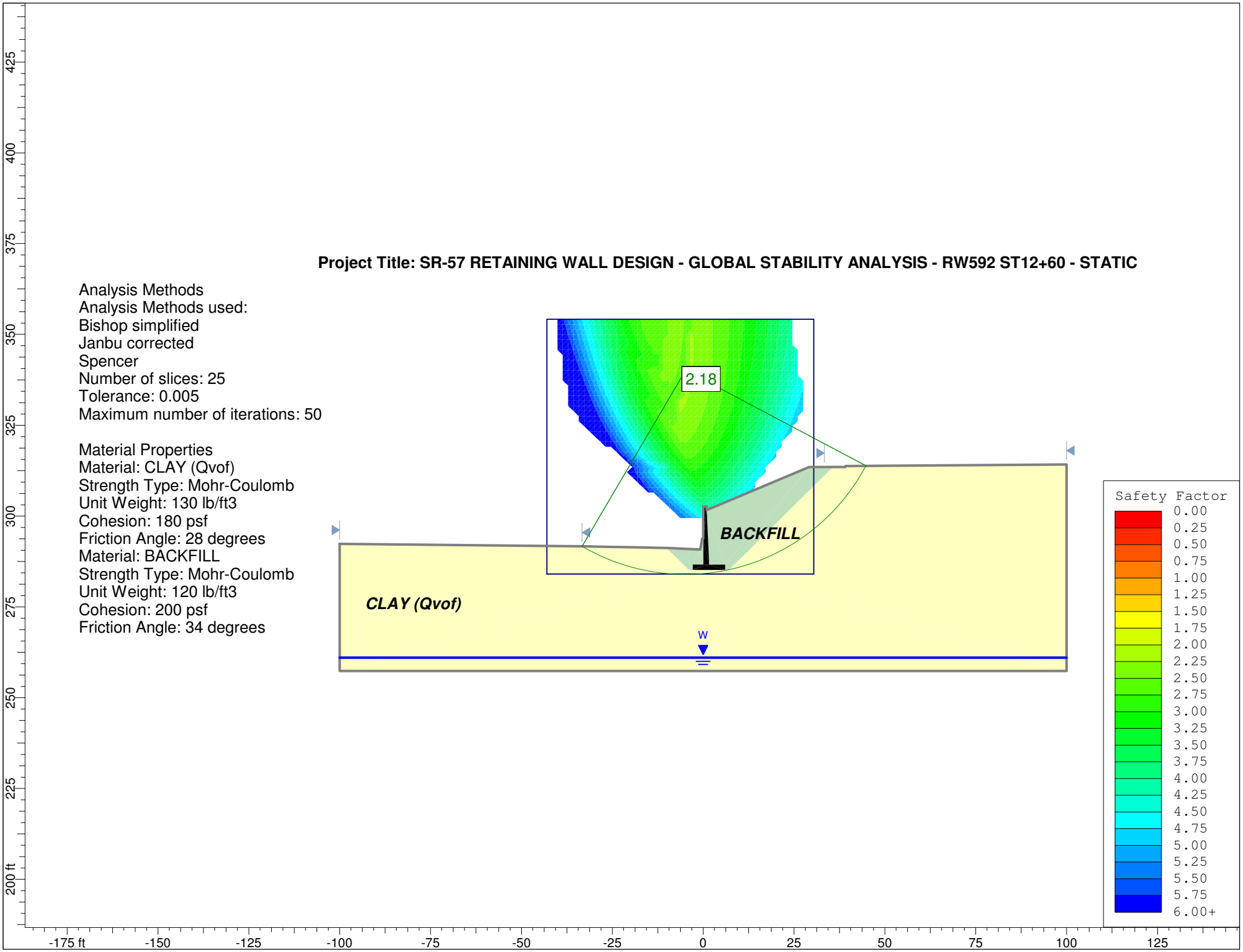
Stability Analyses

Retaining Wall RW 592

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW592 ST12+60 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW592_ST12+60_STATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW592 ST12+60 - STATIC
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.182580
Center: -4.845, 340.119
Radius: 56.226
Left Slip Surface Endpoint: -33.333, 291.645
Right Slip Surface Endpoint: 44.832, 313.783
Resisting Moment=4.36803e+006 lb-ft
Driving Moment=2.00131e+006 lb-ft

Method: janbu corrected
FS: 2.102680
Center: -6.314, 331.705
Radius: 48.321
Left Slip Surface Endpoint: -33.333, 291.645
Right Slip Surface Endpoint: 38.447, 313.500
Resisting Horizontal Force=65608.3 lb
Driving Horizontal Force=31202.3 lb

Method: spencer
FS: 2.184030
Center: -4.845, 340.119
Radius: 56.226
Left Slip Surface Endpoint: -33.333, 291.645
Right Slip Surface Endpoint: 44.832, 313.783
Resisting Moment=4.37093e+006 lb-ft
Driving Moment=2.00131e+006 lb-ft
Resisting Horizontal Force=69248.5 lb
Driving Horizontal Force=31706.7 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 7981
Number of Invalid Surfaces: 20630
Error Codes:
Error Code -99 reported for 351 surfaces
Error Code -101 reported for 411 surfaces
Error Code -103 reported for 16130 surfaces
Error Code -112 reported for 37 surfaces
Error Code -113 reported for 16 surfaces
Error Code -1000 reported for 3685 surfaces

Method: janbu corrected
Number of Valid Surfaces: 7958
Number of Invalid Surfaces: 20653
Error Codes:

Error Code -99 reported for 351 surfaces
Error Code -101 reported for 411 surfaces
Error Code -103 reported for 16130 surfaces
Error Code -111 reported for 25 surfaces
Error Code -112 reported for 35 surfaces
Error Code -113 reported for 16 surfaces
Error Code -1000 reported for 3685 surfaces

Method: spencer
Number of Valid Surfaces: 7928
Number of Invalid Surfaces: 20683
Error Codes:
Error Code -99 reported for 351 surfaces
Error Code -101 reported for 411 surfaces
Error Code -103 reported for 16130 surfaces
Error Code -111 reported for 38 surfaces
Error Code -112 reported for 52 surfaces
Error Code -113 reported for 16 surfaces
Error Code -1000 reported for 3685 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-101 = Only one (or zero) surface / slope intersections.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

-43.037	284.024
30.410	284.024
30.410	354.143
-43.037	354.143

Material Boundary

-82.210	292.090
-79.200	292.060
-78.563	292.103

Material Boundary

0.000	293.760
0.000	286.630
-2.917	286.630
-2.917	285.130
6.083	285.130
6.083	286.630
1.653	286.630
0.960	301.630

Material Boundary

6.083	285.130
7.083	285.130
35.669	313.500

Material Boundary

-10.095	291.187
-3.917	285.130
-2.917	285.130

External Boundary

-100.000	292.320
-100.000	257.320
100.000	257.320
100.000	314.170
39.160	313.743
39.160	313.500
35.669	313.500
29.160	313.500
0.960	301.630
0.960	302.630
0.010	302.630
0.000	293.760
-0.320	293.760
-0.330	293.760
-0.810	290.760
-1.080	290.770
-8.810	291.160
-10.095	291.187
-10.750	291.200
-20.540	291.400
-20.546	291.400
-30.250	291.600
-30.910	291.620
-62.996	291.945
-78.563	292.103

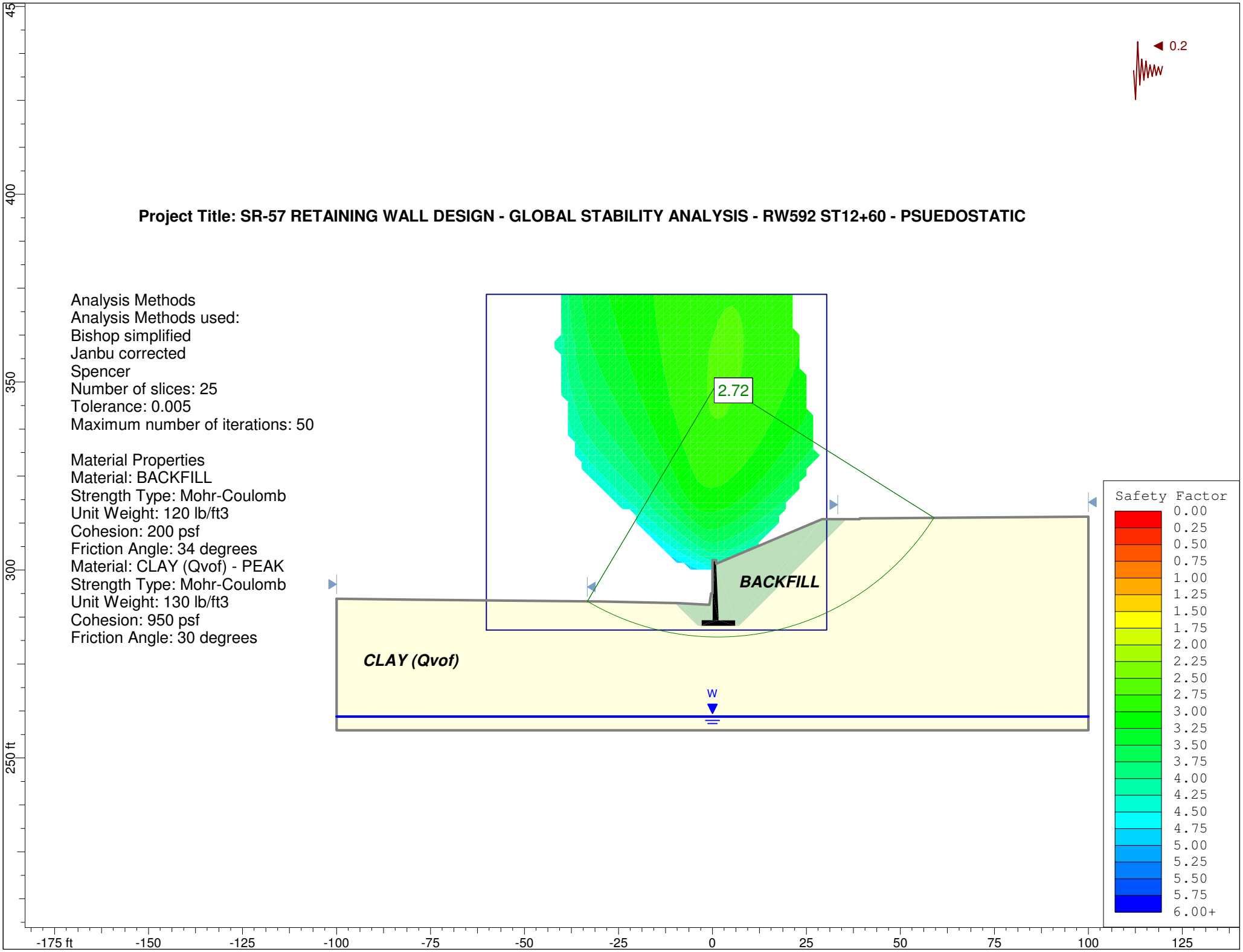
Water Table

-100.000	261.000
100.000	261.000

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW592 ST12+60 - PSUEDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees



Slide Analysis Information

Document Name

File Name: RW592_ST12+60_PSEUDOSTATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW592 ST12+60 - PSEUDOSTATIC
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2

Material Properties

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.724680
Center: 1.425, 350.125
Radius: 68.029
Left Slip Surface Endpoint: -33.333, 291.645
Right Slip Surface Endpoint: 58.997, 313.882
Resisting Moment=1.3375e+007 lb-ft
Driving Moment=4.90882e+006 lb-ft

Method: janbu corrected
FS: 2.620120
Center: 3.236, 341.192
Radius: 61.581
Left Slip Surface Endpoint: -33.333, 291.645
Right Slip Surface Endpoint: 58.429, 313.878
Resisting Horizontal Force=203423 lb
Driving Horizontal Force=77638.7 lb

Method: spencer
FS: 2.734160
Center: 1.425, 351.911
Radius: 69.571
Left Slip Surface Endpoint: -33.333, 291.645
Right Slip Surface Endpoint: 59.686, 313.887
Resisting Moment=1.37159e+007 lb-ft
Driving Moment=5.01651e+006 lb-ft
Resisting Horizontal Force=178363 lb
Driving Horizontal Force=65235.3 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 8312
Number of Invalid Surfaces: 20299
Error Codes:
Error Code -99 reported for 1005 surfaces
Error Code -101 reported for 312 surfaces
Error Code -103 reported for 10635 surfaces
Error Code -112 reported for 16 surfaces
Error Code -113 reported for 26 surfaces

Error Code -1000 reported for 8305 surfaces

Method: janbu corrected
Number of Valid Surfaces: 8226
Number of Invalid Surfaces: 20385
Error Codes:
Error Code -99 reported for 1005 surfaces
Error Code -101 reported for 312 surfaces
Error Code -103 reported for 10635 surfaces
Error Code -108 reported for 21 surfaces
Error Code -111 reported for 68 surfaces
Error Code -112 reported for 13 surfaces
Error Code -113 reported for 26 surfaces
Error Code -1000 reported for 8305 surfaces

Method: spencer
Number of Valid Surfaces: 8200
Number of Invalid Surfaces: 20411
Error Codes:
Error Code -99 reported for 1005 surfaces
Error Code -101 reported for 312 surfaces
Error Code -103 reported for 10635 surfaces
Error Code -108 reported for 21 surfaces
Error Code -111 reported for 90 surfaces
Error Code -112 reported for 17 surfaces
Error Code -113 reported for 26 surfaces
Error Code -1000 reported for 8305 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-101 = Only one (or zero) surface / slope intersections.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

-60.169	284.024
30.410	284.024
30.410	373.349
-60.169	373.349

Material Boundary

-82.210	292.090
-79.200	292.060
-78.563	292.103

Material Boundary

0.000	293.760
0.000	286.630
-2.917	286.630
-2.917	285.130
6.083	285.130
6.083	286.630
1.653	286.630
0.960	301.630

Material Boundary

6.083	285.130
7.083	285.130
35.669	313.500

Material Boundary

-10.095	291.187
-3.917	285.130
-2.917	285.130

External Boundary

-100.000	292.320
-100.000	257.320
100.000	257.320
100.000	314.170
39.160	313.743
39.160	313.500
35.669	313.500
29.160	313.500
0.960	301.630
0.960	302.630

0.010	302.630
0.000	293.760
-0.320	293.760
-0.330	293.760
-0.810	290.760
-1.080	290.770
-8.810	291.160
-10.095	291.187
-10.750	291.200
-20.540	291.400
-20.546	291.400
-30.250	291.600
-30.910	291.620
-62.996	291.945
-78.563	292.103

Water Table

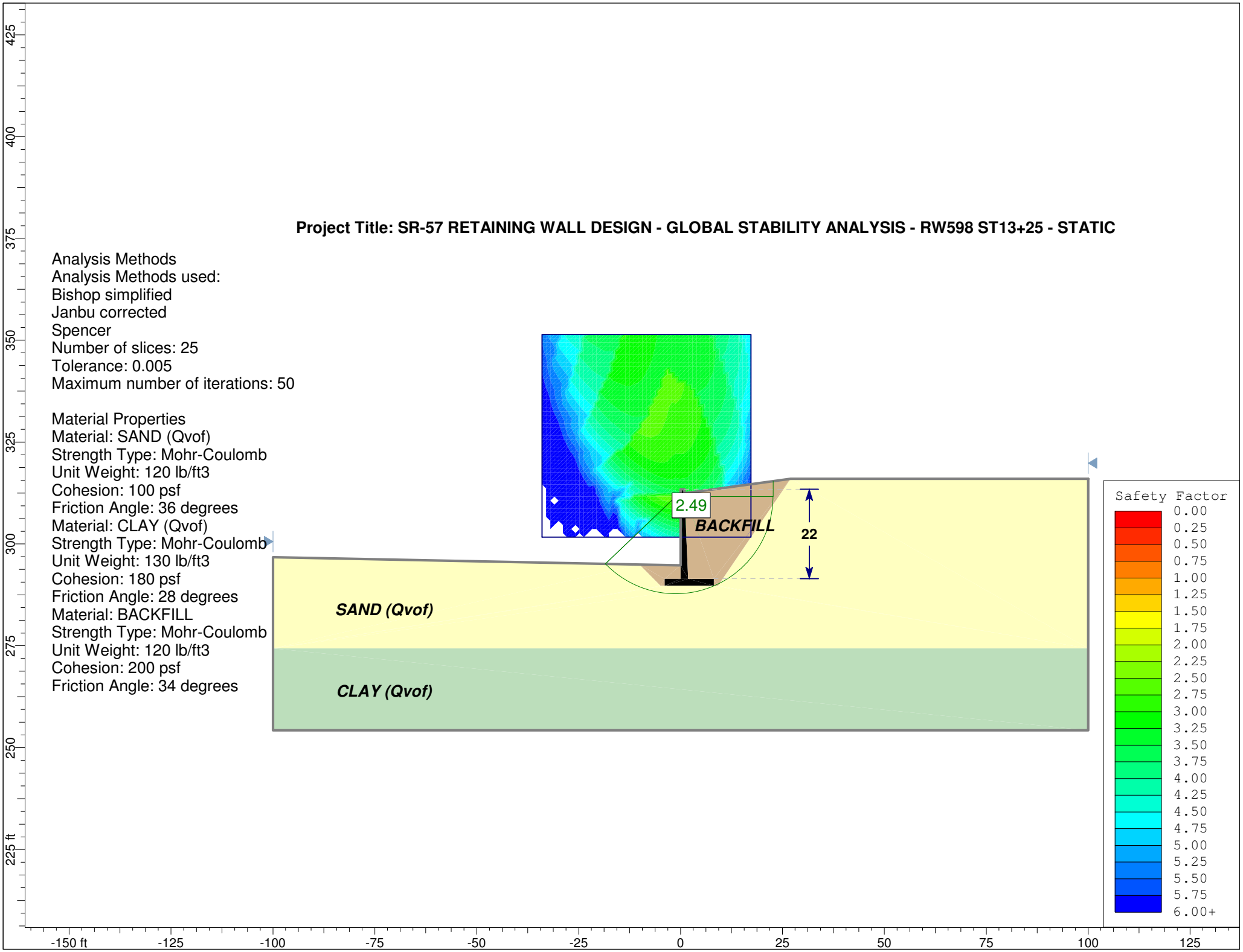
-100.000	261.000
100.000	261.000

Retaining Wall RW 598

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW598 ST13+25 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW598_ST13+25_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW598 ST13+25 - STATIC
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.490210
Center: -1.182, 311.629
Radius: 23.895
Left Slip Surface Endpoint: -18.437, 295.099
Right Slip Surface Endpoint: 22.713, 311.629
Left Slope Intercept: -18.437 295.099
Right Slope Intercept: 22.713 315.407
Resisting Moment=1.41315e+006 lb-ft
Driving Moment=567485 lb-ft

Method: spencer
FS: 2.525340
Center: -2.208, 311.629
Radius: 24.452
Left Slip Surface Endpoint: -20.259, 295.135
Right Slip Surface Endpoint: 22.244, 311.629
Left Slope Intercept: -20.259 295.135
Right Slope Intercept: 22.244 315.342
Resisting Moment=1.49772e+006 lb-ft
Driving Moment=593077 lb-ft
Resisting Horizontal Force=50796.8 lb
Driving Horizontal Force=20114.9 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 11543
Number of Invalid Surfaces: 17068
Error Codes:
Error Code -99 reported for 9030 surfaces
Error Code -103 reported for 6735 surfaces
Error Code -106 reported for 33 surfaces
Error Code -107 reported for 703 surfaces
Error Code -109 reported for 47 surfaces
Error Code -112 reported for 520 surfaces

Method: spencer
Number of Valid Surfaces: 10799
Number of Invalid Surfaces: 17812
Error Codes:
Error Code -99 reported for 9030 surfaces

Error Code -103 reported for 6735 surfaces
Error Code -106 reported for 33 surfaces
Error Code -107 reported for 703 surfaces
Error Code -108 reported for 71 surfaces
Error Code -109 reported for 47 surfaces
Error Code -111 reported for 406 surfaces
Error Code -112 reported for 787 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

-34.010	301.684
17.283	301.684
17.283	351.413
-34.010	351.413

Material Boundary

0.000	291.400
0.000	294.730

Material Boundary

0.000	291.400
-3.917	291.400
-3.917	289.730
8.170	289.730
8.170	291.400
1.877	291.400
0.960	312.400

Material Boundary

-100.000	274.360
100.000	274.360

Material Boundary

8.170	289.730
9.170	289.730
27.000	316.000

Material Boundary

-10.088	294.932
-4.917	289.730
-3.917	289.730

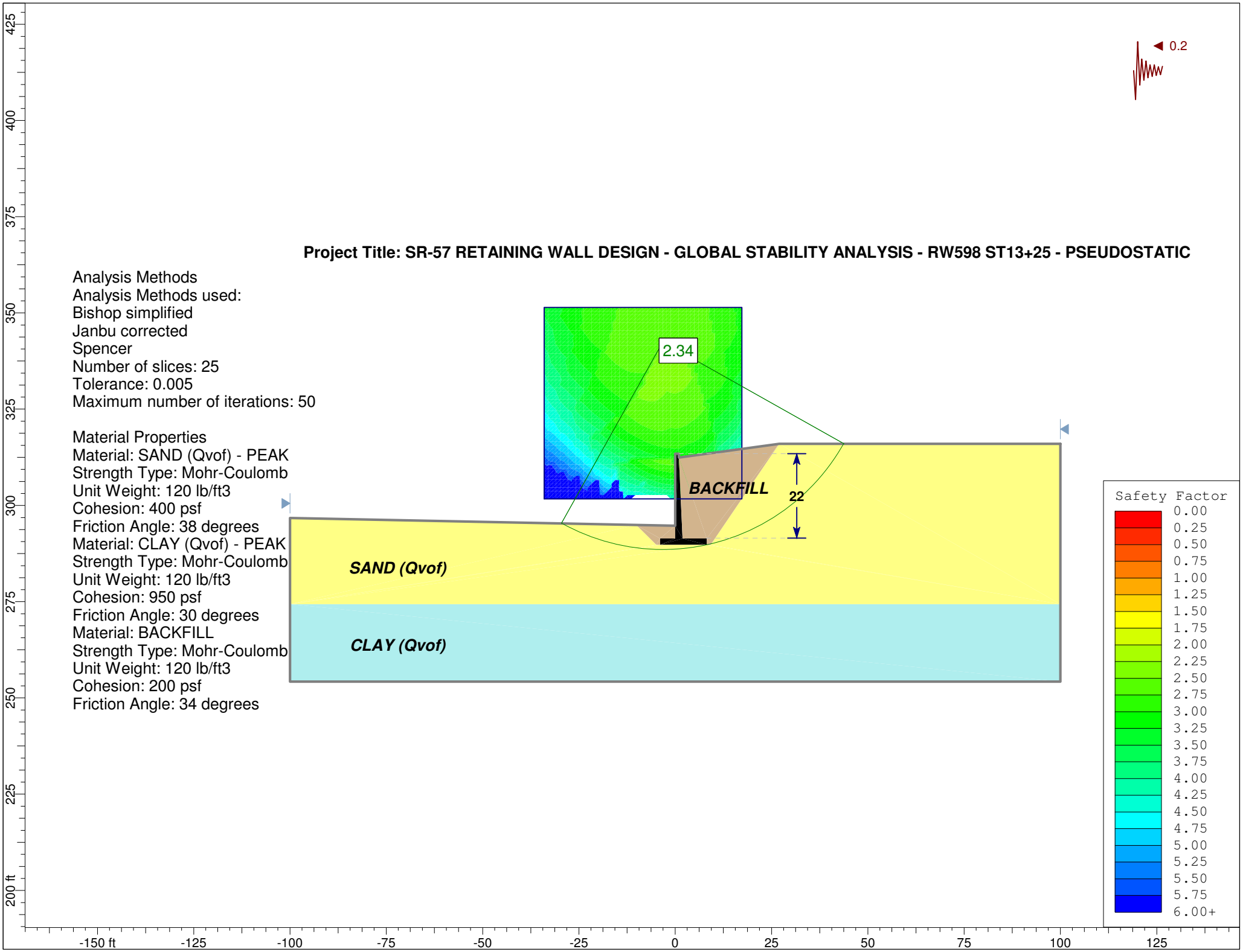
External Boundary

100.000	316.000
27.000	316.000
0.960	312.400
0.960	313.400
0.000	313.400
0.000	294.730
-10.088	294.932
-100.000	296.730
-100.000	274.360
-100.000	254.237
100.000	254.237
100.000	274.360

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW598 ST13+25 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: SAND (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 400 psf
Friction Angle: 38 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW598_ST13+25_Pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW598 ST13+25 - PSEUDOSTATIC
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2

Material Properties

Material: SAND (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 400 psf
Friction Angle: 38 degrees
Water Surface: None

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.337940
Center: -3.234, 342.461
Radius: 53.987
Left Slip Surface Endpoint: -29.546, 295.321
Right Slip Surface Endpoint: 43.823, 316.000
Resisting Moment=6.32384e+006 lb-ft
Driving Moment=2.70488e+006 lb-ft

Method: spencer
FS: 2.358880
Center: -3.234, 342.461
Radius: 53.987
Left Slip Surface Endpoint: -29.546, 295.321
Right Slip Surface Endpoint: 43.823, 316.000
Resisting Moment=6.38049e+006 lb-ft
Driving Moment=2.70488e+006 lb-ft
Resisting Horizontal Force=107147 lb
Driving Horizontal Force=45423 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 11984
Number of Invalid Surfaces: 16627
Error Codes:
Error Code -99 reported for 9029 surfaces
Error Code -103 reported for 6735 surfaces
Error Code -106 reported for 35 surfaces
Error Code -109 reported for 46 surfaces
Error Code -112 reported for 782 surfaces

Method: spencer
Number of Valid Surfaces: 10822
Number of Invalid Surfaces: 17789
Error Codes:

Error Code -99 reported for 9029 surfaces
Error Code -103 reported for 6735 surfaces
Error Code -106 reported for 35 surfaces
Error Code -108 reported for 25 surfaces
Error Code -109 reported for 46 surfaces
Error Code -111 reported for 296 surfaces
Error Code -112 reported for 1623 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

-34.010	301.684
17.283	301.684
17.283	351.413
-34.010	351.413

Material Boundary

0.000	291.400
0.000	294.730

Material Boundary

0.000	291.400
-3.917	291.400
-3.917	289.730
8.170	289.730
8.170	291.400
1.877	291.400
0.960	312.400

Material Boundary

-100.000	274.360
100.000	274.360

Material Boundary

8.170	289.730
9.170	289.730
27.000	316.000

Material Boundary

-10.157	294.933
-4.917	289.730
-3.917	289.730

External Boundary

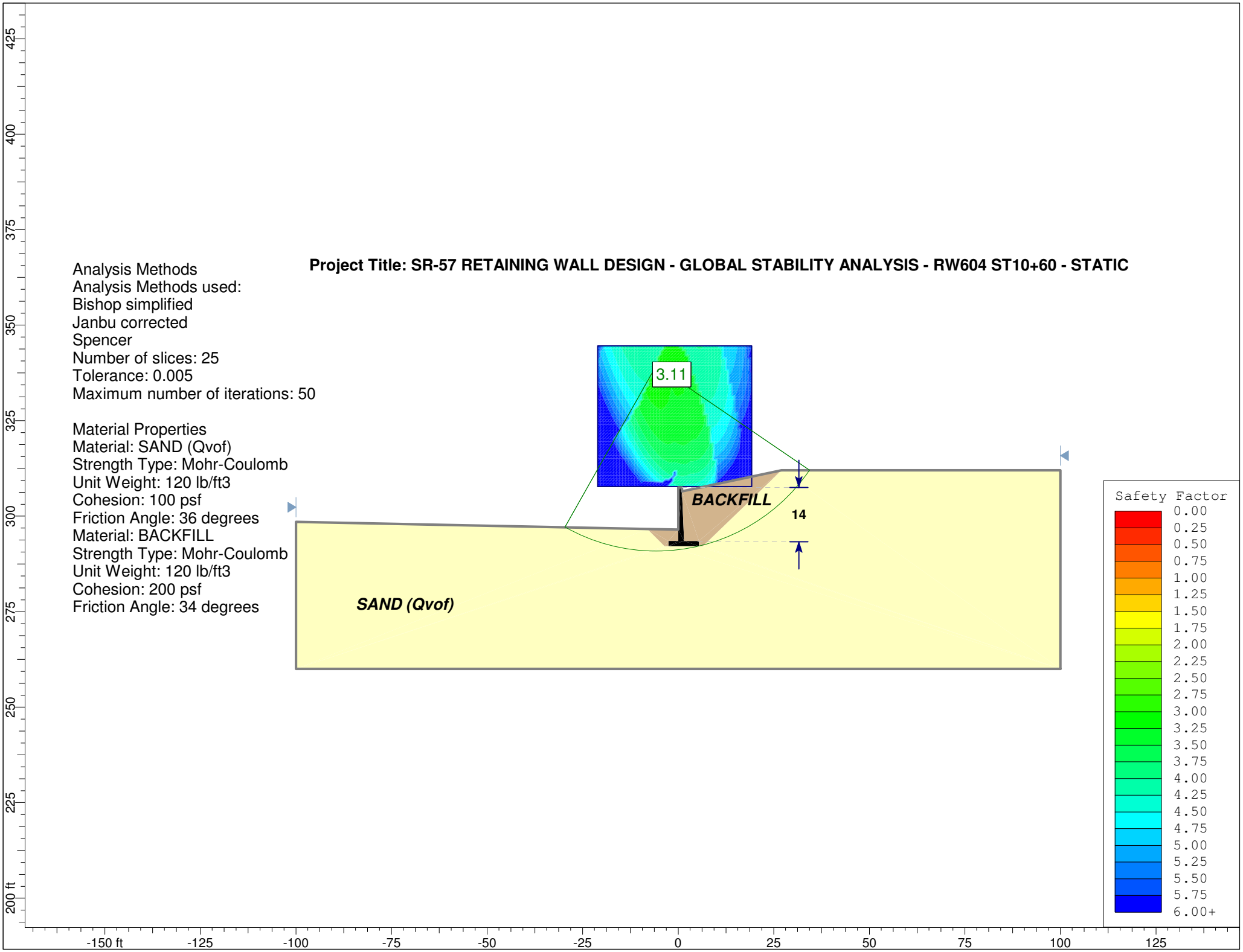
100.000	316.000
27.000	316.000
0.960	312.400
0.960	313.400
0.000	313.400
0.000	294.730
-10.157	294.933
-100.000	296.730
-100.000	274.360
-100.000	254.237
100.000	254.237
100.000	274.360

Retaining Wall RW 604

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW604 ST10+60 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW604_ST10+60_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW604 ST10+60 - STATIC
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 3.108790
Center: -5.751, 339.409
Radius: 48.622
Left Slip Surface Endpoint: -29.646, 297.063
Right Slip Surface Endpoint: 34.410, 312.000
Resisting Moment=2.65775e+006 lb-ft
Driving Moment=854912 lb-ft

Method: spencer
FS: 3.111040
Center: -5.751, 339.409
Radius: 48.622
Left Slip Surface Endpoint: -29.646, 297.063
Right Slip Surface Endpoint: 34.410, 312.000
Resisting Moment=2.65966e+006 lb-ft
Driving Moment=854912 lb-ft
Resisting Horizontal Force=49960.9 lb
Driving Horizontal Force=16059.2 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 12290
Number of Invalid Surfaces: 16321
Error Codes:
Error Code -99 reported for 5905 surfaces
Error Code -103 reported for 10174 surfaces
Error Code -106 reported for 10 surfaces
Error Code -107 reported for 57 surfaces
Error Code -109 reported for 17 surfaces
Error Code -112 reported for 158 surfaces

Method: spencer
Number of Valid Surfaces: 12193
Number of Invalid Surfaces: 16418
Error Codes:
Error Code -99 reported for 5905 surfaces
Error Code -103 reported for 10174 surfaces
Error Code -106 reported for 10 surfaces
Error Code -107 reported for 57 surfaces
Error Code -108 reported for 43 surfaces
Error Code -109 reported for 17 surfaces
Error Code -111 reported for 49 surfaces
Error Code -112 reported for 163 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite
strength material. If infinite strength regions
are defined for a model, a large number of
potential slip surfaces may show this error code.
This is Normal.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-106 = Average slice width is less than
0.0001 * (maximum horizontal extent of soil region).
This limitation is imposed to avoid numerical errors
which may result from too many slices, or too
small a slip region.

-107 = Total driving moment or
total driving force is negative. This will occur
if the wrong failure direction is specified,
or if high external or anchor loads are applied
against the failure direction.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-109 = Soiltype for slice base not
located. This error should occur very rarely,
if at all. It may occur if a very low number of
slices is combined with certain soil geometries,
such that the midpoint of a slice base is
actually outside the soil region,even though
the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F)
< 0.2 for the final iteration of the safety factor calculation. This screens out
some slip surfaces which may not be valid in the context of the analysis, in
particular, deep seated slip surfaces with many high negative base angle
slices in the passive zone.

List of All Coordinates

Search Grid

-21.050	307.721
19.211	307.721
19.211	344.567
-21.050	344.567

Material Boundary

0.000	293.470
0.000	296.470

Material Boundary

0.000	293.470
-2.580	293.470
-2.580	292.120
5.417	292.120
5.417	293.470
1.543	293.470
0.960	306.470

Material Boundary

5.417	292.120
6.417	292.120
27.000	312.000

Material Boundary

-8.088	296.632
-3.580	292.120
-2.580	292.120

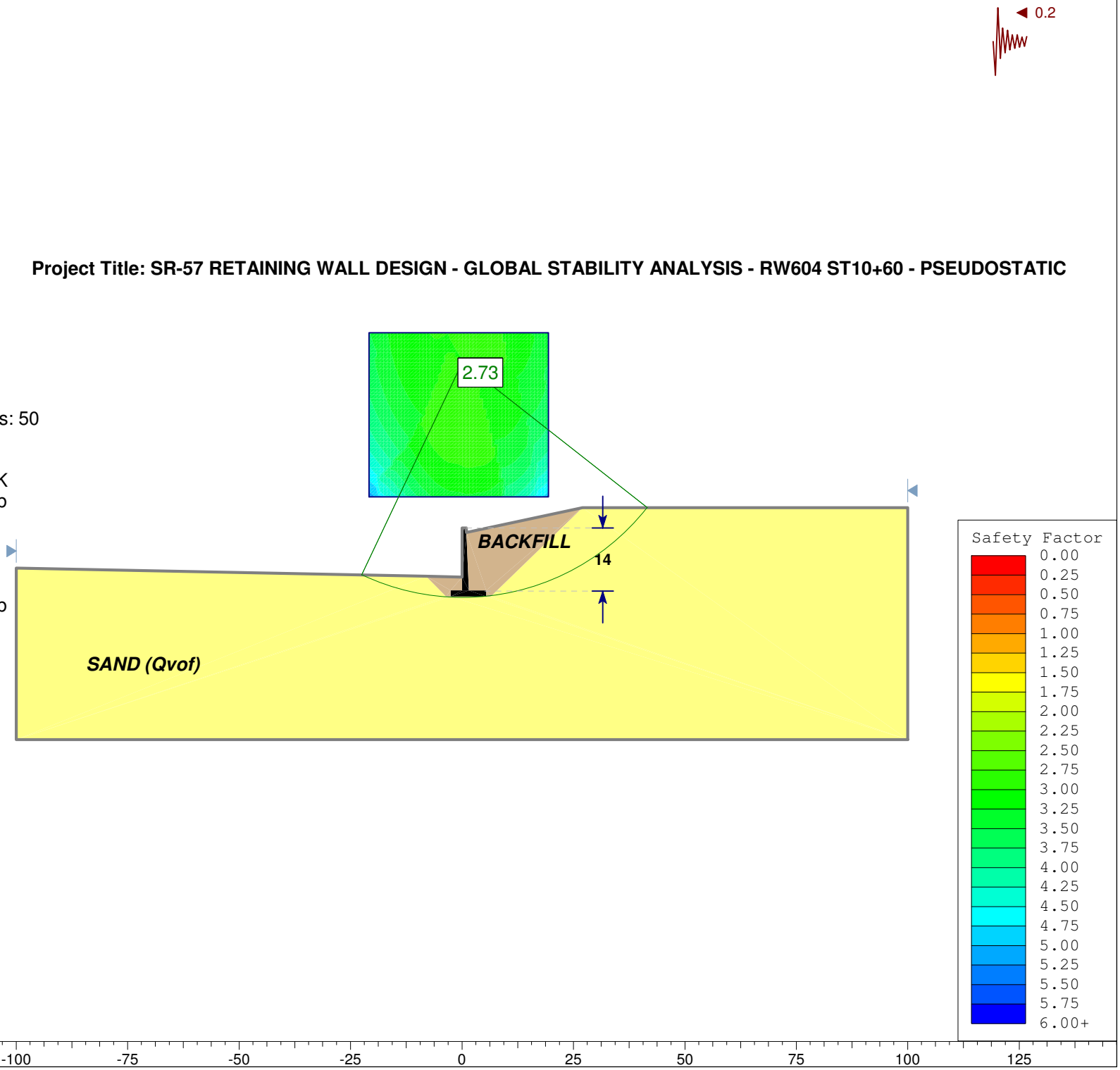
External Boundary

100.000	260.000
100.000	312.000
27.000	312.000
0.960	306.470
0.960	307.470
0.000	307.470
0.000	296.470
-8.088	296.632
-100.000	298.470
-100.000	260.000

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW604 ST10+60 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: SAND (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 450 psf
Friction Angle: 38 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW604_ST10+60_Pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW604 ST10+60 - PSEUDOSTATIC
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2

Material Properties

Material: SAND (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 400 psf
Friction Angle: 38 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.731180
Center: 0.074, 344.649
Radius: 52.807
Left Slip Surface Endpoint: -22.520, 296.920
Right Slip Surface Endpoint: 41.578, 312.000
Resisting Moment=4.28378e+006 lb-ft
Driving Moment=1.56848e+006 lb-ft

Method: spencer
FS: 2.744000
Center: 0.074, 344.649
Radius: 52.807
Left Slip Surface Endpoint: -22.520, 296.920
Right Slip Surface Endpoint: 41.578, 312.000
Resisting Moment=4.3039e+006 lb-ft
Driving Moment=1.56848e+006 lb-ft
Resisting Horizontal Force=75482.9 lb
Driving Horizontal Force=27508.3 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 13410
Number of Invalid Surfaces: 15201
Error Codes:
Error Code -99 reported for 6484 surfaces
Error Code -103 reported for 8705 surfaces
Error Code -106 reported for 4 surfaces
Error Code -109 reported for 7 surfaces
Error Code -112 reported for 1 surface

Method: spencer
Number of Valid Surfaces: 13386
Number of Invalid Surfaces: 15225
Error Codes:
Error Code -99 reported for 6484 surfaces
Error Code -103 reported for 8705 surfaces
Error Code -106 reported for 4 surfaces
Error Code -109 reported for 7 surfaces
Error Code -111 reported for 24 surfaces
Error Code -112 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

-20.862	314.436
19.399	314.436
19.399	351.282
-20.862	351.282

Material Boundary

0.000	293.470
0.000	296.470

Material Boundary

0.000	293.470
-2.580	293.470
-2.580	292.120
5.417	292.120
5.417	293.470
1.543	293.470
0.960	306.470

Material Boundary

5.417	292.120
6.417	292.120
27.000	312.000

Material Boundary

-8.088	296.632
-3.580	292.120
-2.580	292.120

External Boundary

100.000	260.000
100.000	312.000
27.000	312.000
0.960	306.470
0.960	307.470
0.000	307.470
0.000	296.470
-8.088	296.632
-100.000	298.470
-100.000	260.000

Retaining Wall RW 614

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW614
Client: OCTA
Designer: RB
Station Number: 13+48

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....is\RW614_ST13+48.BEN
Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	39.0 °
Equivalent cohesion, $c_{equiv.}$	900.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 7.67 N γ= 20.89

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

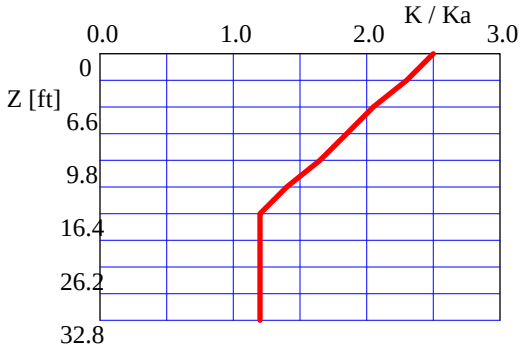
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

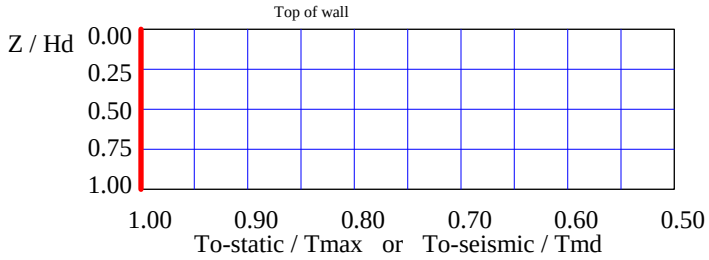


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

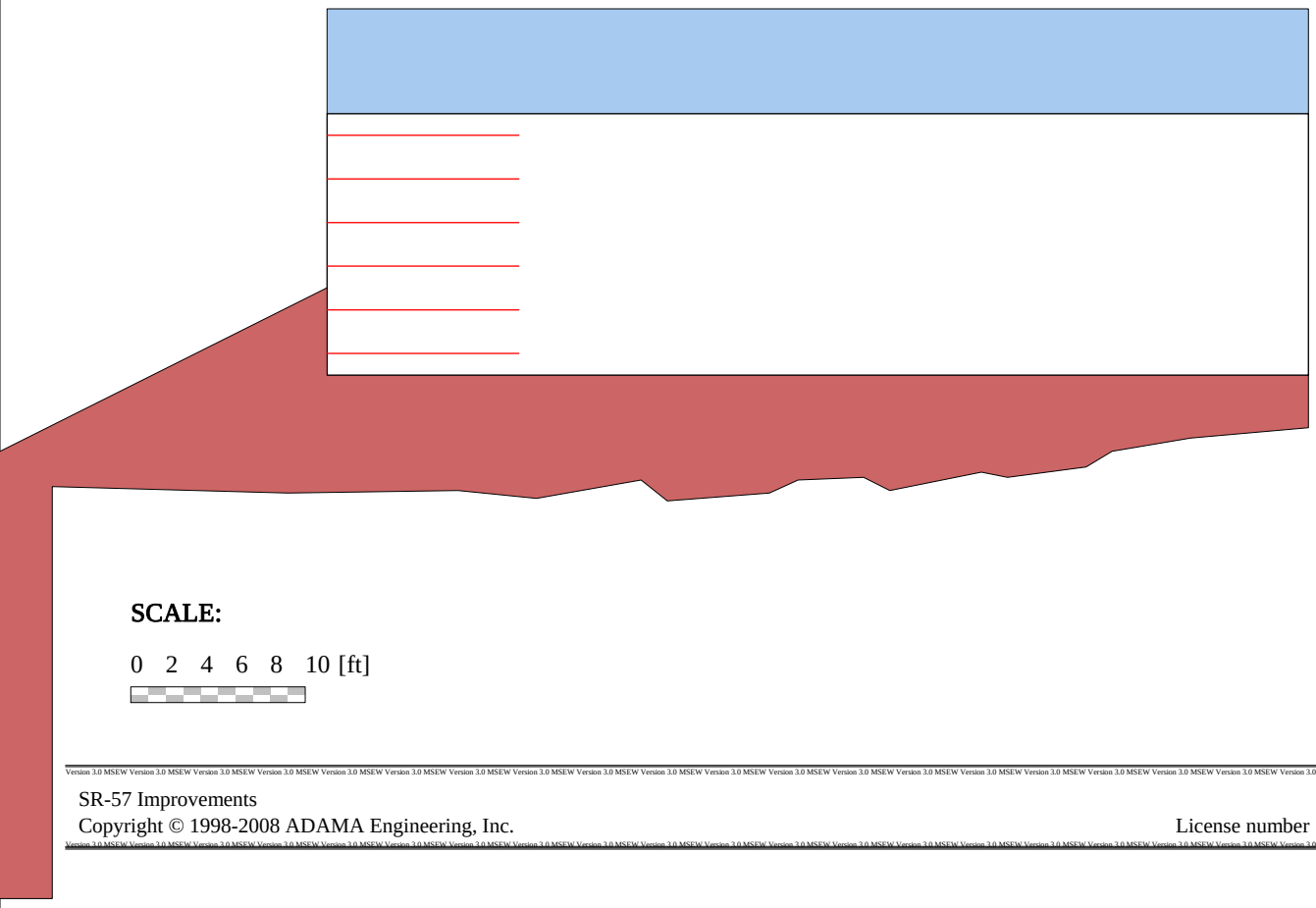
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	15.00	[ft]	{ Embedded depth is E = 5.00 ft, and height above top of finished bottom grade is H = 10.00 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 7.15, Meyerhof stress = 2604 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.131, Eccentricity, e/L = 0.1082, Fs-overturning = 4.62

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	11.00	1	N/A	7.72	8.57	8.573	14.784	3.387	0.0923	Caltrans W20
2	3.75	11.00	1	N/A	8.30	9.22	9.224	12.537	4.054	0.0642	Caltrans W20
3	6.25	11.00	1	N/A	9.42	10.47	10.471	10.417	5.058	0.0409	Caltrans W20
4	8.75	11.00	1	N/A	11.33	12.59	12.589	9.320	6.759	0.0226	Caltrans W20
5	11.25	11.00	1	N/A	15.01	16.68	16.681	9.257	10.385	0.0093	Caltrans W20
6	13.75	11.00	1	N/A	24.83	27.59	27.594	9.263	25.994	0.0014	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

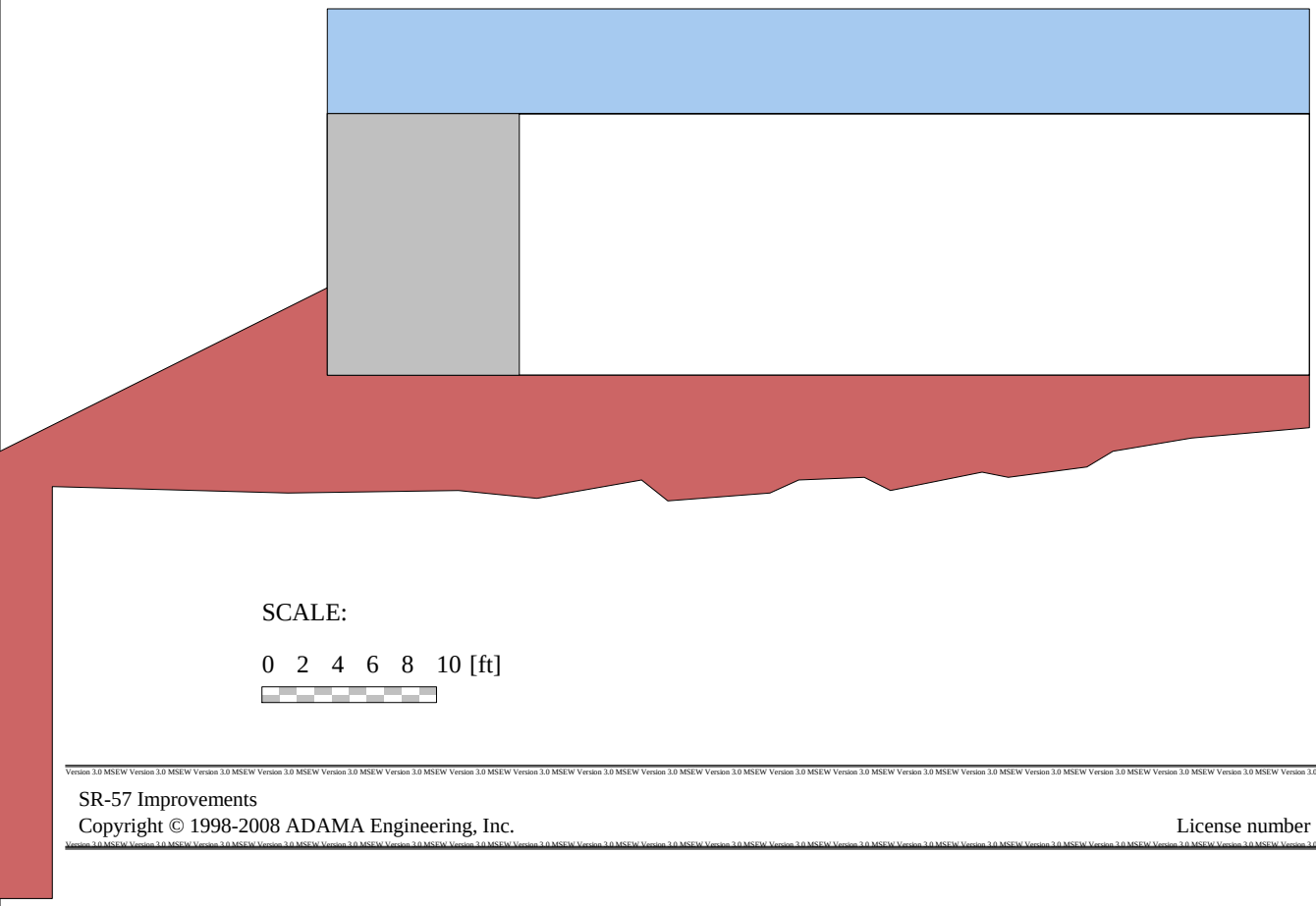
Bearing capacity, Fs = 3.48, Meyerhof stress = 4114 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.620, Eccentricity, e/L = 0.2520, Fs-overturning = 1.98

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	11.00	1	N/A	6.65	7.39	7.390	10.194	1.769	0.2119	Caltrans W20
2	3.75	11.00	1	N/A	7.24	8.04	8.041	8.743	2.166	0.1420	Caltrans W20
3	6.25	11.00	1	N/A	8.28	9.20	9.198	7.320	2.794	0.0861	Caltrans W20
4	8.75	11.00	1	N/A	9.86	10.96	10.955	6.489	3.930	0.0440	Caltrans W20
5	11.25	11.00	1	N/A	12.54	13.93	13.928	6.183	6.609	0.0159	Caltrans W20
6	13.75	11.00	1	N/A	18.72	20.80	20.796	5.585	20.290	0.0018	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	18607	14310	[lb/ft ²]
Meyerhof stress, σ_V	2603.6	4114	[lb/ft ²]
Eccentricity, e	1.19	2.77	[ft]
Eccentricity, e/L	0.108	0.252	
Fs calculated	7.15	3.48	
Base length	11.00	11.00	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT
(for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.131 and Fs-seismic = 1.620

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	11.00	3.387	1.769	1	Caltrans W20
2	3.75	11.00	4.054	2.166	1	Caltrans W20
3	6.25	11.00	5.058	2.794	1	Caltrans W20
4	8.75	11.00	6.759	3.930	1	Caltrans W20
5	11.25	11.00	10.385	6.609	1	Caltrans W20
6	13.75	11.00	25.994	20.290	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1082, e/L seismic = 0.2520; Overturning: Fs-static = 4.62, Fs-seismic = 1.98

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	11.00	0.0923	0.2119	1	Caltrans W20
2	3.75	11.00	0.0642	0.1420	1	Caltrans W20
3	6.25	11.00	0.0409	0.0861	1	Caltrans W20
4	8.75	11.00	0.0226	0.0440	1	Caltrans W20
5	11.25	11.00	0.0093	0.0159	1	Caltrans W20
6	13.75	11.00	0.0014	0.0018	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2124.39	340.26	N/A	8.573	N/A	7.390
2	3.75	1.000	0.500	18213	1974.51	290.47	N/A	9.224	N/A	8.041
3	6.25	1.000	0.500	18213	1739.39	240.67	N/A	10.471	N/A	9.198
4	8.75	1.000	0.500	18213	1446.71	215.78	N/A	12.589	N/A	10.955
5	11.25	1.000	0.500	18213	1091.87	215.78	N/A	16.681	N/A	13.928
6	13.75	1.000	0.500	18213	660.03	215.78	N/A	27.594	N/A	20.796

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2124.4	340.3	10.25	0.75	31406.2	N/A	14.784	25125.0	N/A	10.194
2	3.75	1.000	1974.5	290.5	8.75	2.25	24754.2	N/A	12.537	19803.4	N/A	8.743
3	6.25	1.000	1739.4	240.7	7.25	3.75	18118.8	N/A	10.417	14495.0	N/A	7.320
4	8.75	1.000	1446.7	215.8	6.50	4.50	13483.8	N/A	9.320	10787.1	N/A	6.489
5	11.25	1.000	1091.9	215.8	6.50	4.50	10107.2	N/A	9.257	8085.8	N/A	6.183
6	13.75	1.000	660.0	215.8	6.50	4.50	6113.7	N/A	9.263	4891.0	N/A	5.585

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	1.000	0.500	2124	0.90	16392	18213	N/A	7.72	N/A	8.57	Caltrans W20
2	3.75	1.000	0.500	1975	0.90	16392	18213	N/A	8.30	N/A	9.22	Caltrans W20
3	6.25	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
4	8.75	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
5	11.25	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
6	13.75	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	1.000	0.500	2465	0.90	16392	18213	N/A	6.65	N/A	7.39	Caltrans W20
2	3.75	1.000	0.500	2265	0.90	16392	18213	N/A	7.24	N/A	8.04	Caltrans W20
3	6.25	1.000	0.500	1980	0.90	16392	18213	N/A	8.28	N/A	9.20	Caltrans W20
4	8.75	1.000	0.500	1662	0.90	16392	18213	N/A	9.86	N/A	10.96	Caltrans W20
5	11.25	1.000	0.500	1308	0.90	16392	18213	N/A	12.54	N/A	13.93	Caltrans W20
6	13.75	1.000	0.500	876	0.90	16392	18213	N/A	18.72	N/A	20.80	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW614
Client: OCTA
Designer: RB
Station Number: 14+70

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....is\RW614_ST14+70.BEN

Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	30.0 °
Equivalent cohesion, $c_{equiv.}$	950.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 6.83 N γ= 4.00

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

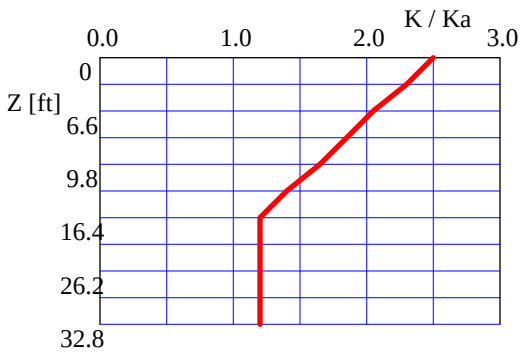
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

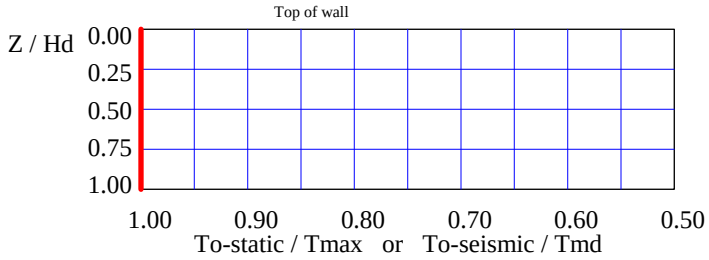


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

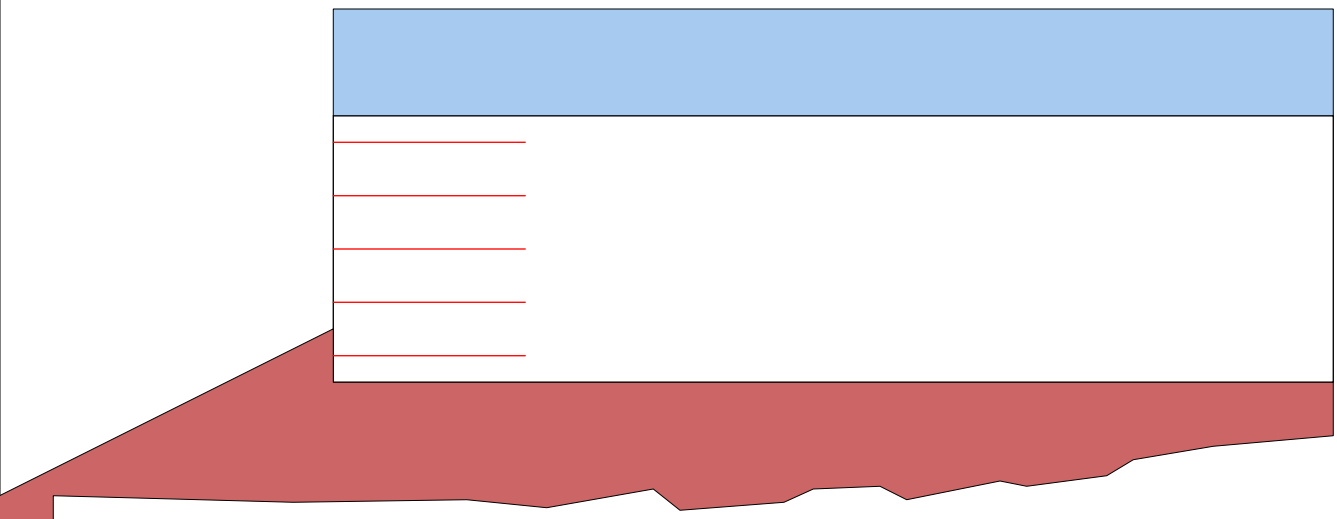
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	12.50	[ft]	{ Embedded depth is E = 2.50 ft, and height above top of finished bottom grade is H = 10.00 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 3.66, Meyerhof stress = 2265 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.019, Eccentricity, e/L = 0.1160, Fs-overturning = 4.31

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	9.00	1	N/A	8.30	9.22	9.224	11.825	3.317	0.0958	Caltrans W20
2	3.75	9.00	1	N/A	9.42	10.47	10.471	9.703	4.138	0.0611	Caltrans W20
3	6.25	9.00	1	N/A	11.33	12.59	12.589	7.532	5.530	0.0337	Caltrans W20
4	8.75	9.00	1	N/A	15.01	16.68	16.681	7.480	8.497	0.0139	Caltrans W20
5	11.25	9.00	1	N/A	24.83	27.59	27.594	7.485	21.268	0.0020	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

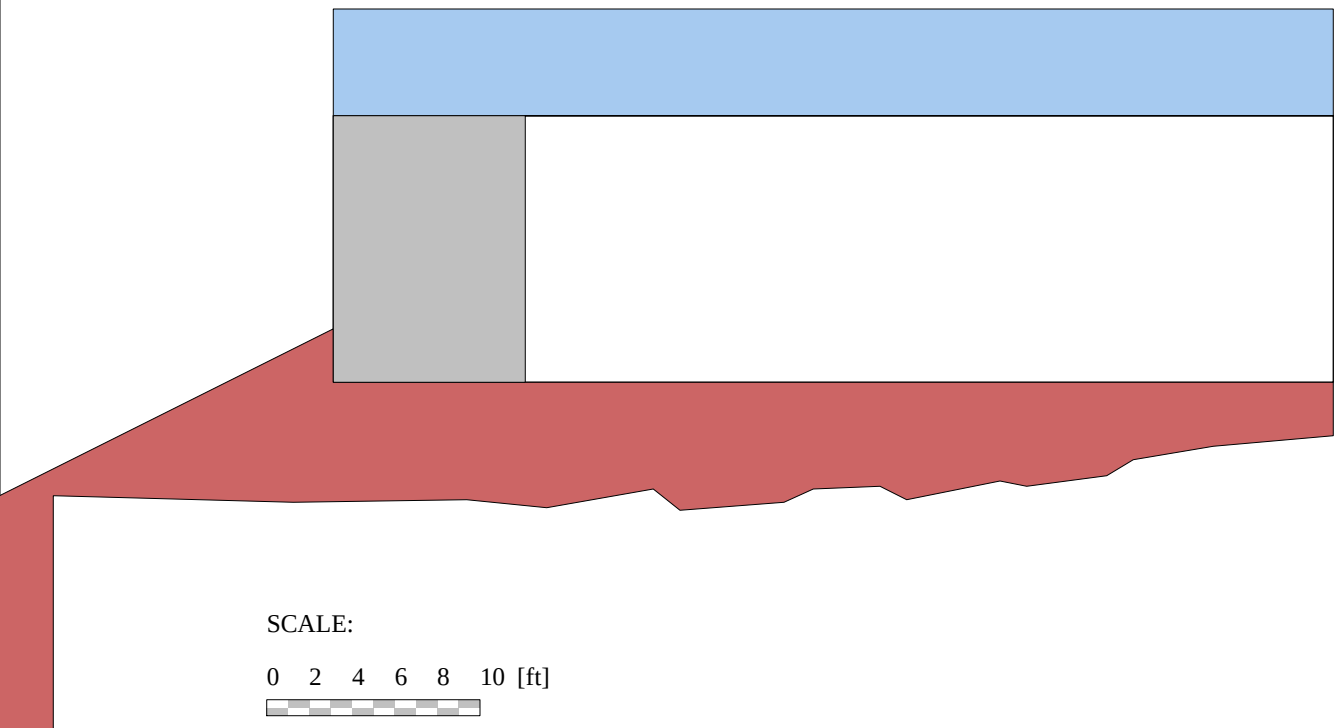
Bearing capacity, Fs = 2.08, Meyerhof stress = 3651 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.594, Eccentricity, e/L = 0.2617, Fs-overturning = 1.91

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	9.00	1	N/A	7.26	8.07	8.068	8.274	1.773	0.2121	Caltrans W20
2	3.75	9.00	1	N/A	8.32	9.24	9.241	6.850	2.286	0.1285	Caltrans W20
3	6.25	9.00	1	N/A	10.08	11.20	11.196	5.358	3.215	0.0658	Caltrans W20
4	8.75	9.00	1	N/A	12.89	14.32	14.319	5.137	5.407	0.0238	Caltrans W20
5	11.25	9.00	1	N/A	19.51	21.68	21.680	4.705	16.601	0.0027	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	8289	7606	[lb/ft ²]
Meyerhof stress, σ_V	2265.4	3651	[lb/ft ²]
Eccentricity, e	1.04	2.36	[ft]
Eccentricity, e/L	0.116	0.262	
Fs calculated	3.66	2.08	
Base length	9.00	9.00	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.019 and Fs-seismic = 1.594

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	9.00	3.317	1.773	1	Caltrans W20
2	3.75	9.00	4.138	2.286	1	Caltrans W20
3	6.25	9.00	5.530	3.215	1	Caltrans W20
4	8.75	9.00	8.497	5.407	1	Caltrans W20
5	11.25	9.00	21.268	16.601	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1160, e/L seismic = 0.2617; Overturning: Fs-static = 4.31, Fs-seismic = 1.91

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	9.00	0.0958	0.2121	1	Caltrans W20
2	3.75	9.00	0.0611	0.1285	1	Caltrans W20
3	6.25	9.00	0.0337	0.0658	1	Caltrans W20
4	8.75	9.00	0.0139	0.0238	1	Caltrans W20
5	11.25	9.00	0.0020	0.0027	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	1974.51	282.96	N/A	9.224	N/A	8.068
2	3.75	1.000	0.500	18213	1739.39	231.51	N/A	10.471	N/A	9.241
3	6.25	1.000	0.500	18213	1446.71	180.07	N/A	12.589	N/A	11.196
4	8.75	1.000	0.500	18213	1091.87	180.07	N/A	16.681	N/A	14.319
5	11.25	1.000	0.500	18213	660.03	180.07	N/A	27.594	N/A	21.680

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	1974.5	283.0	8.25	0.75	23348.0	N/A	11.825	18678.4	N/A	8.274
2	3.75	1.000	1739.4	231.5	6.75	2.25	16876.5	N/A	9.703	13501.2	N/A	6.850
3	6.25	1.000	1446.7	180.1	5.25	3.75	10896.0	N/A	7.532	8716.8	N/A	5.358
4	8.75	1.000	1091.9	180.1	5.25	3.75	8167.4	N/A	7.480	6533.9	N/A	5.137
5	11.25	1.000	660.0	180.1	5.25	3.75	4940.4	N/A	7.485	3952.3	N/A	4.705

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	1975	0.90	16392	18213	N/A	8.30	N/A	9.22	Caltrans W20
2	3.75	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
3	6.25	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
4	8.75	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
5	11.25	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2257	0.90	16392	18213	N/A	7.26	N/A	8.07	Caltrans W20
2	3.75	1.000	0.500	1971	0.90	16392	18213	N/A	8.32	N/A	9.24	Caltrans W20
3	6.25	1.000	0.500	1627	0.90	16392	18213	N/A	10.08	N/A	11.20	Caltrans W20
4	8.75	1.000	0.500	1272	0.90	16392	18213	N/A	12.89	N/A	14.32	Caltrans W20
5	11.25	1.000	0.500	840	0.90	16392	18213	N/A	19.51	N/A	21.68	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW614
Client: OCTA
Designer: RB
Station Number: 15+40

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....is\RW614_ST15+40.BEN
Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	30.0 °
Equivalent cohesion, $c_{equiv.}$	950.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 6.83 N γ= 4.00

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

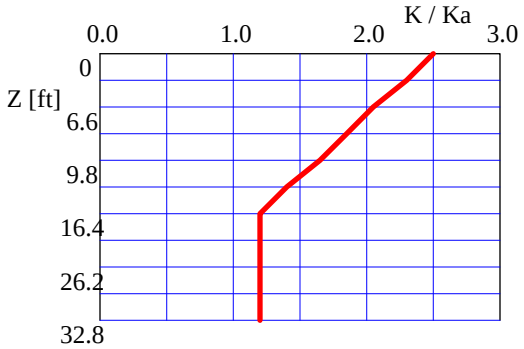
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

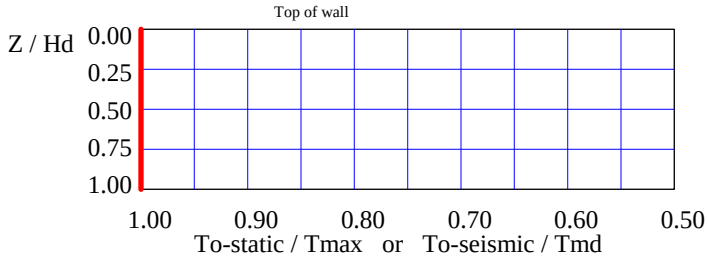


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

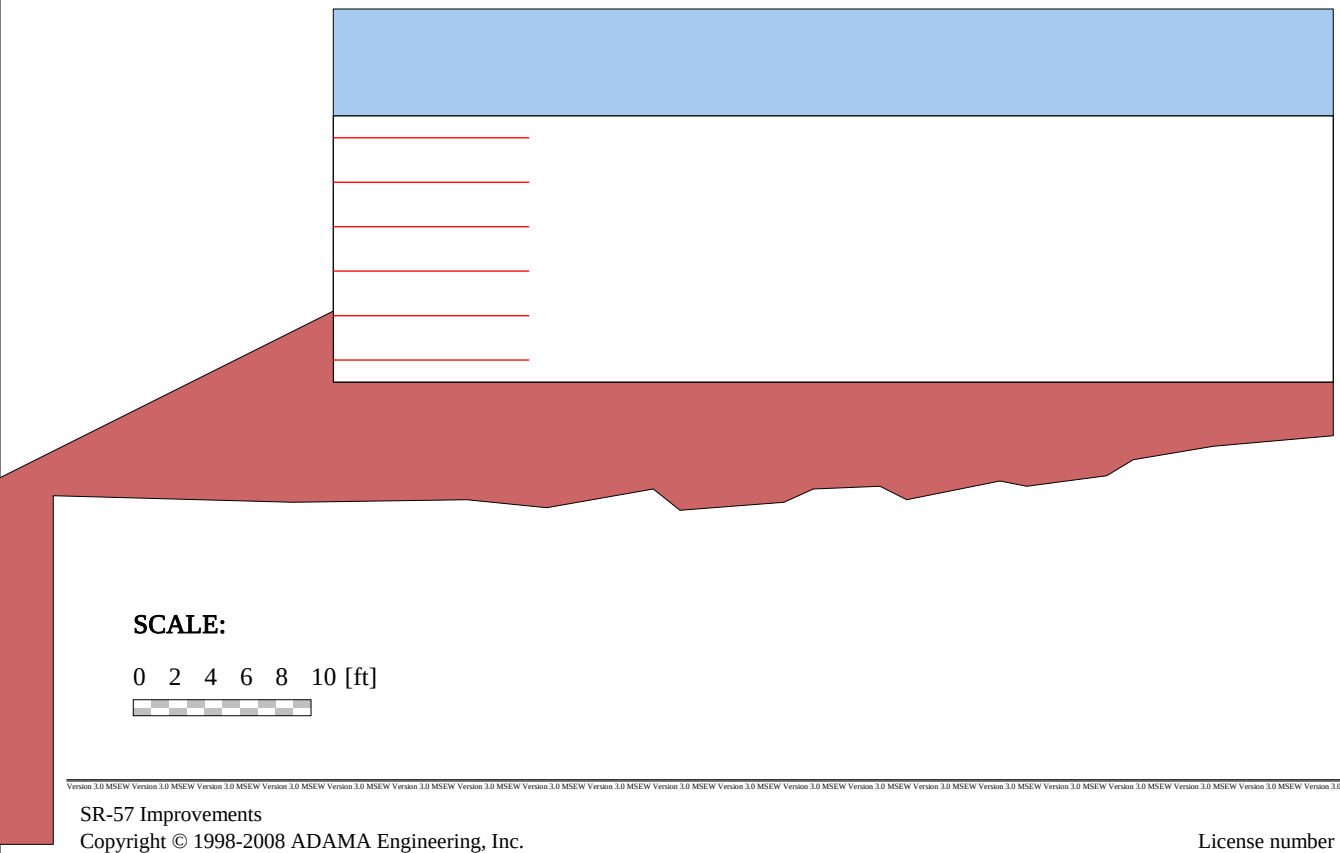
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	15.00	[ft]	{ Embedded depth is E = 4.00 ft, and height above top of finished bottom grade is H = 11.00 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 3.35, Meyerhof stress = 2604 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.131, Eccentricity, e/L = 0.1082, Fs-overturning = 4.62

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	11.00	1	N/A	7.72	8.57	8.573	14.784	3.387	0.0923	Caltrans W20
2	3.75	11.00	1	N/A	8.30	9.22	9.224	12.537	4.054	0.0642	Caltrans W20
3	6.25	11.00	1	N/A	9.42	10.47	10.471	10.417	5.058	0.0409	Caltrans W20
4	8.75	11.00	1	N/A	11.33	12.59	12.589	9.320	6.759	0.0226	Caltrans W20
5	11.25	11.00	1	N/A	15.01	16.68	16.681	9.257	10.385	0.0093	Caltrans W20
6	13.75	11.00	1	N/A	24.83	27.59	27.594	9.263	25.994	0.0014	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

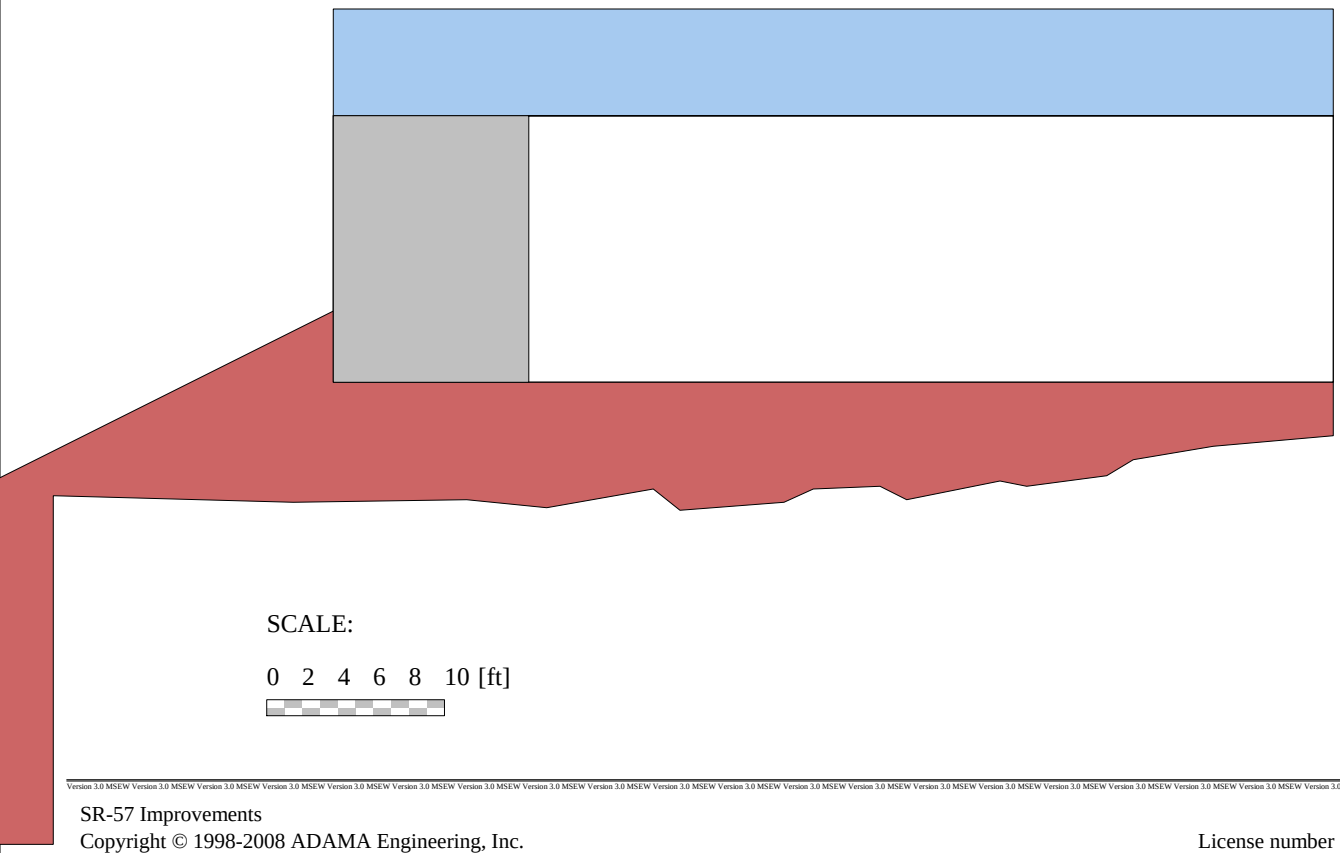
Bearing capacity, Fs = 1.92, Meyerhof stress = 4114 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.620, Eccentricity, e/L = 0.2520, Fs-overturning = 1.98

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	11.00	1	N/A	6.65	7.39	7.390	10.194	1.769	0.2119	Caltrans W20
2	3.75	11.00	1	N/A	7.24	8.04	8.041	8.743	2.166	0.1420	Caltrans W20
3	6.25	11.00	1	N/A	8.28	9.20	9.198	7.320	2.794	0.0861	Caltrans W20
4	8.75	11.00	1	N/A	9.86	10.96	10.955	6.489	3.930	0.0440	Caltrans W20
5	11.25	11.00	1	N/A	12.54	13.93	13.928	6.183	6.609	0.0159	Caltrans W20
6	13.75	11.00	1	N/A	18.72	20.80	20.796	5.585	20.290	0.0018	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	8732	7910	[lb/ft ²]
Meyerhof stress, σ_V	2603.6	4114	[lb/ft ²]
Eccentricity, e	1.19	2.77	[ft]
Eccentricity, e/L	0.108	0.252	
Fs calculated	3.35	1.92	
Base length	11.00	11.00	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT
(for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.131 and Fs-seismic = 1.620

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	11.00	3.387	1.769	1	Caltrans W20
2	3.75	11.00	4.054	2.166	1	Caltrans W20
3	6.25	11.00	5.058	2.794	1	Caltrans W20
4	8.75	11.00	6.759	3.930	1	Caltrans W20
5	11.25	11.00	10.385	6.609	1	Caltrans W20
6	13.75	11.00	25.994	20.290	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1082, e/L seismic = 0.2520; Overturning: Fs-static = 4.62, Fs-seismic = 1.98

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	11.00	0.0923	0.2119	1	Caltrans W20
2	3.75	11.00	0.0642	0.1420	1	Caltrans W20
3	6.25	11.00	0.0409	0.0861	1	Caltrans W20
4	8.75	11.00	0.0226	0.0440	1	Caltrans W20
5	11.25	11.00	0.0093	0.0159	1	Caltrans W20
6	13.75	11.00	0.0014	0.0018	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2124.39	340.26	N/A	8.573	N/A	7.390
2	3.75	1.000	0.500	18213	1974.51	290.47	N/A	9.224	N/A	8.041
3	6.25	1.000	0.500	18213	1739.39	240.67	N/A	10.471	N/A	9.198
4	8.75	1.000	0.500	18213	1446.71	215.78	N/A	12.589	N/A	10.955
5	11.25	1.000	0.500	18213	1091.87	215.78	N/A	16.681	N/A	13.928
6	13.75	1.000	0.500	18213	660.03	215.78	N/A	27.594	N/A	20.796

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2124.4	340.3	10.25	0.75	31406.2	N/A	14.784	25125.0	N/A	10.194
2	3.75	1.000	1974.5	290.5	8.75	2.25	24754.2	N/A	12.537	19803.4	N/A	8.743
3	6.25	1.000	1739.4	240.7	7.25	3.75	18118.8	N/A	10.417	14495.0	N/A	7.320
4	8.75	1.000	1446.7	215.8	6.50	4.50	13483.8	N/A	9.320	10787.1	N/A	6.489
5	11.25	1.000	1091.9	215.8	6.50	4.50	10107.2	N/A	9.257	8085.8	N/A	6.183
6	13.75	1.000	660.0	215.8	6.50	4.50	6113.7	N/A	9.263	4891.0	N/A	5.585

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2124	0.90	16392	18213	N/A	7.72	N/A	8.57	Caltrans W20
2	3.75	1.000	0.500	1975	0.90	16392	18213	N/A	8.30	N/A	9.22	Caltrans W20
3	6.25	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
4	8.75	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
5	11.25	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
6	13.75	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2465	0.90	16392	18213	N/A	6.65	N/A	7.39	Caltrans W20
2	3.75	1.000	0.500	2265	0.90	16392	18213	N/A	7.24	N/A	8.04	Caltrans W20
3	6.25	1.000	0.500	1980	0.90	16392	18213	N/A	8.28	N/A	9.20	Caltrans W20
4	8.75	1.000	0.500	1662	0.90	16392	18213	N/A	9.86	N/A	10.96	Caltrans W20
5	11.25	1.000	0.500	1308	0.90	16392	18213	N/A	12.54	N/A	13.93	Caltrans W20
6	13.75	1.000	0.500	876	0.90	16392	18213	N/A	18.72	N/A	20.80	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW614
Client: OCTA
Designer: RB
Station Number: 15+50

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....is\RW614_ST15+50.BEN

Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	30.0 °
Equivalent cohesion, $c_{equiv.}$	950.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 10.84 N γ= 4.00

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

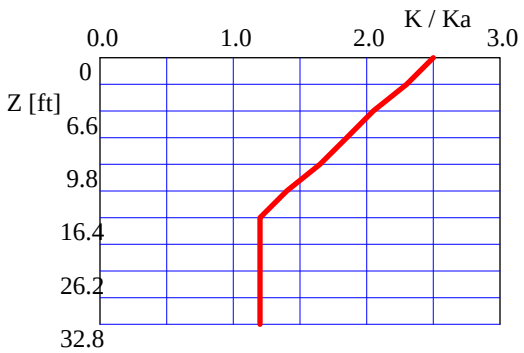
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

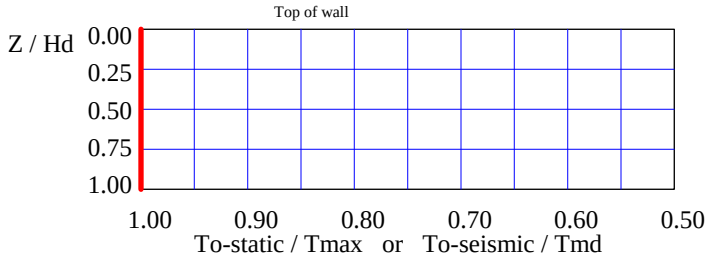


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

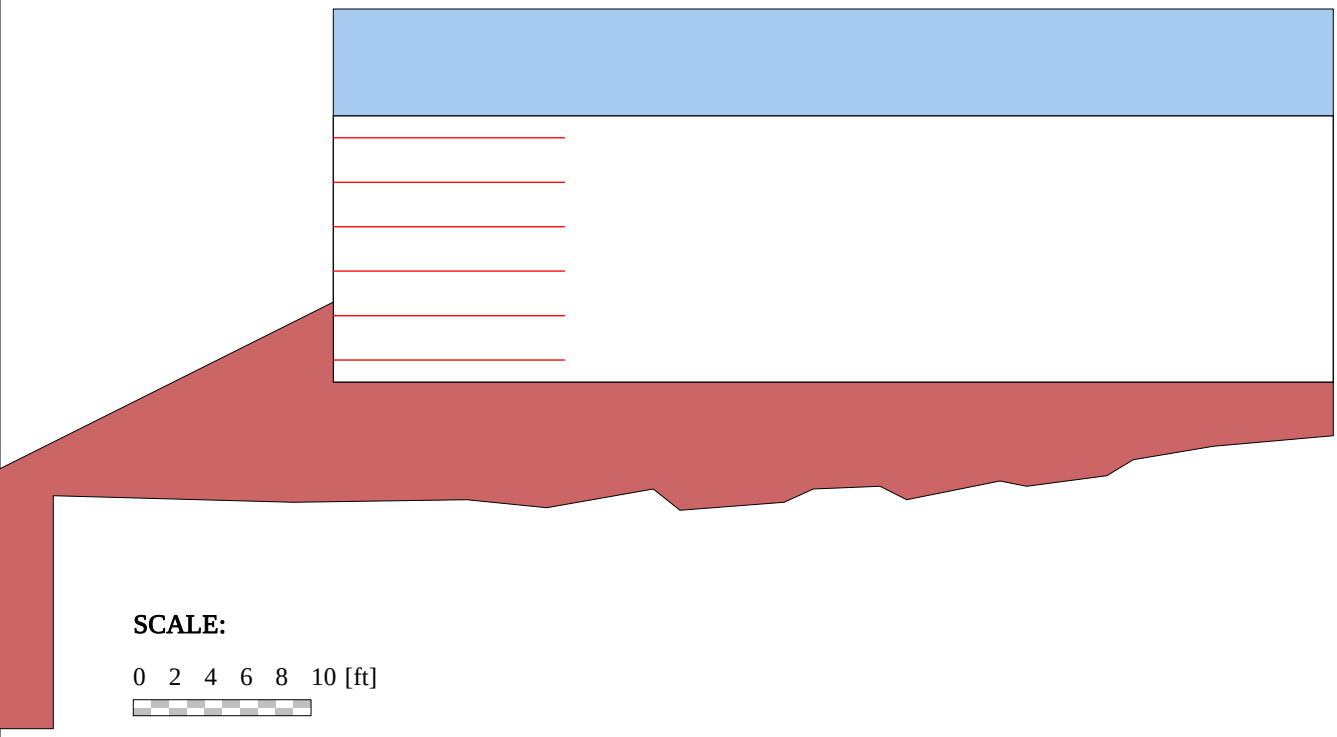
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	15.00	[ft]	{ Embedded depth is E = 4.50 ft, and height above top of finished bottom grade is H = 10.50 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 5.45, Meyerhof stress = 2414 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.700, Eccentricity, e/L = 0.0775, Fs-overturning = 6.45

	METAL MATS			CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	13.00	1	N/A	7.72	8.57	8.573	17.671	4.003	0.0661	Caltrans W20
2	3.75	13.00	1	N/A	8.30	9.22	9.224	15.406	4.791	0.0459	Caltrans W20
3	6.25	13.00	1	N/A	9.42	10.47	10.471	13.294	5.977	0.0293	Caltrans W20
4	8.75	13.00	1	N/A	11.33	12.59	12.589	12.192	7.988	0.0162	Caltrans W20
5	11.25	13.00	1	N/A	15.01	16.68	16.681	12.109	12.273	0.0066	Caltrans W20
6	13.75	13.00	1	N/A	24.83	27.59	27.594	12.116	30.720	0.0010	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

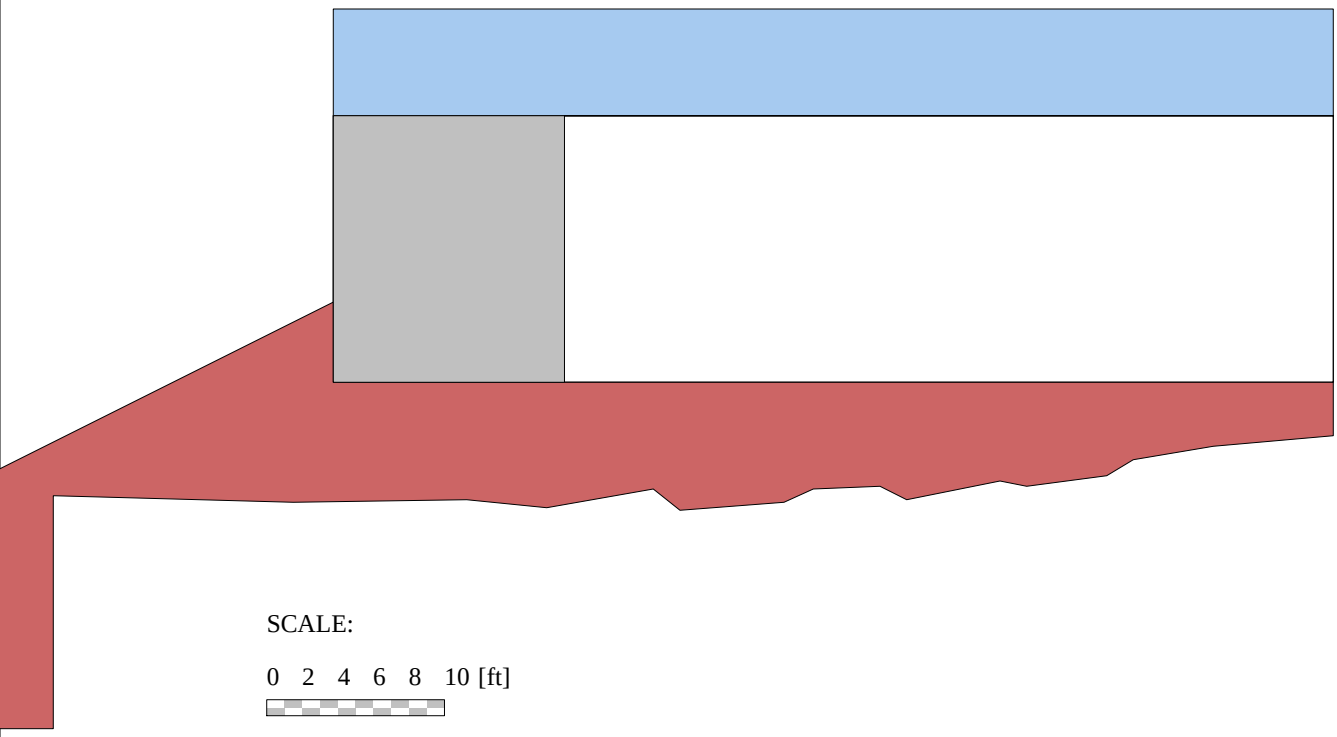
Bearing capacity, Fs = 3.90, Meyerhof stress = 3192 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.915, Eccentricity, e/L = 0.1805, Fs-overturning = 2.77

	METAL MATS			CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	13.00	1	N/A	6.70	7.44	7.444	12.276	2.091	0.1517	Caltrans W20
2	3.75	13.00	1	N/A	7.26	8.07	8.069	10.781	2.560	0.1017	Caltrans W20
3	6.25	13.00	1	N/A	8.27	9.19	9.186	9.330	3.302	0.0616	Caltrans W20
4	8.75	13.00	1	N/A	9.81	10.90	10.904	8.448	4.644	0.0315	Caltrans W20
5	11.25	13.00	1	N/A	12.46	13.85	13.846	8.041	7.810	0.0114	Caltrans W20
6	13.75	13.00	1	N/A	18.55	20.61	20.613	7.241	23.979	0.0013	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	13157	12461	[lb/ft ²]
Meyerhof stress, σ_V	2414.2	3192	[lb/ft ²]
Eccentricity, e	1.01	2.35	[ft]
Eccentricity, e/L	0.077	0.180	
Fs calculated	5.45	3.90	
Base length	13.00	13.00	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT
(for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.700 and Fs-seismic = 1.915

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	13.00	4.003	2.091	1	Caltrans W20
2	3.75	13.00	4.791	2.560	1	Caltrans W20
3	6.25	13.00	5.977	3.302	1	Caltrans W20
4	8.75	13.00	7.988	4.644	1	Caltrans W20
5	11.25	13.00	12.273	7.810	1	Caltrans W20
6	13.75	13.00	30.720	23.979	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.0775, e/L seismic = 0.1805; Overturning: Fs-static = 6.45, Fs-seismic = 2.77

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	13.00	0.0661	0.1517	1	Caltrans W20
2	3.75	13.00	0.0459	0.1017	1	Caltrans W20
3	6.25	13.00	0.0293	0.0616	1	Caltrans W20
4	8.75	13.00	0.0162	0.0315	1	Caltrans W20
5	11.25	13.00	0.0066	0.0114	1	Caltrans W20
6	13.75	13.00	0.0010	0.0013	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2124.39	322.16	N/A	8.573	N/A	7.444
2	3.75	1.000	0.500	18213	1974.51	282.71	N/A	9.224	N/A	8.069
3	6.25	1.000	0.500	18213	1739.39	243.26	N/A	10.471	N/A	9.186
4	8.75	1.000	0.500	18213	1446.71	223.54	N/A	12.589	N/A	10.904
5	11.25	1.000	0.500	18213	1091.87	223.54	N/A	16.681	N/A	13.846
6	13.75	1.000	0.500	18213	660.03	223.54	N/A	27.594	N/A	20.613

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2124.4	322.2	12.25	0.75	37541.0	N/A	17.671	30032.8	N/A	12.276
2	3.75	1.000	1974.5	282.7	10.75	2.25	30418.8	N/A	15.406	24335.0	N/A	10.781
3	6.25	1.000	1739.4	243.3	9.25	3.75	23123.1	N/A	13.294	18498.5	N/A	9.330
4	8.75	1.000	1446.7	223.5	8.50	4.50	17637.9	N/A	12.192	14110.4	N/A	8.448
5	11.25	1.000	1091.9	223.5	8.50	4.50	13221.0	N/A	12.109	10576.8	N/A	8.041
6	13.75	1.000	660.0	223.5	8.50	4.50	7997.2	N/A	12.116	6397.8	N/A	7.241

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	1.000	0.500	2124	0.90	16392	18213	N/A	7.72	N/A	8.57	Caltrans W20
2	3.75	1.000	0.500	1975	0.90	16392	18213	N/A	8.30	N/A	9.22	Caltrans W20
3	6.25	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
4	8.75	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
5	11.25	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
6	13.75	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	1.000	0.500	2447	0.90	16392	18213	N/A	6.70	N/A	7.44	Caltrans W20
2	3.75	1.000	0.500	2257	0.90	16392	18213	N/A	7.26	N/A	8.07	Caltrans W20
3	6.25	1.000	0.500	1983	0.90	16392	18213	N/A	8.27	N/A	9.19	Caltrans W20
4	8.75	1.000	0.500	1670	0.90	16392	18213	N/A	9.81	N/A	10.90	Caltrans W20
5	11.25	1.000	0.500	1315	0.90	16392	18213	N/A	12.46	N/A	13.85	Caltrans W20
6	13.75	1.000	0.500	884	0.90	16392	18213	N/A	18.55	N/A	20.61	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW614
Client: OCTA
Designer: RB
Station Number: 17+13.15

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....RW614_ST17+13.15.BEN

Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	30.0 °
Equivalent cohesion, $c_{equiv.}$	950.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 13.62 N γ= 4.00

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

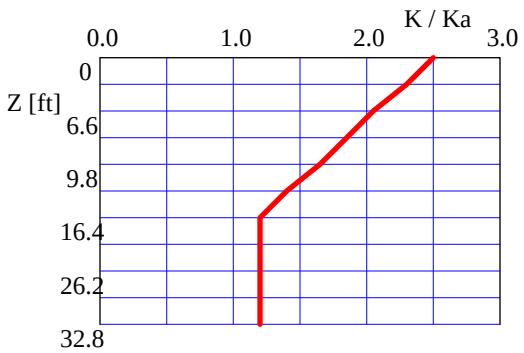
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

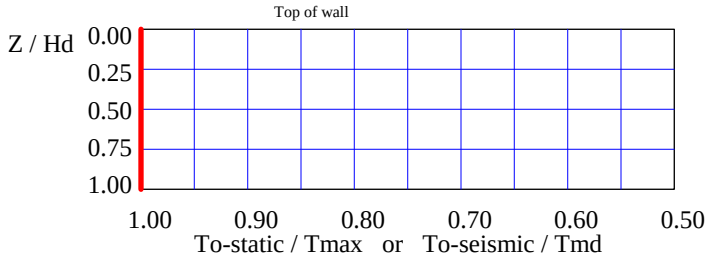


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

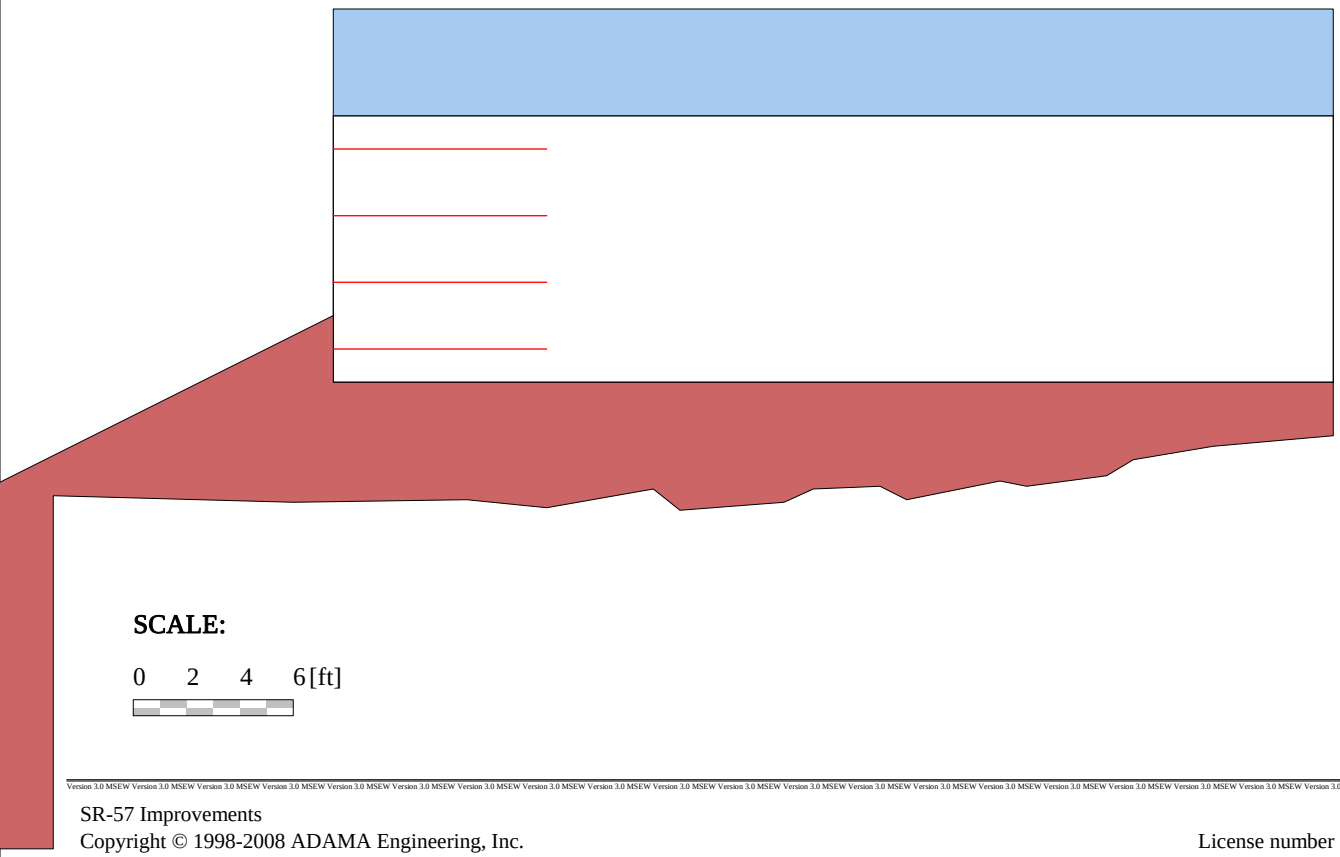
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	10.00	[ft]	{ Embedded depth is E = 2.50 ft, and height above top of finished bottom grade is H = 7.50 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 8.15, Meyerhof stress = 1792 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.272, Eccentricity, e/L = 0.0982, Fs-overturning = 5.09

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	8.00	1	N/A	9.42	10.47	10.471	10.417	3.678	0.0773	Caltrans W20
2	3.75	8.00	1	N/A	11.33	12.59	12.589	8.244	4.916	0.0427	Caltrans W20
3	6.25	8.00	1	N/A	15.01	16.68	16.681	7.120	7.553	0.0176	Caltrans W20
4	8.75	8.00	1	N/A	24.83	27.59	27.594	7.124	18.905	0.0026	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

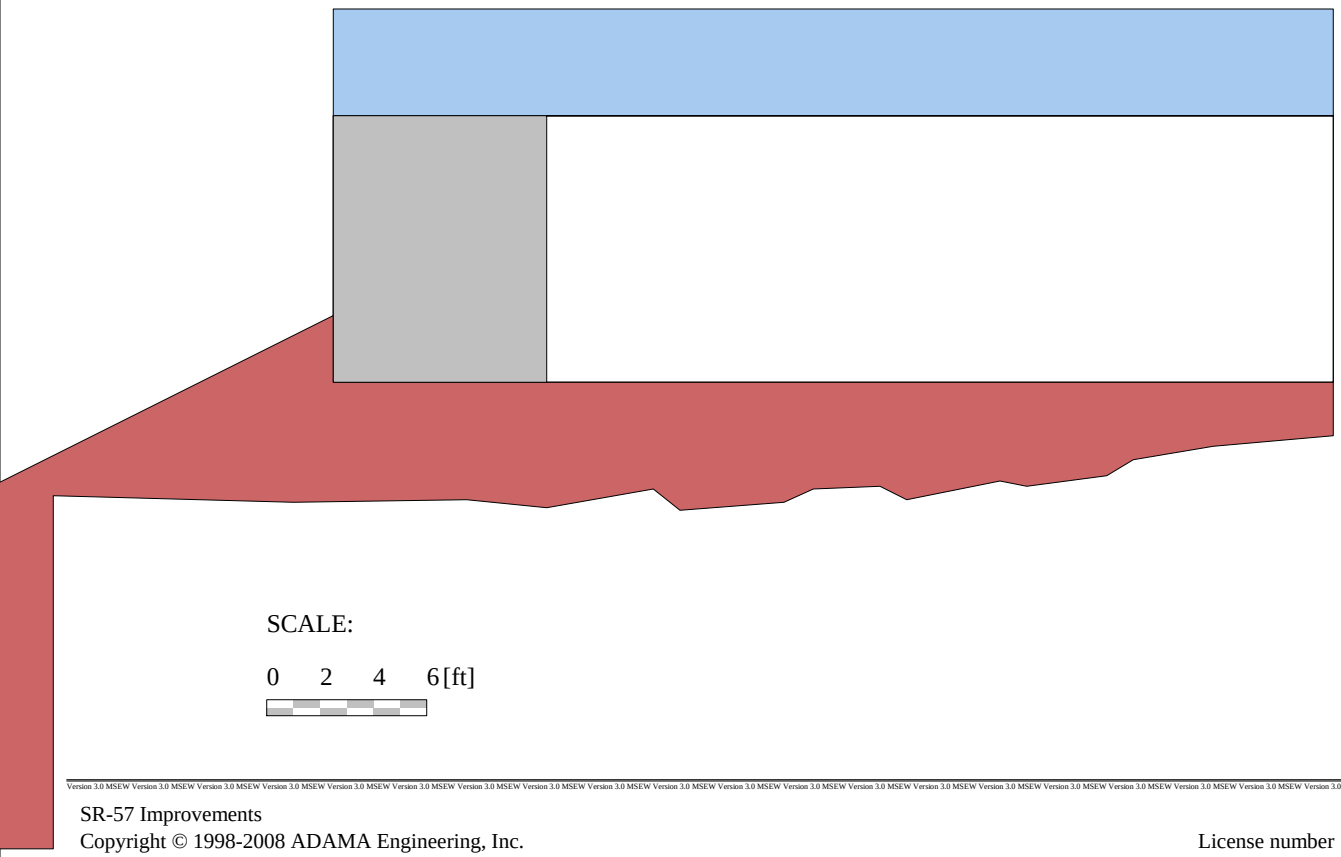
Bearing capacity, Fs = 5.65, Meyerhof stress = 2503 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.775, Eccentricity, e/L = 0.2123, Fs-overturning = 2.36

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	8.00	1	N/A	8.40	9.33	9.330	7.425	2.032	0.1627	Caltrans W20
2	3.75	8.00	1	N/A	10.15	11.27	11.274	5.907	2.858	0.0832	Caltrans W20
3	6.25	8.00	1	N/A	13.23	14.70	14.704	5.021	4.806	0.0301	Caltrans W20
4	8.75	8.00	1	N/A	20.32	22.58	22.575	4.663	14.756	0.0034	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	14610	14135	[lb/ft ²]
Meyerhof stress, σ_V	1791.8	2503	[lb/ft ²]
Eccentricity, e	0.79	1.70	[ft]
Eccentricity, e/L	0.098	0.212	
Fs calculated	8.15	5.65	
Base length	8.00	8.00	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT
(for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.272 and Fs-seismic = 1.775

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	8.00	3.678	2.032	1	Caltrans W20
2	3.75	8.00	4.916	2.858	1	Caltrans W20
3	6.25	8.00	7.553	4.806	1	Caltrans W20
4	8.75	8.00	18.905	14.756	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.0982, e/L seismic = 0.2123; Overturning: Fs-static = 5.09, Fs-seismic = 2.36

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	8.00	0.0773	0.1627	1	Caltrans W20
2	3.75	8.00	0.0427	0.0832	1	Caltrans W20
3	6.25	8.00	0.0176	0.0301	1	Caltrans W20
4	8.75	8.00	0.0026	0.0034	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	1739.39	212.77	N/A	10.471	N/A	9.330
2	3.75	1.000	0.500	18213	1446.71	168.75	N/A	12.589	N/A	11.274
3	6.25	1.000	0.500	18213	1091.87	146.74	N/A	16.681	N/A	14.704
4	8.75	1.000	0.500	18213	660.03	146.74	N/A	27.594	N/A	22.575

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	1739.4	212.8	7.25	0.75	18118.8	N/A	10.417	14495.0	N/A	7.425
2	3.75	1.000	1446.7	168.7	5.75	2.25	11927.3	N/A	8.244	9541.8	N/A	5.907
3	6.25	1.000	1091.9	146.7	5.00	3.00	7773.6	N/A	7.120	6218.9	N/A	5.021
4	8.75	1.000	660.0	146.7	5.00	3.00	4702.2	N/A	7.124	3761.7	N/A	4.663

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
2	3.75	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
3	6.25	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
4	8.75	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

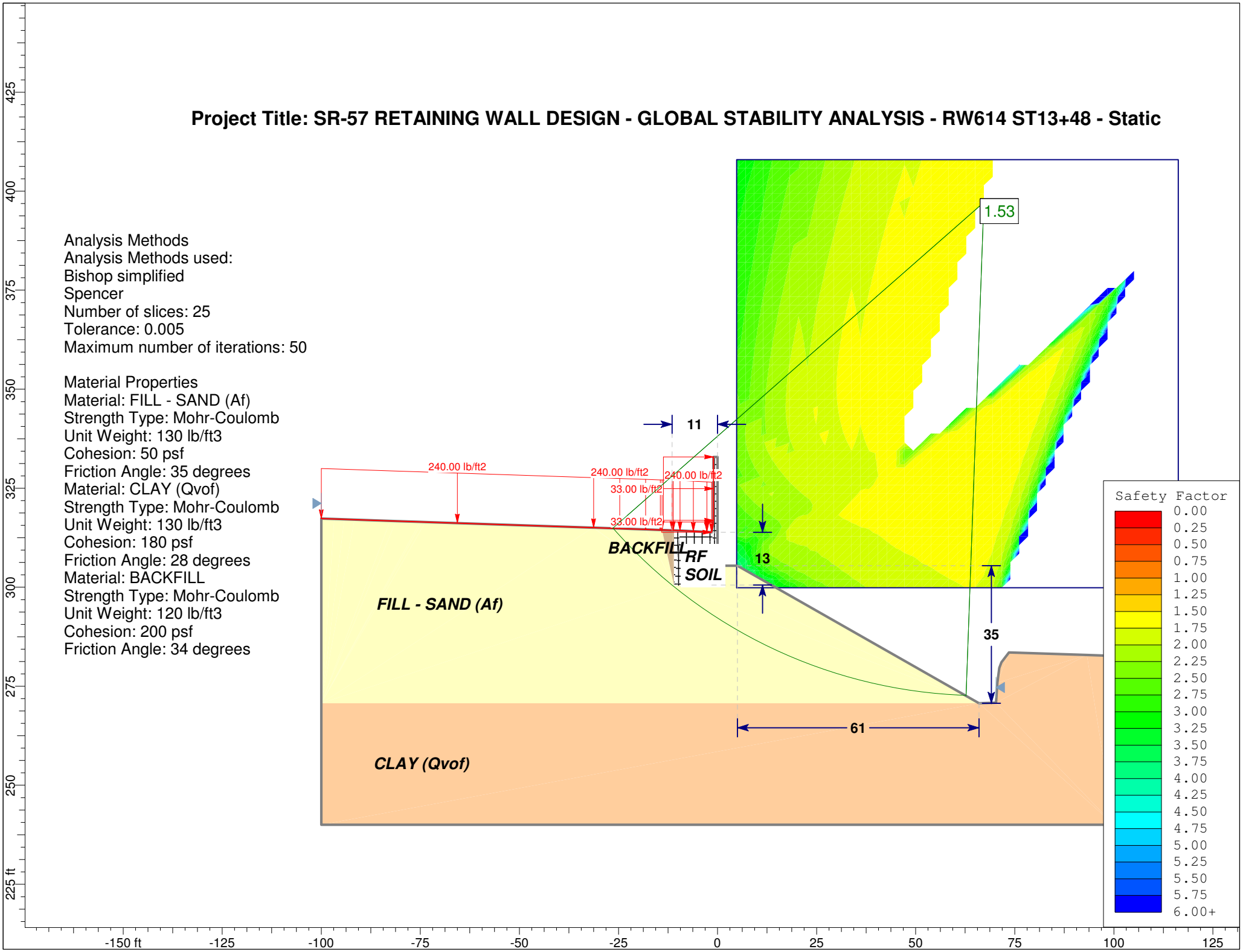
#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	1952	0.90	16392	18213	N/A	8.40	N/A	9.33	Caltrans W20
2	3.75	1.000	0.500	1615	0.90	16392	18213	N/A	10.15	N/A	11.27	Caltrans W20
3	6.25	1.000	0.500	1239	0.90	16392	18213	N/A	13.23	N/A	14.70	Caltrans W20
4	8.75	1.000	0.500	807	0.90	16392	18213	N/A	20.32	N/A	22.58	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614 ST13+48 - Static

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL - SAND (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 50 psf
Friction Angle: 35 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW614_ST13+48_Static_sand.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614 ST13+48 - Static
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2

Material Properties

Material: FILL - SAND (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 50 psf
Friction Angle: 35 degrees
Water Surface: None

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Global Minimums

Method: bishop simplified
FS: 1.531250
Center: 67.219, 397.171
Radius: 124.682
Left Slip Surface Endpoint: -26.442, 314.871
Right Slip Surface Endpoint: 62.711, 272.571
Resisting Moment=1.16189e+007 lb-ft
Driving Moment=7.58786e+006 lb-ft

Method: spencer
FS: 1.531490
Center: 64.990, 390.682
Radius: 118.291
Left Slip Surface Endpoint: -25.795, 314.848
Right Slip Surface Endpoint: 62.998, 272.408
Resisting Moment=1.12609e+007 lb-ft
Driving Moment=7.3529e+006 lb-ft
Resisting Horizontal Force=84237.9 lb
Driving Horizontal Force=55004 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 10162
Number of Invalid Surfaces: 18449
Error Codes:
Error Code -99 reported for 3900 surfaces
Error Code -100 reported for 33 surfaces
Error Code -103 reported for 74 surfaces
Error Code -105 reported for 8 surfaces
Error Code -106 reported for 270 surfaces
Error Code -109 reported for 8705 surfaces
Error Code -112 reported for 7 surfaces
Error Code -113 reported for 7 surfaces

Error Code -1000 reported for 5445 surfaces

Method: spencer
Number of Valid Surfaces: 10124
Number of Invalid Surfaces: 18487
Error Codes:
Error Code -99 reported for 3900 surfaces
Error Code -100 reported for 33 surfaces
Error Code -103 reported for 74 surfaces
Error Code -105 reported for 8 surfaces
Error Code -106 reported for 270 surfaces
Error Code -108 reported for 34 surfaces
Error Code -109 reported for 8705 surfaces
Error Code -111 reported for 3 surfaces
Error Code -112 reported for 8 surfaces
Error Code -113 reported for 7 surfaces
Error Code -1000 reported for 5445 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

4.824	299.842
116.242	299.842
116.242	407.985
4.824	407.985

Material Boundary

-96.713	317.211
-94.190	317.090
-91.660	316.980
-82.640	316.730
-81.177	316.696

Material Boundary

-75.057	316.493
-74.580	316.470
-73.696	316.447

Material Boundary

-11.000	314.333
-11.000	300.400
-0.010	300.400
-0.010	305.400

Material Boundary

-100.000	270.700
66.000	270.700

Material Boundary

-14.004	314.440
-11.000	300.400

External Boundary

-100.000	317.320
-100.000	270.700
-100.000	240.000
100.000	240.000
100.000	282.670
93.202	282.888
73.550	283.520
71.660	281.060
71.080	279.620
70.630	275.850
70.280	270.860
66.000	270.700
5.000	305.400
-0.010	305.400
-0.010	332.880
-1.010	332.880
-1.010	316.880
-1.090	316.440
-1.490	313.880
-2.680	313.940
-9.490	314.280
-11.000	314.333
-11.200	314.340
-11.490	314.350
-14.004	314.440
-14.010	314.440
-14.430	314.460
-18.140	314.580
-18.220	314.583
-31.270	315.040
-31.483	315.047
-73.696	316.447
-75.057	316.493
-81.177	316.696
-96.713	317.211

Distributed Load

-100.000	317.320
-96.713	317.211
-81.177	316.696
-75.057	316.493
-73.696	316.447
-31.483	315.047
-31.270	315.040
-18.220	314.583
-18.140	314.580
-14.430	314.460
-14.010	314.440
-14.004	314.440
-11.490	314.350
-11.200	314.340
-11.000	314.333
-9.490	314.280
-2.680	313.940
-1.490	313.880

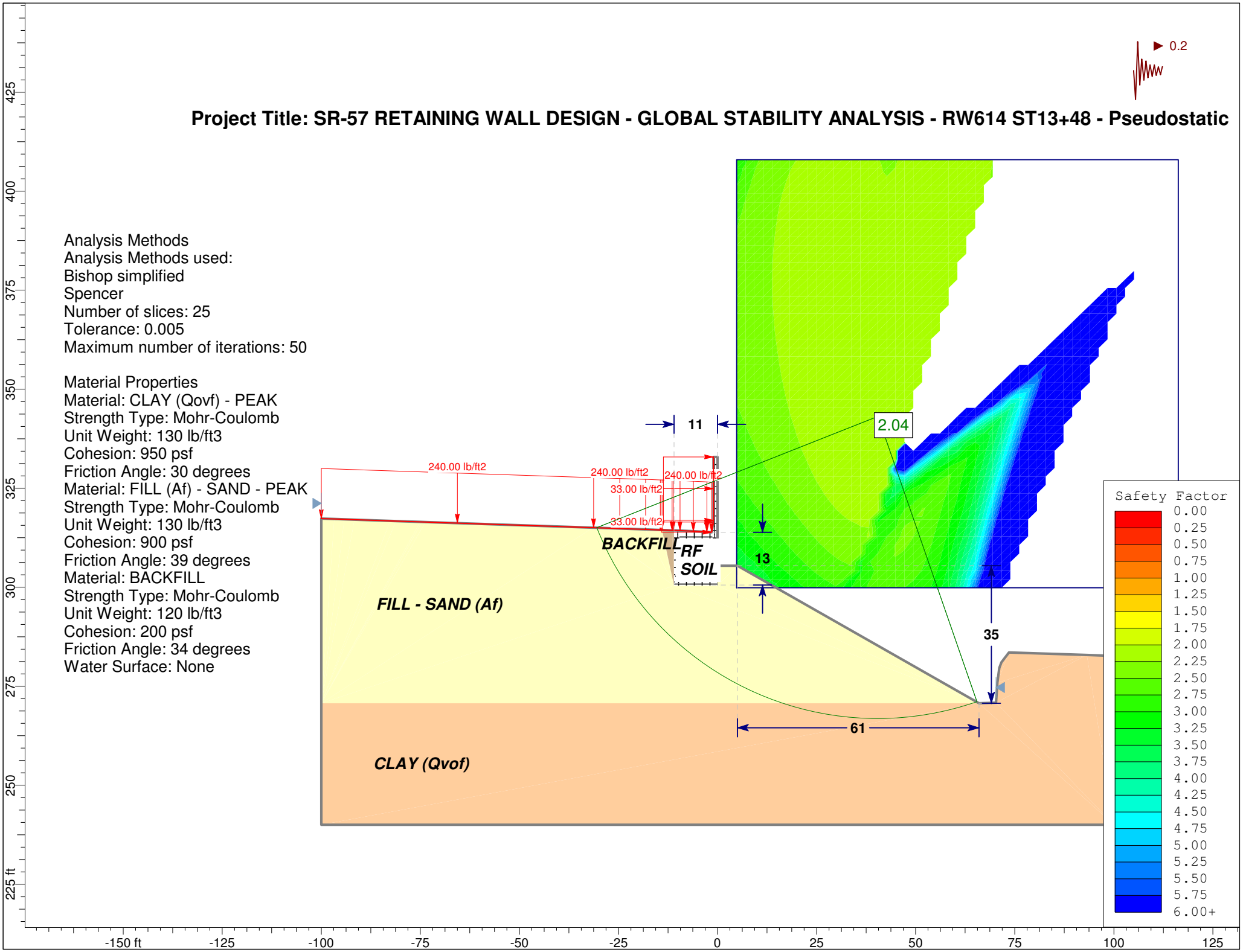
Distributed Load

-1.010	332.880
-1.010	316.880
-1.090	316.440
-1.490	313.880

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614 ST13+48 - Pseudostatic

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qovf) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: FILL (Af) - SAND - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 900 psf
Friction Angle: 39 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None



Slide Analysis Information

Document Name

File Name: RW614_ST13+48_Pseudostatic_sand.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614 ST13+48 - Pseudostatic
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2

Material Properties

Material: FILL - SAND (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 50 psf
Friction Angle: 35 degrees
Water Surface: None

Material: CLAY (Qovf) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: None

Material: FILL (Af) - SAND - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 900 psf
Friction Angle: 39 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.039130
Center: 40.478, 343.099
Radius: 76.326
Left Slip Surface Endpoint: -30.492, 315.013
Right Slip Surface Endpoint: 65.492, 270.989
Resisting Moment=2.10653e+007 lb-ft
Driving Moment=1.03305e+007 lb-ft

Method: spencer
FS: 2.003870
Center: 40.478, 345.262
Radius: 78.258
Left Slip Surface Endpoint: -31.715, 315.055
Right Slip Surface Endpoint: 65.359, 271.064
Resisting Moment=2.14361e+007 lb-ft
Driving Moment=1.06974e+007 lb-ft
Resisting Horizontal Force=238392 lb
Driving Horizontal Force=118966 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 10166
Number of Invalid Surfaces: 18445
Error Codes:

Error Code -99 reported for 3900 surfaces
Error Code -100 reported for 33 surfaces
Error Code -103 reported for 74 surfaces
Error Code -105 reported for 8 surfaces
Error Code -106 reported for 270 surfaces
Error Code -109 reported for 8705 surfaces
Error Code -112 reported for 3 surfaces
Error Code -113 reported for 7 surfaces
Error Code -1000 reported for 5445 surfaces

Method: spencer
Number of Valid Surfaces: 8677
Number of Invalid Surfaces: 19934
Error Codes:
Error Code -99 reported for 3900 surfaces
Error Code -100 reported for 33 surfaces
Error Code -103 reported for 74 surfaces
Error Code -105 reported for 8 surfaces
Error Code -106 reported for 270 surfaces
Error Code -108 reported for 325 surfaces
Error Code -109 reported for 8705 surfaces
Error Code -111 reported for 1158 surfaces
Error Code -112 reported for 9 surfaces
Error Code -113 reported for 7 surfaces
Error Code -1000 reported for 5445 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

4.824	299.842
116.242	299.842
116.242	407.985
4.824	407.985

Material Boundary

-96.713	317.211
-94.190	317.090
-91.660	316.980
-82.640	316.730
-81.177	316.696

Material Boundary

-75.057	316.493
-74.580	316.470
-73.696	316.447

Material Boundary

-11.000	314.333
-11.000	300.400
-0.010	300.400
-0.010	305.400

Material Boundary

-100.000	270.700
66.000	270.700

Material Boundary

-14.004	314.440
-11.000	300.400

External Boundary

-100.000	317.320
-100.000	270.700
-100.000	240.000
100.000	240.000
100.000	282.670
93.202	282.888
73.550	283.520
71.660	281.060
71.080	279.620
70.630	275.850
70.280	270.860
66.000	270.700
5.000	305.400
-0.010	305.400
-0.010	332.880
-1.010	332.880
-1.010	316.880
-1.090	316.440
-1.490	313.880
-2.680	313.940
-9.490	314.280
-11.000	314.333
-11.200	314.340
-11.490	314.350
-14.004	314.440
-14.010	314.440
-14.430	314.460
-18.140	314.580
-18.220	314.583
-31.270	315.040
-31.483	315.047
-73.696	316.447
-75.057	316.493
-81.177	316.696
-96.713	317.211

Distributed Load

-100.000	317.320
-96.713	317.211
-81.177	316.696
-75.057	316.493
-73.696	316.447
-31.483	315.047
-31.270	315.040
-18.220	314.583
-18.140	314.580
-14.430	314.460
-14.010	314.440
-14.004	314.440
-11.490	314.350
-11.200	314.340
-11.000	314.333
-9.490	314.280
-2.680	313.940
-1.490	313.880

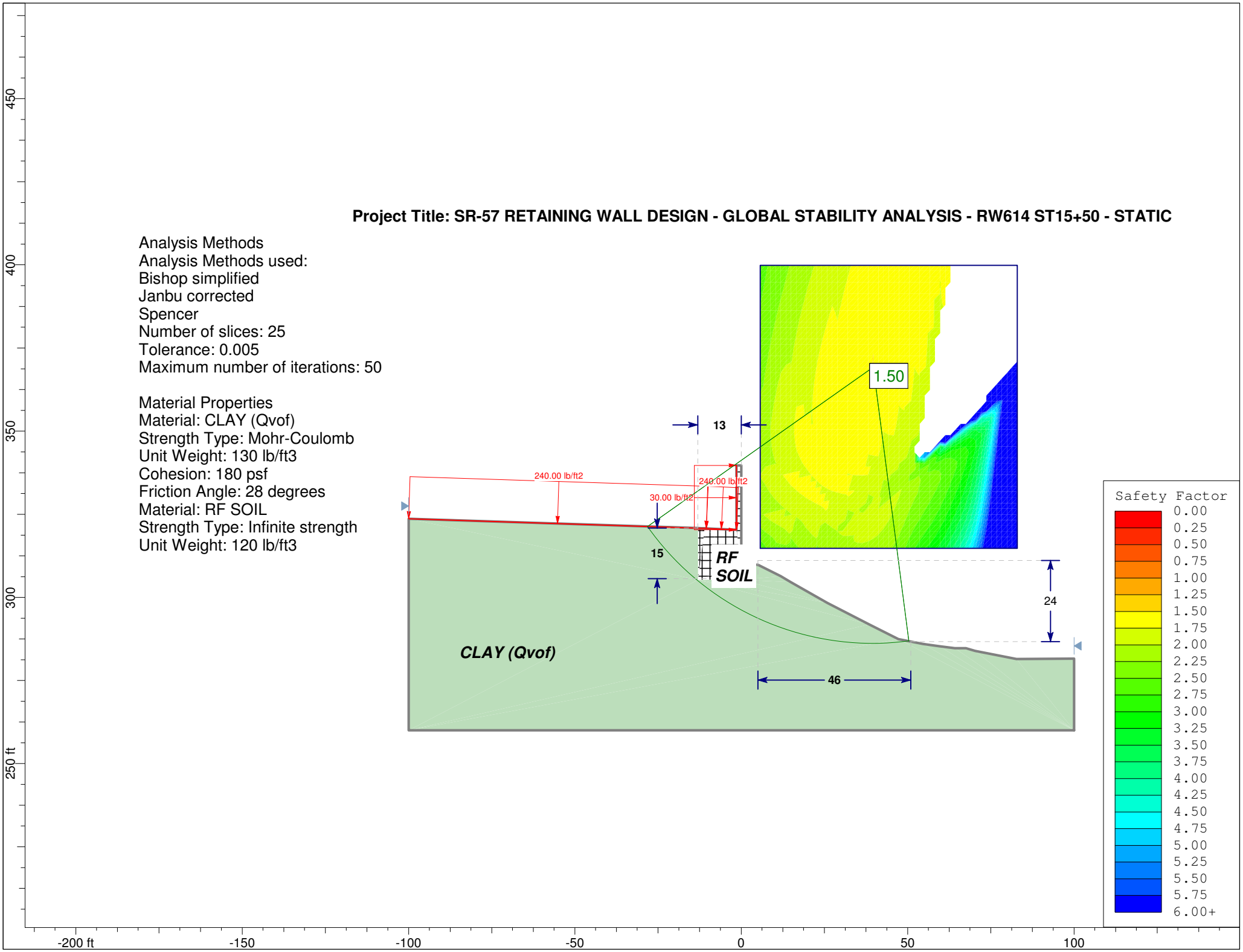
Distributed Load

-1.010	332.880
-1.010	316.880
-1.090	316.440
-1.490	313.880

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614 ST15+50 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3



Slide Analysis Information

Document Name

File Name: RW614_ST15+50_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614 ST15+50 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Normal to boundary, Magnitude: 30 lb/ft2

Material Properties

Material: CLAY (Ovof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: None

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Global Minimums

Method: bishop simplified
FS: 1.495850
Center: 39.674, 369.200
Radius: 83.076
Left Slip Surface Endpoint: -28.211, 321.311
Right Slip Surface Endpoint: 50.343, 286.812
Resisting Moment=6.55572e+006 lb-ft
Driving Moment=4.38262e+006 lb-ft

Method: spencer
FS: 1.494540
Center: 39.674, 369.200
Radius: 83.076
Left Slip Surface Endpoint: -28.211, 321.311
Right Slip Surface Endpoint: 50.343, 286.812
Resisting Moment=6.54998e+006 lb-ft
Driving Moment=4.38262e+006 lb-ft
Resisting Horizontal Force=69749 lb
Driving Horizontal Force=46669.4 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 11960
Number of Invalid Surfaces: 16651
Error Codes:
Error Code -99 reported for 5341 surfaces
Error Code -100 reported for 48 surfaces
Error Code -103 reported for 2050 surfaces
Error Code -105 reported for 38 surfaces
Error Code -106 reported for 102 surfaces
Error Code -109 reported for 9042 surfaces
Error Code -113 reported for 30 surfaces

Method: spencer
Number of Valid Surfaces: 11916
Number of Invalid Surfaces: 16695
Error Codes:
Error Code -99 reported for 5341 surfaces
Error Code -100 reported for 48 surfaces
Error Code -103 reported for 2050 surfaces
Error Code -105 reported for 38 surfaces
Error Code -106 reported for 102 surfaces
Error Code -108 reported for 8 surfaces
Error Code -109 reported for 9042 surfaces
Error Code -111 reported for 36 surfaces

Error Code -113 reported for 30 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

5.675	314.708
82.945	314.708
82.945	399.851
5.675	399.851

Material Boundary

-13.000	305.250
-0.000	305.250
-0.020	309.790

Material Boundary

-13.000	305.250
-13.000	320.820

External Boundary

100.000	260.000
100.000	281.540
82.690	281.430
70.260	283.870
67.490	284.730
64.170	284.730
59.580	285.310
54.590	285.960
47.210	287.440
38.440	291.840
25.890	298.280
14.860	304.550
11.820	306.340
5.000	309.790
-0.020	309.790
-0.020	339.633
-1.490	339.633
-1.490	320.300
-10.500	320.739
-11.000	320.755
-12.000	320.787
-13.000	320.820
-100.000	323.630
-100.000	260.000

Distributed Load

-1.490	320.300
-10.500	320.739
-100.000	323.630

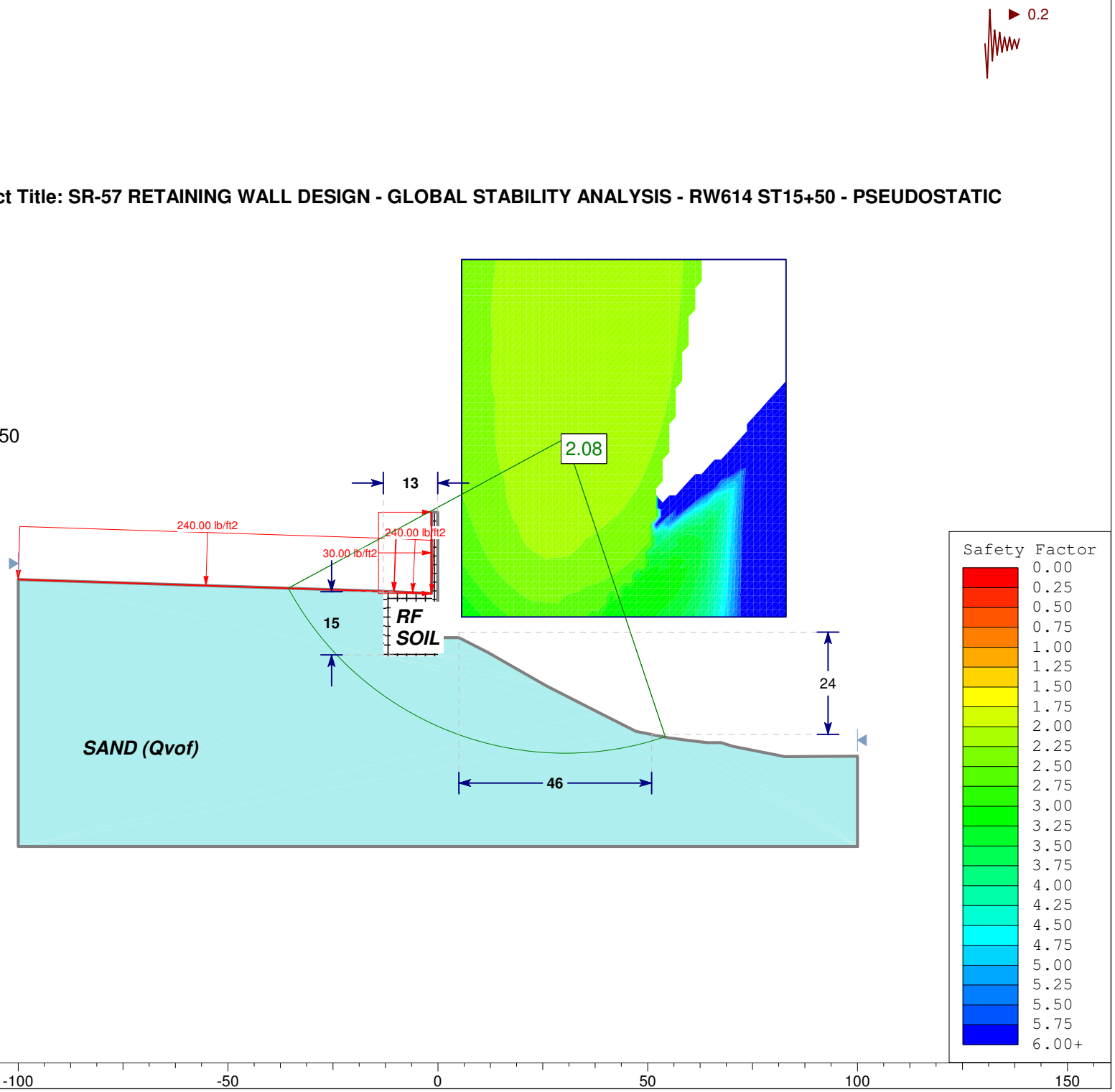
Distributed Load

-1.490	339.633
-1.490	320.300

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614 ST15+50 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3



Slide Analysis Information

Document Name

File Name: RW614_ST15+50_Pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614 ST15+50 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Normal to boundary, Magnitude: 30 lb/ft2

Material Properties

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: None

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.077190
Center: 30.401, 357.279
Radius: 75.107
Left Slip Surface Endpoint: -35.664, 321.552
Right Slip Surface Endpoint: 54.193, 286.040
Resisting Moment=1.49287e+007 lb-ft
Driving Moment=7.18699e+006 lb-ft

Method: spencer
FS: 2.076430
Center: 30.401, 357.279
Radius: 75.107
Left Slip Surface Endpoint: -35.664, 321.552
Right Slip Surface Endpoint: 54.193, 286.040
Resisting Moment=1.49233e+007 lb-ft
Driving Moment=7.18699e+006 lb-ft
Resisting Horizontal Force=175852 lb
Driving Horizontal Force=84689.4 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 11960
Number of Invalid Surfaces: 16651
Error Codes:
Error Code -99 reported for 5341 surfaces
Error Code -100 reported for 48 surfaces
Error Code -103 reported for 2050 surfaces
Error Code -105 reported for 38 surfaces
Error Code -106 reported for 102 surfaces
Error Code -109 reported for 9042 surfaces
Error Code -113 reported for 30 surfaces

Method: spencer
Number of Valid Surfaces: 11665
Number of Invalid Surfaces: 16946
Error Codes:
Error Code -99 reported for 5341 surfaces
Error Code -100 reported for 48 surfaces
Error Code -103 reported for 2050 surfaces
Error Code -105 reported for 38 surfaces
Error Code -106 reported for 102 surfaces
Error Code -108 reported for 17 surfaces
Error Code -109 reported for 9042 surfaces

Error Code -111 reported for 278 surfaces
Error Code -113 reported for 30 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

5.675	314.708
82.945	314.708
82.945	399.851
5.675	399.851

Material Boundary

-13.000	305.250
-0.000	305.250
-0.020	309.790

Material Boundary

-13.000	305.250
-13.000	320.820

External Boundary

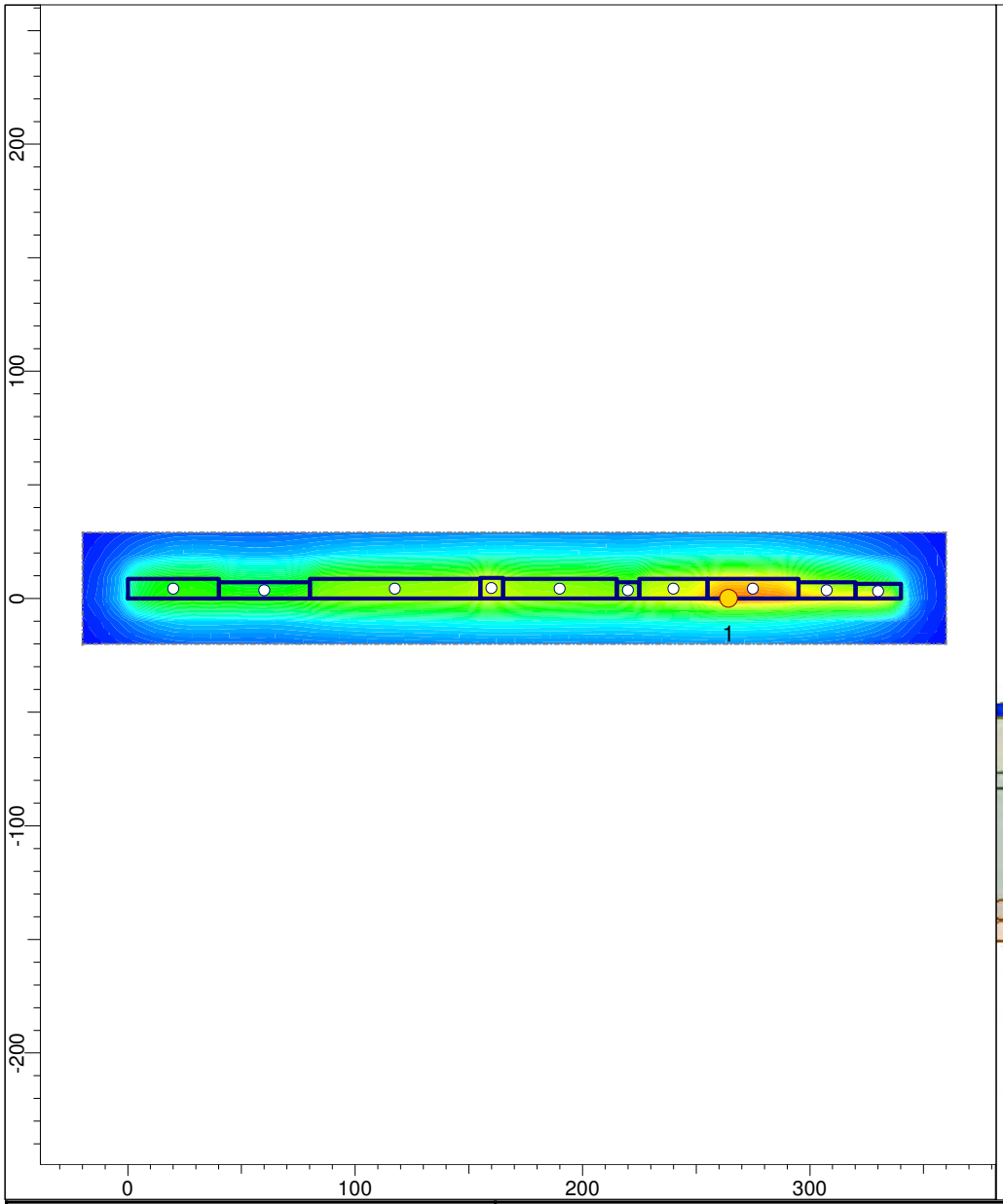
100.000	260.000
100.000	281.540
82.690	281.430
70.260	283.870
67.490	284.730
64.170	284.730
59.580	285.310
54.590	285.960
47.210	287.440
38.440	291.840
25.890	298.280
14.860	304.550
11.820	306.340
5.000	309.790
-0.020	309.790
-0.020	339.633
-1.490	339.633
-1.490	320.300
-10.500	320.739
-11.000	320.755
-12.000	320.787
-13.000	320.820
-100.000	323.630
-100.000	260.000

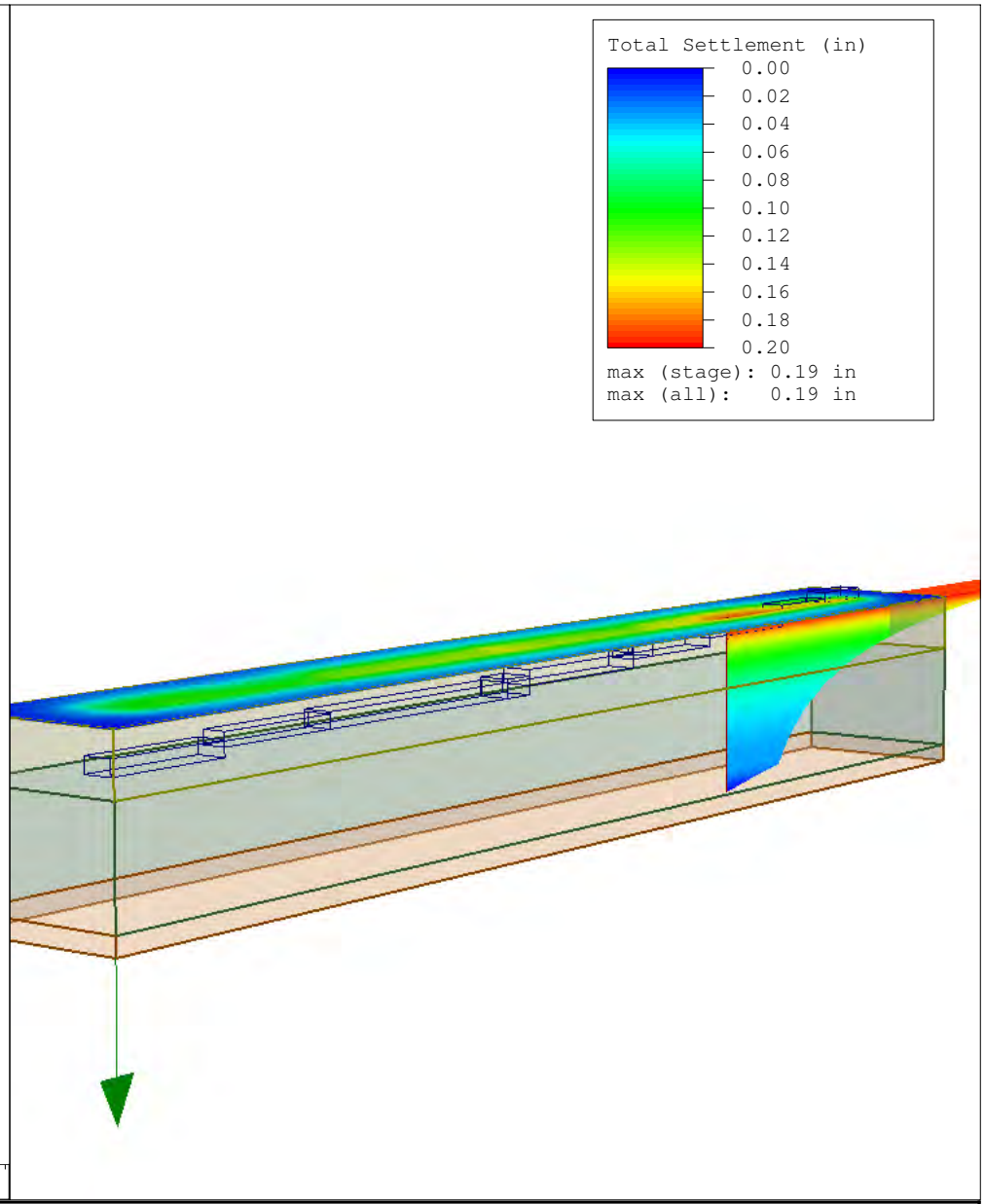
Distributed Load

-1.490	320.300
-10.500	320.739
-100.000	323.630

Distributed Load

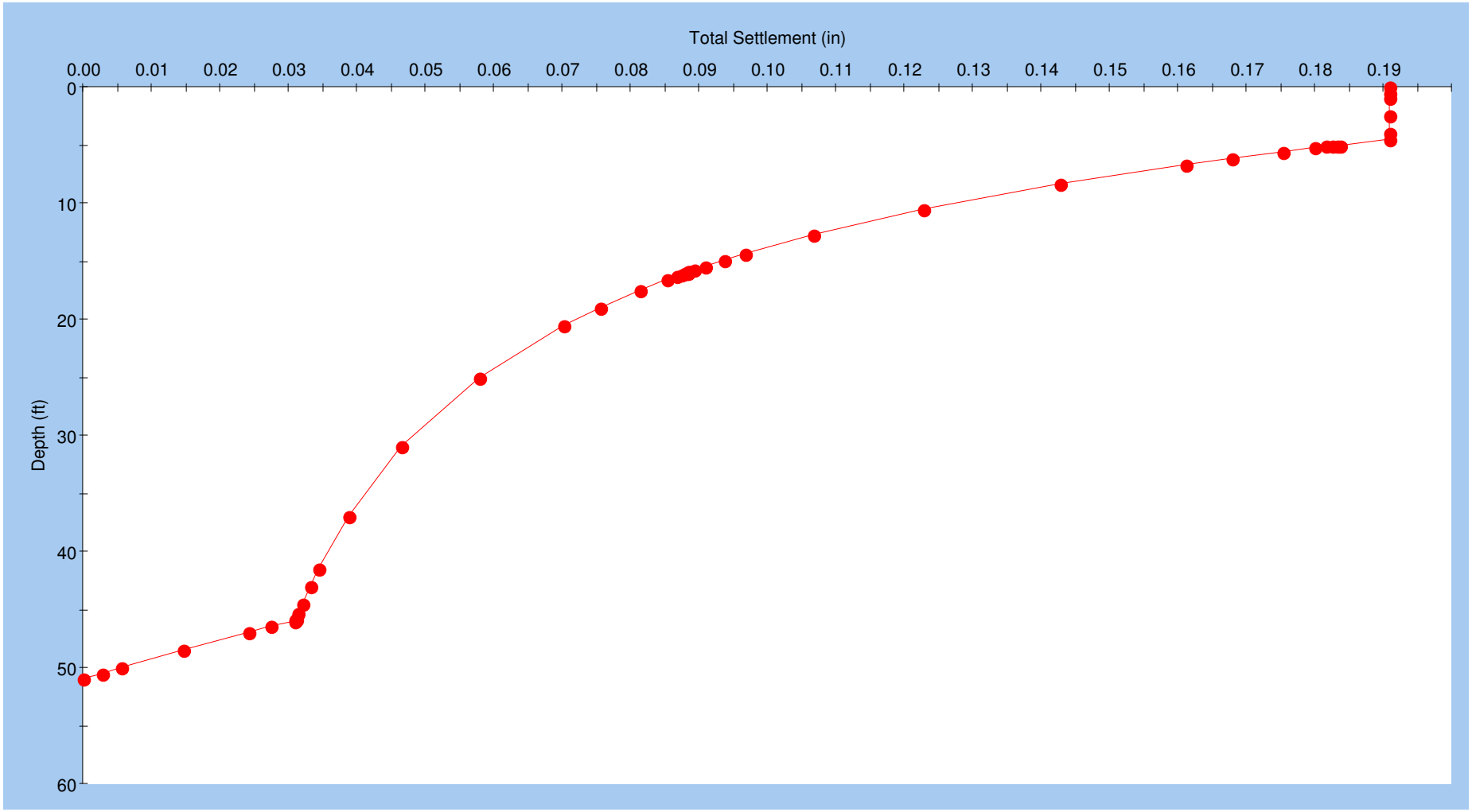
-1.490	339.633
-1.490	320.300





rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW614 ST13+93.15 to ST17+33.15	
	Drawn By RB	*Company*	CH2M HILL
	Date 2/25/2009, 9:40:08 AM	*File Name*	RW614_ST13+93_ST17+33.s3z

Total Settlement vs. Depth



Query Point 1 (Stage Stage 1)
Reference Stage: None

rocscience	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW614 ST13+93.15 to ST17+33.15	
	Drawn By	RB	*Company* CH2M HILL
SETTLE3D 1.011	*Date*	2/25/2009, 9:40:08 AM	*File Name* RW614_ST13+93_ST17+33.s3z

Settle3D Analysis Information

Project Settings

Project Title: SR-57 Settlement Analysis
Analysis: RW614 ST13+93.15 to ST17+33.15
Author: RB
Company: CH2M HILL
Date Created: 2/25/2009, 9:40:08 AM
Stress Computation Method: Boussinesq

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.190896
Consolidation Settlement [in]	0	0.190896
Immediate Settlement [in]	0	0
Loading Stress [ksf]	0	2.46844
Total Stress [ksf]	0	7.00016
Total Strain	0	0.00173053
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 20 ft
Width: 6.42 ft
Rotation angle: 0 degrees
Load: 1.904 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
320	0
340	0
340	6.42
320	6.42

Rectangular Load

Length: 25 ft
Width: 7.06 ft
Rotation angle: 0 degrees
Load: 2.276 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
295	8.88178e-016
320	8.88178e-016
320	7.06
295	7.06

Rectangular Load

Length: 40 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.604 ksf
Depth: 5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
255	2.66454e-015
295	2.66454e-015
295	8.62
255	8.62

Rectangular Load

Length: 30 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.604 ksf
Depth: 7.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
225	2.44249e-015
255	2.44249e-015
255	8.62
225	8.62

Rectangular Load

Length: 10 ft
Width: 7.06 ft

Rotation angle: 0 degrees
Load: 2.276 ksf
Depth: 7.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
215	2.66454e-015
225	2.66454e-015
225	7.06
215	7.06

Rectangular Load

Length: 50 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.604 ksf
Depth: 10 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
165	2.66454e-015
215	2.66454e-015
215	8.62
165	8.62

Rectangular Load

Length: 10 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 12.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
155	2.66454e-015
165	2.66454e-015
165	9.1
155	9.1

Rectangular Load

Length: 75 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.604 ksf
Depth: 12.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
80	1.77636e-015
155	1.77636e-015
155	8.62
80	8.62

Rectangular Load

Length: 40 ft
Width: 7.06 ft
Rotation angle: 0 degrees
Load: 2.276 ksf
Depth: 12.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
40	1.77636e-015
80	1.77636e-015
80	7.06
40	7.06

Rectangular Load

Length: 40 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.604 ksf
Depth: 15 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-2.84217e-014	1.77636e-015
40	1.77636e-015
40	8.62
-2.84217e-014	8.62

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	CLAY 1 (Qvof)	16	0
2	CLAY 2 (Qvof)	30	16
3	CLAY 3 (Qvof)	5	46

Soil Properties

CLAY 1 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.025
Cre	0.0025
Pc [ksf]	24.5

CLAY 2 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.025
Cre	0.0025
Pc [ksf]	15.75

CLAY 3 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.025
Cre	0.0025
Pc [ksf]	3.36

Query Points

String #	(X,Y) Location	Number of Divisions
1	264.329, 0.02	49

Grid

Number of points: 288
Expansion Factor: 2

Grid Coordinates

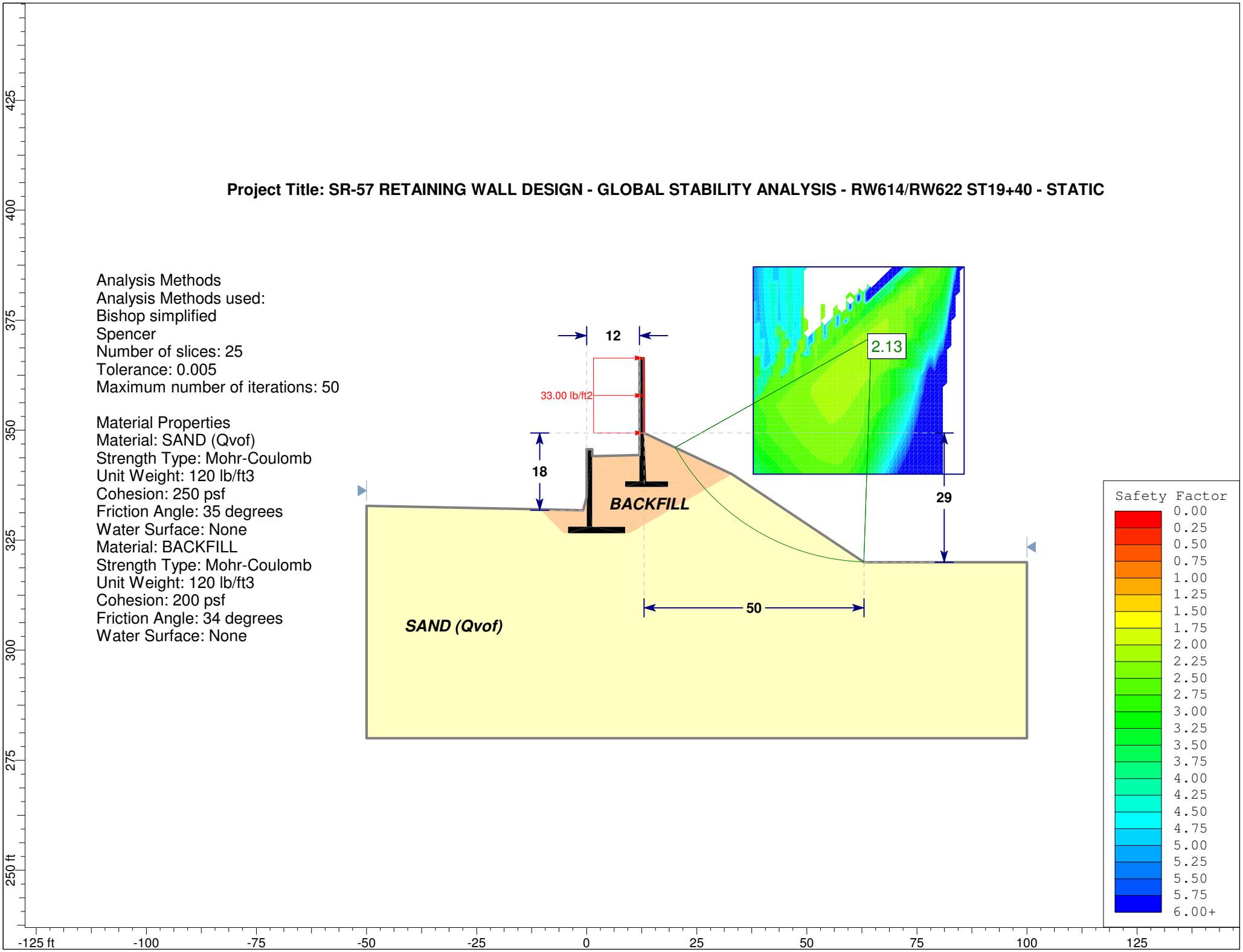
X [ft]	Y [ft]
360	29.1
360	-20
-20	-20
-20	29.1

Retaining Wall RW 622

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614/RW622 ST19+40 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 250 psf
Friction Angle: 35 degrees
Water Surface: None
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None



Slide Analysis Information

Document Name

File Name: RW614_ST19+40_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614/RW622 ST19+40 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2

Material Properties

Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 250 psf
Friction Angle: 35 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.132300
Center: 64.644, 371.080
Radius: 51.084
Left Slip Surface Endpoint: 20.116, 346.042
Right Slip Surface Endpoint: 62.964, 320.024
Resisting Moment=1.64419e+006 lb-ft
Driving Moment=771087 lb-ft

Method: spencer
FS: 2.129340
Center: 64.644, 371.080
Radius: 51.084
Left Slip Surface Endpoint: 20.116, 346.042
Right Slip Surface Endpoint: 62.964, 320.024
Resisting Moment=1.64191e+006 lb-ft
Driving Moment=771087 lb-ft
Resisting Horizontal Force=27288.6 lb
Driving Horizontal Force=12815.5 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 14167
Number of Invalid Surfaces: 14444
Error Codes:
Error Code -99 reported for 9142 surfaces
Error Code -100 reported for 1 surface
Error Code -101 reported for 2 surfaces
Error Code -103 reported for 8 surfaces
Error Code -105 reported for 111 surfaces
Error Code -106 reported for 94 surfaces
Error Code -108 reported for 3501 surfaces
Error Code -109 reported for 1556 surfaces
Error Code -112 reported for 26 surfaces
Error Code -113 reported for 3 surfaces

Method: spencer
Number of Valid Surfaces: 14016
Number of Invalid Surfaces: 14595
Error Codes:
Error Code -99 reported for 9142 surfaces

Error Code -100 reported for 1 surface
Error Code -101 reported for 2 surfaces
Error Code -103 reported for 8 surfaces
Error Code -105 reported for 111 surfaces
Error Code -106 reported for 94 surfaces
Error Code -108 reported for 3542 surfaces
Error Code -109 reported for 1556 surfaces
Error Code -111 reported for 108 surfaces
Error Code -112 reported for 28 surfaces
Error Code -113 reported for 3 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-101 = Only one (or zero) surface / slope intersections.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

37.838	340.000
85.705	340.000
85.705	387.091
37.838	387.091

Material Boundary

0.000	334.800
0.000	328.080
-4.250	328.080
-4.250	326.580
8.750	326.580
8.750	328.080
1.250	328.080
1.250	344.090

Material Boundary

8.750	338.360
12.000	338.360
12.000	344.330

Material Boundary

8.750	337.110
8.750	338.360

Material Boundary

8.750	337.110
18.500	337.110
18.500	338.360
13.500	338.360
13.042	349.360

Material Boundary

8.750	326.580
9.750	326.580
33.000	340.000

Material Boundary

-10.663	332.000
-5.250	326.580

-4.250	326.580

External Boundary

0.000	345.650
0.000	334.800
-0.813	331.800
-10.663	332.000
-50.000	332.800
-50.000	280.000
100.000	280.000
100.000	320.000
63.000	320.000
33.000	340.000
13.042	349.360
13.000	366.360
12.000	366.360
12.000	344.330
1.250	344.090
1.250	345.650

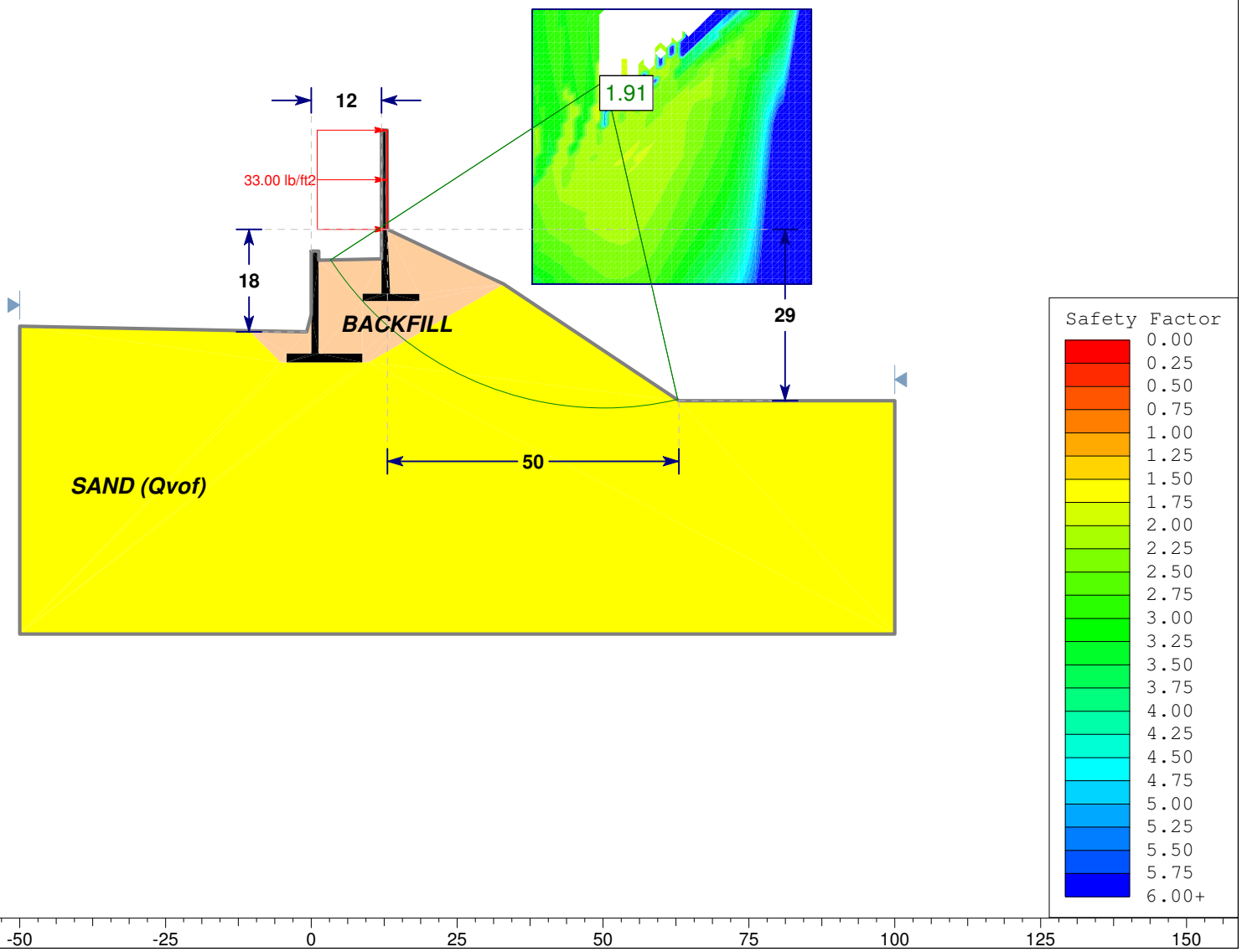
Distributed Load

13.042	349.360
13.000	366.360

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614/RW622 ST19+40 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 250 psf
Friction Angle: 35 degrees
Water Surface: None
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None



Slide Analysis Information

Document Name

File Name: RW614_ST19+40_Pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW614/RW622 ST19+40 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2

Material Properties

Material: SAND (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 450 psf
Friction Angle: 38 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 1.913840
Center: 50.283, 374.847
Radius: 56.132
Left Slip Surface Endpoint: 3.298, 344.136
Right Slip Surface Endpoint: 62.805, 320.130
Resisting Moment=5.15715e+006 lb-ft
Driving Moment=2.69465e+006 lb-ft

Method: spencer
FS: 1.933880
Center: 50.283, 374.847
Radius: 56.132
Left Slip Surface Endpoint: 3.298, 344.136
Right Slip Surface Endpoint: 62.805, 320.130
Resisting Moment=5.21115e+006 lb-ft
Driving Moment=2.69465e+006 lb-ft
Resisting Horizontal Force=85187.3 lb
Driving Horizontal Force=44049.9 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 17691
Number of Invalid Surfaces: 10920
Error Codes:
Error Code -99 reported for 9142 surfaces
Error Code -100 reported for 1 surface
Error Code -101 reported for 2 surfaces
Error Code -103 reported for 8 surfaces
Error Code -105 reported for 111 surfaces
Error Code -106 reported for 94 surfaces
Error Code -109 reported for 1556 surfaces
Error Code -112 reported for 3 surfaces
Error Code -113 reported for 3 surfaces

Method: spencer
Number of Valid Surfaces: 16248
Number of Invalid Surfaces: 12363
Error Codes:
Error Code -99 reported for 9142 surfaces

Error Code -100 reported for 1 surface
Error Code -101 reported for 2 surfaces
Error Code -103 reported for 8 surfaces
Error Code -105 reported for 111 surfaces
Error Code -106 reported for 94 surfaces
Error Code -108 reported for 247 surfaces
Error Code -109 reported for 1556 surfaces
Error Code -111 reported for 1196 surfaces
Error Code -112 reported for 3 surfaces
Error Code -113 reported for 3 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-101 = Only one (or zero) surface / slope intersections.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

37.838	340.000
85.705	340.000
85.705	387.091
37.838	387.091

Material Boundary

0.000	334.800
0.000	328.080
-4.250	328.080
-4.250	326.580
8.750	326.580
8.750	328.080
1.250	328.080
1.250	344.090

Material Boundary

8.750	338.360
12.000	338.360
12.000	344.330

Material Boundary

8.750	337.110
8.750	338.360

Material Boundary

8.750	337.110
18.500	337.110
18.500	338.360
13.500	338.360
13.042	349.360

Material Boundary

8.750	326.580
9.750	326.580
33.000	340.000

Material Boundary

-10.663	332.000
-5.250	326.580

-4.250	326.580

External Boundary

0.000	345.650
0.000	334.800
-0.813	331.800
-10.663	332.000
-50.000	332.800
-50.000	280.000
100.000	280.000
100.000	320.000
63.000	320.000
33.000	340.000
13.042	349.360
13.000	366.360
12.000	366.360
12.000	344.330
1.250	344.090
1.250	345.650

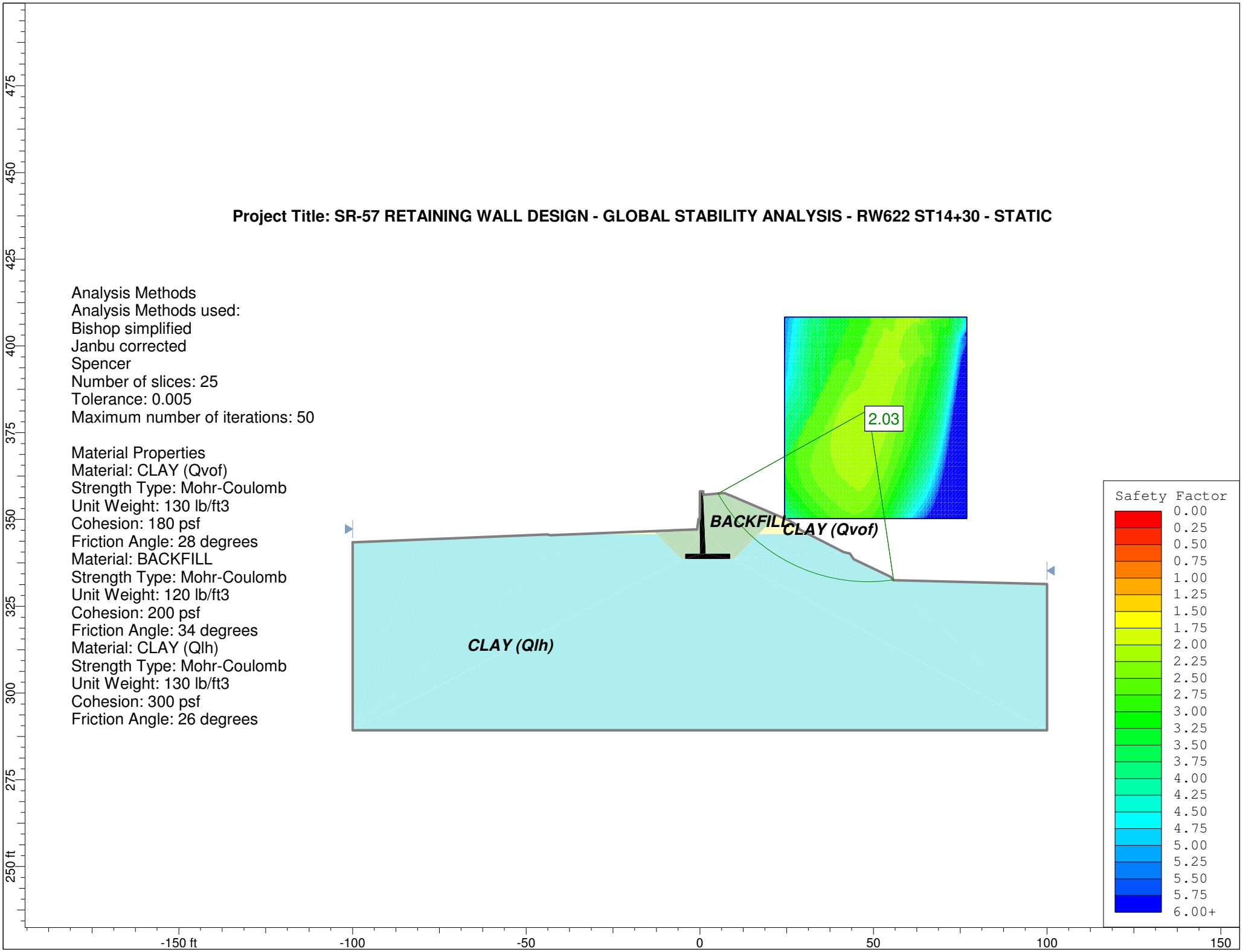
Distributed Load

13.042	349.360
13.000	366.360

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW622 ST14+30 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CLAY (Qlh)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 300 psf
Friction Angle: 26 degrees



Slide Analysis Information

Document Name

File Name: RW622_ST14+30_STATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW622 ST14+30 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: CLAY (Qlh)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 300 psf
Friction Angle: 26 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 2.034620
Center: 48.568, 381.600
Radius: 49.620
Left Slip Surface Endpoint: 5.219, 357.456
Right Slip Surface Endpoint: 55.783, 332.507
Resisting Moment=2.04262e+006 lb-ft
Driving Moment=1.00393e+006 lb-ft

Method: janbu corrected
FS: 2.007550
Center: 45.420, 375.794
Radius: 44.653
Left Slip Surface Endpoint: 4.725, 357.414
Right Slip Surface Endpoint: 56.328, 332.494
Resisting Horizontal Force=42772.7 lb
Driving Horizontal Force=21305.9 lb

Method: spencer
FS: 2.023220
Center: 48.568, 381.600
Radius: 49.620
Left Slip Surface Endpoint: 5.219, 357.456
Right Slip Surface Endpoint: 55.783, 332.507
Resisting Moment=2.03118e+006 lb-ft
Driving Moment=1.00393e+006 lb-ft
Resisting Horizontal Force=35877.1 lb
Driving Horizontal Force=17732.6 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 21567
Number of Invalid Surfaces: 7044
Error Codes:
Error Code -99 reported for 6445 surfaces
Error Code -101 reported for 4 surfaces
Error Code -103 reported for 178 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 247 surfaces
Error Code -109 reported for 70 surfaces

Error Code -112 reported for 99 surfaces

Method: janbu corrected
Number of Valid Surfaces: 21551
Number of Invalid Surfaces: 7060
Error Codes:
Error Code -99 reported for 6445 surfaces
Error Code -101 reported for 4 surfaces
Error Code -103 reported for 178 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 247 surfaces
Error Code -108 reported for 54 surfaces
Error Code -109 reported for 70 surfaces
Error Code -111 reported for 37 surfaces
Error Code -112 reported for 24 surfaces

Method: spencer
Number of Valid Surfaces: 21310
Number of Invalid Surfaces: 7301
Error Codes:
Error Code -99 reported for 6445 surfaces
Error Code -101 reported for 4 surfaces
Error Code -103 reported for 178 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 247 surfaces
Error Code -108 reported for 57 surfaces
Error Code -109 reported for 70 surfaces
Error Code -111 reported for 193 surfaces
Error Code -112 reported for 106 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-101 = Only one (or zero) surface / slope intersections.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

24.430	350.246
76.905	350.246
76.905	408.308
24.430	408.308

Material Boundary

-36.019	345.740
-12.404	345.740
-0.010	345.740
1.474	345.740
16.845	345.740
31.367	345.740

Material Boundary

-0.010	350.130
-0.010	345.740
-0.010	340.100
-4.250	340.100
-4.250	338.600
8.750	338.600
8.750	340.100

Material Boundary

1.000	357.100
1.474	345.740
1.710	340.100

Material Boundary

1.710	340.100

8.750	340.100

Material Boundary

8.750	338.600
9.750	338.600
16.845	345.740
22.247	351.177

Material Boundary

-13.299	346.633
-12.404	345.740
-5.250	338.600
-4.250	338.600

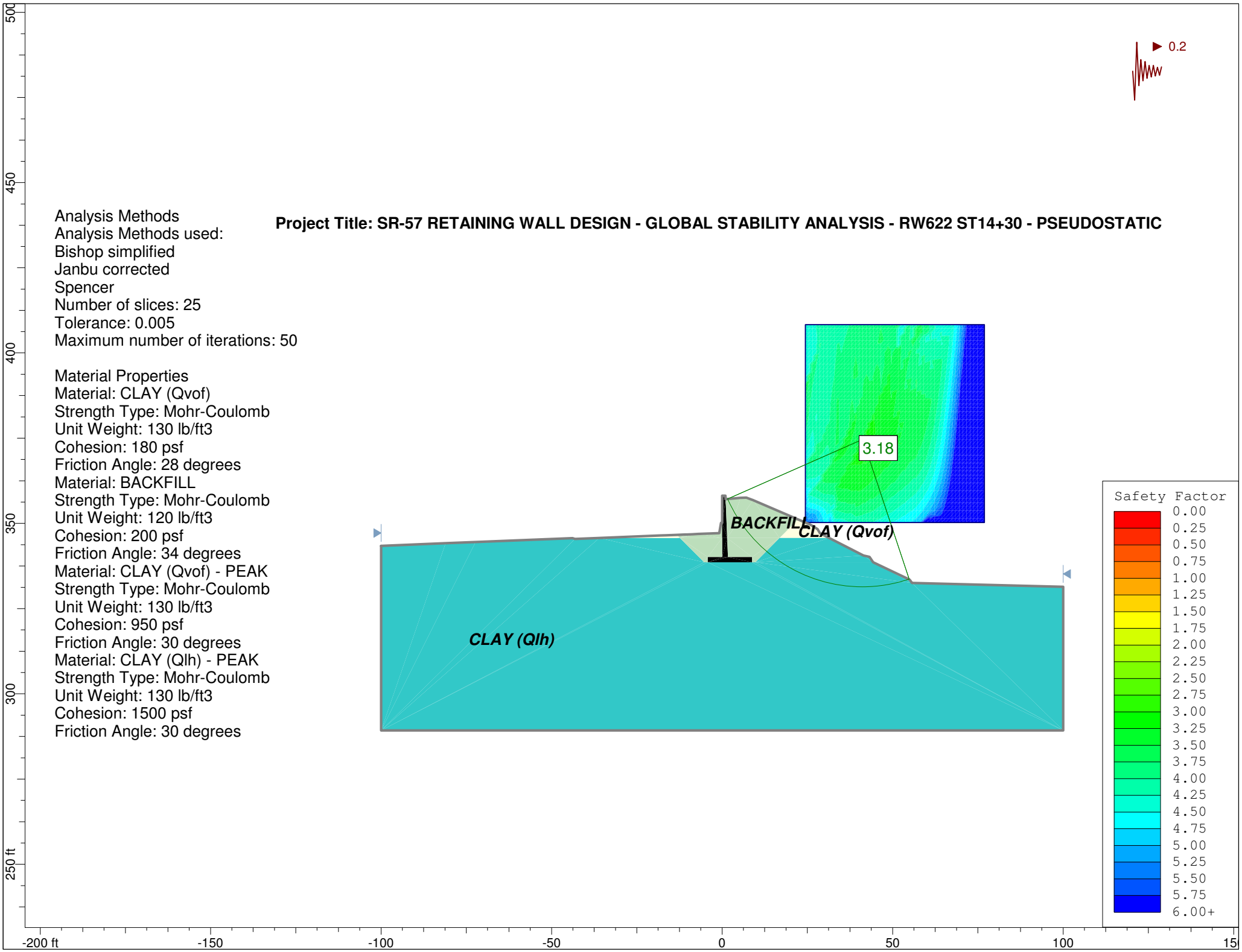
External Boundary

-100.000	343.410
-100.000	289.240
100.000	289.240
100.000	331.400
55.680	332.510
54.990	333.470
44.280	338.570
43.210	340.170
41.470	340.570
31.367	345.740
28.670	347.120
27.950	348.320
25.640	349.730
24.430	350.246
22.247	351.177
9.040	356.810
7.070	357.580
5.390	357.470
1.000	357.100
0.950	358.100
0.000	358.100
-0.001	357.015
-0.010	350.130
-0.350	350.130
-0.830	347.130
-7.020	346.890
-8.830	346.810
-10.380	346.750
-10.830	346.730
-13.299	346.633
-16.189	346.519
-18.190	346.440
-36.019	345.740
-43.150	345.460
-43.910	345.687
-72.331	344.533
-81.081	344.178

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW622 ST14+30 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: CLAY (Qlh) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 1500 psf
Friction Angle: 30 degrees



Slide Analysis Information

Document Name

File Name: RW622_ST14+30_PSEUDOSTATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW622 ST14+30 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2

Material Properties

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: CLAY (Qlh) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 1500 psf
Friction Angle: 30 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 3.183350
Center: 41.222, 374.632
Radius: 43.323
Left Slip Surface Endpoint: 1.583, 357.149
Right Slip Surface Endpoint: 54.885, 333.520
Resisting Moment=4.84067e+006 lb-ft
Driving Moment=1.52062e+006 lb-ft

Method: janbu corrected
FS: 2.853910
Center: 37.024, 366.504
Radius: 36.840
Left Slip Surface Endpoint: 1.395, 357.133
Right Slip Surface Endpoint: 54.134, 333.878
Resisting Horizontal Force=117862 lb
Driving Horizontal Force=41298.4 lb

Method: spencer
FS: 3.154830
Center: 41.222, 374.632
Radius: 43.323
Left Slip Surface Endpoint: 1.583, 357.149
Right Slip Surface Endpoint: 54.885, 333.520
Resisting Moment=4.79731e+006 lb-ft
Driving Moment=1.52062e+006 lb-ft
Resisting Horizontal Force=101150 lb
Driving Horizontal Force=32061.9 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 21518
Number of Invalid Surfaces: 7093
Error Codes:

Error Code -99 reported for 6445 surfaces
Error Code -101 reported for 4 surfaces
Error Code -103 reported for 178 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 247 surfaces
Error Code -109 reported for 70 surfaces
Error Code -112 reported for 148 surfaces

Method: janbu corrected
Number of Valid Surfaces: 21427
Number of Invalid Surfaces: 7184
Error Codes:
Error Code -99 reported for 6445 surfaces
Error Code -101 reported for 4 surfaces
Error Code -103 reported for 178 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 247 surfaces
Error Code -108 reported for 145 surfaces
Error Code -109 reported for 70 surfaces
Error Code -111 reported for 34 surfaces
Error Code -112 reported for 60 surfaces

Method: spencer
Number of Valid Surfaces: 20431
Number of Invalid Surfaces: 8180
Error Codes:
Error Code -99 reported for 6445 surfaces
Error Code -101 reported for 4 surfaces
Error Code -103 reported for 178 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 247 surfaces
Error Code -108 reported for 389 surfaces
Error Code -109 reported for 70 surfaces
Error Code -111 reported for 690 surfaces
Error Code -112 reported for 156 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-101 = Only one (or zero) surface / slope intersections.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

24.430	350.246
76.905	350.246
76.905	408.308
24.430	408.308

Material Boundary

-36.019	345.740
-12.404	345.740
-0.010	345.740
1.474	345.740
16.845	345.740
31.367	345.740

Material Boundary

-0.010	350.130
-0.010	345.740
-0.010	340.100
-4.250	340.100
-4.250	338.600
8.750	338.600
8.750	340.100

Material Boundary

1.000	357.100
1.474	345.740
1.710	340.100

Material Boundary

1.710	340.100
8.750	340.100

Material Boundary

8.750	338.600
9.750	338.600
16.845	345.740
22.247	351.177

Material Boundary

-13.299	346.633
-12.404	345.740
-5.250	338.600
-4.250	338.600

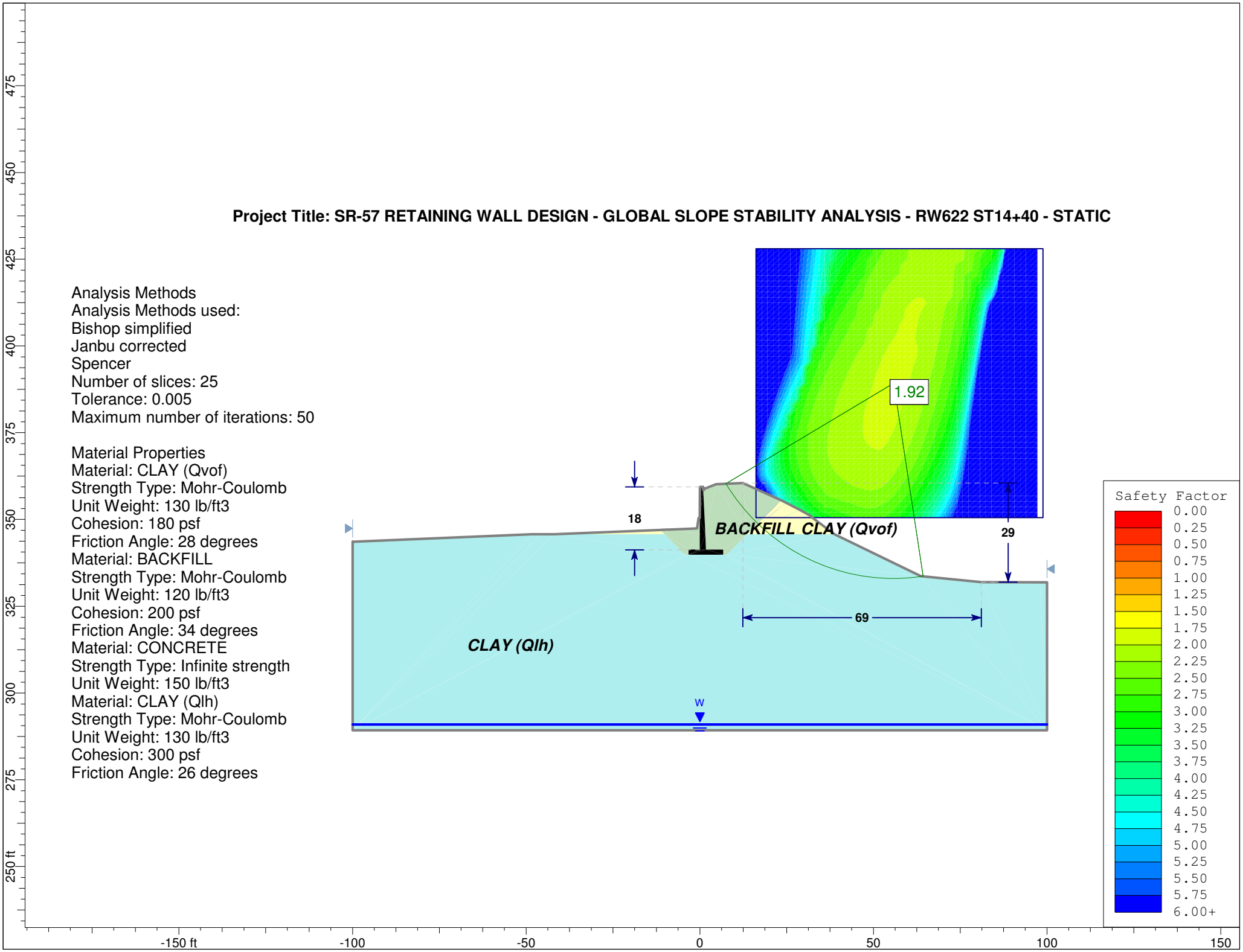
External Boundary

-100.000	343.410
-100.000	289.240
100.000	289.240
100.000	331.400
55.680	332.510
54.990	333.470
44.280	338.570
43.210	340.170
41.470	340.570
31.367	345.740
28.670	347.120
27.950	348.320
25.640	349.730
24.430	350.246
22.247	351.177
9.040	356.810
7.070	357.580
5.390	357.470
1.000	357.100
0.950	358.100
0.000	358.100
-0.001	357.015
-0.010	350.130
-0.350	350.130
-0.830	347.130
-7.020	346.890
-8.830	346.810
-10.380	346.750
-10.830	346.730
-13.299	346.633
-16.189	346.519
-18.190	346.440
-36.019	345.740
-43.150	345.460
-43.910	345.687
-72.331	344.533
-81.081	344.178

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL SLOPE STABILITY ANALYSIS - RW622 ST14+40 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3
Material: CLAY (Qlh)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 300 psf
Friction Angle: 26 degrees



Slide Analysis Information

Document Name

File Name: RW622_ST14+40_STATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL SLOPE STABILITY ANALYSIS - RW622 ST14+40 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: CLAY (Qlh)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 300 psf
Friction Angle: 26 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.923150
Center: 55.842, 389.267
Radius: 56.310
Left Slip Surface Endpoint: 7.555, 360.297
Right Slip Surface Endpoint: 64.293, 333.594
Resisting Moment=2.64602e+006 lb-ft
Driving Moment=1.37588e+006 lb-ft

Method: spencer
FS: 1.912640
Center: 55.842, 389.267
Radius: 56.310
Left Slip Surface Endpoint: 7.555, 360.297
Right Slip Surface Endpoint: 64.293, 333.594
Resisting Moment=2.63156e+006 lb-ft
Driving Moment=1.37588e+006 lb-ft
Resisting Horizontal Force=41103.5 lb
Driving Horizontal Force=21490.4 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 22425
Number of Invalid Surfaces: 6186
Error Codes:
Error Code -99 reported for 5033 surfaces
Error Code -101 reported for 4 surfaces
Error Code -103 reported for 239 surfaces
Error Code -105 reported for 2 surfaces
Error Code -106 reported for 123 surfaces
Error Code -108 reported for 612 surfaces
Error Code -109 reported for 66 surfaces
Error Code -112 reported for 107 surfaces

Method: spencer
Number of Valid Surfaces: 21042
Number of Invalid Surfaces: 7569
Error Codes:
Error Code -99 reported for 5033 surfaces

Error Code -101 reported for 4 surfaces
Error Code -103 reported for 239 surfaces
Error Code -105 reported for 2 surfaces
Error Code -106 reported for 123 surfaces
Error Code -108 reported for 1851 surfaces
Error Code -109 reported for 66 surfaces
Error Code -111 reported for 139 surfaces
Error Code -112 reported for 112 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-101 = Only one (or zero) surface / slope intersections.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

16.155	350.547
98.836	350.547
98.836	427.986
16.155	427.986

Material Boundary

-0.010	350.420
-0.010	345.740
-0.010	341.370
-3.250	341.370
-3.250	339.870
6.750	339.870
6.750	341.370
1.750	341.370
1.557	345.740
1.000	358.380

Material Boundary

-41.955	345.740
-10.158	345.740
-0.010	345.740

Material Boundary

1.557	345.740
13.618	345.740
38.780	345.740

Material Boundary

6.750	339.870
7.750	339.870
13.618	345.740
23.385	355.510

Material Boundary

-11.412	346.986
-10.158	345.740
-4.250	339.870
-3.250	339.870

External Boundary

-100.000	343.560
-100.000	289.240
100.000	289.240
100.000	331.880
97.900	331.880
81.050	331.930
63.630	333.660
38.780	345.740
32.950	350.100
31.520	351.260

28.820	352.770
24.870	354.840
23.385	355.510
12.370	360.510
4.719	360.171
1.438	358.888
1.000	358.380
0.950	359.370
0.000	359.370
-0.010	350.420
-0.350	350.420
-0.830	347.420
-8.830	347.100
-9.210	347.080
-10.830	347.010
-11.412	346.986
-41.955	345.740
-45.847	345.740
-48.218	345.740

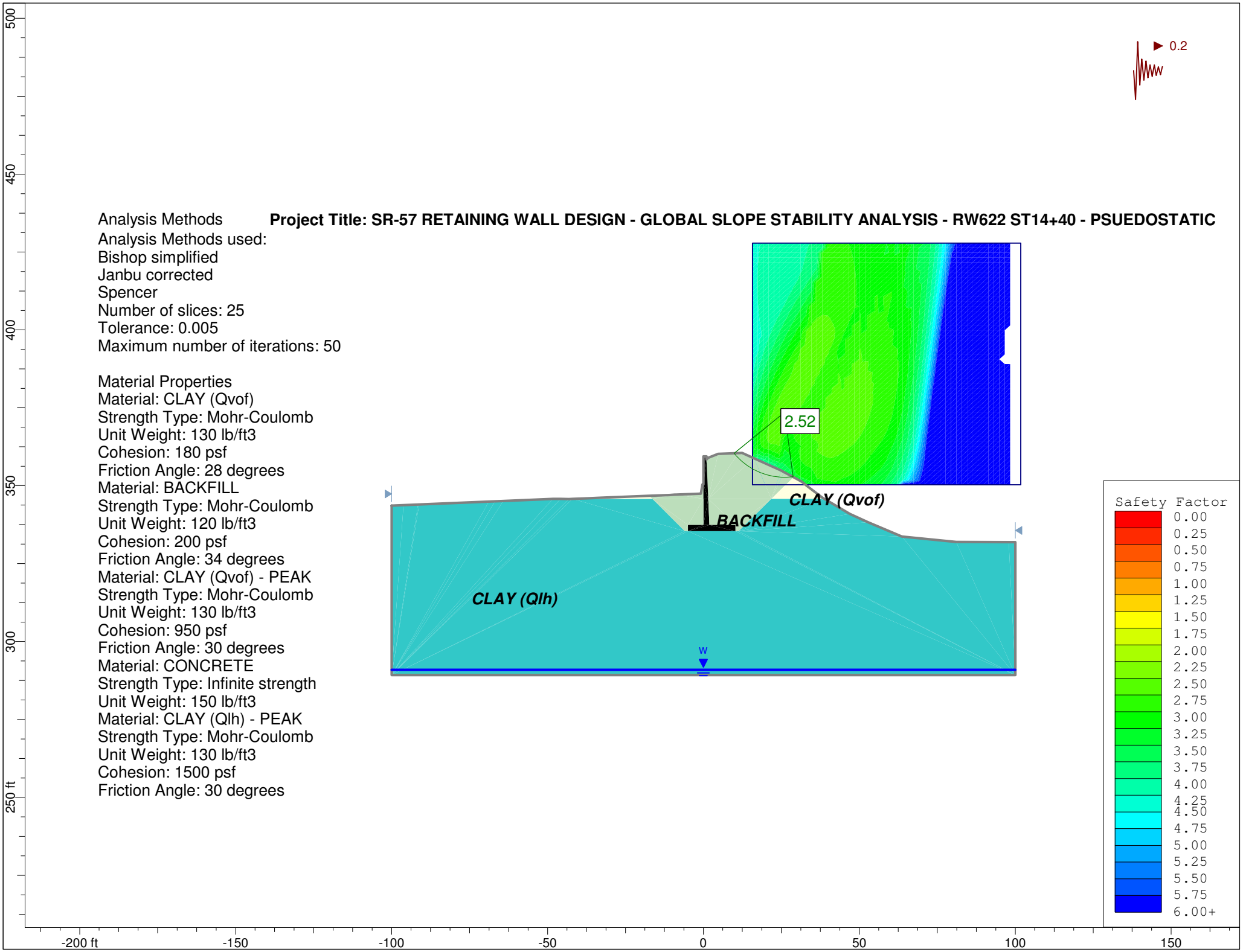
Water Table

-100.000	290.900
100.000	290.900

Analysis Methods **Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL SLOPE STABILITY ANALYSIS - RW622 ST14+40 - PSUEDOSTATIC**

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3
Material: CLAY (Qlh) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 1500 psf
Friction Angle: 30 degrees



Slide Analysis Information

Document Name

File Name: RW622_ST14+50_PSEUDOSTATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL SLOPE STABILITY ANALYSIS - RW622 ST14+50 - PSUEDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2

Material Properties

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: CLAY (Qlh) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 1500 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.533340
Center: 26.024, 373.511
Radius: 20.863
Left Slip Surface Endpoint: 9.827, 360.362
Right Slip Surface Endpoint: 28.717, 352.823
Resisting Moment=162253 lb-ft
Driving Moment=64047 lb-ft

Method: janbu corrected
FS: 2.519360
Center: 26.024, 373.511
Radius: 20.863
Left Slip Surface Endpoint: 9.827, 360.362
Right Slip Surface Endpoint: 28.717, 352.823
Resisting Horizontal Force=7342.95 lb
Driving Horizontal Force=2914.6 lb

Method: spencer
FS: 2.533460
Center: 26.024, 373.511
Radius: 20.863
Left Slip Surface Endpoint: 9.827, 360.362
Right Slip Surface Endpoint: 28.717, 352.823

Resisting Moment=162260 lb-ft
Driving Moment=64047 lb-ft
Resisting Horizontal Force=7037.33 lb
Driving Horizontal Force=2777.76 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 21015
Number of Invalid Surfaces: 7596
Error Codes:
Error Code -99 reported for 5919 surfaces
Error Code -103 reported for 245 surfaces
Error Code -105 reported for 2 surfaces
Error Code -106 reported for 113 surfaces
Error Code -109 reported for 63 surfaces
Error Code -112 reported for 132 surfaces
Error Code -1000 reported for 1122 surfaces

Method: janbu corrected
Number of Valid Surfaces: 20570
Number of Invalid Surfaces: 8041
Error Codes:
Error Code -99 reported for 5919 surfaces
Error Code -103 reported for 245 surfaces
Error Code -105 reported for 2 surfaces
Error Code -106 reported for 113 surfaces
Error Code -108 reported for 501 surfaces
Error Code -109 reported for 63 surfaces
Error Code -111 reported for 19 surfaces
Error Code -112 reported for 57 surfaces
Error Code -1000 reported for 1122 surfaces

Method: spencer
Number of Valid Surfaces: 19672
Number of Invalid Surfaces: 8939
Error Codes:
Error Code -99 reported for 5919 surfaces
Error Code -103 reported for 245 surfaces
Error Code -105 reported for 2 surfaces
Error Code -106 reported for 113 surfaces
Error Code -108 reported for 700 surfaces
Error Code -109 reported for 63 surfaces
Error Code -111 reported for 638 surfaces
Error Code -112 reported for 137 surfaces
Error Code -1000 reported for 1122 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

15.697	350.255
101.758	350.255
101.758	427.776
15.697	427.776

Material Boundary

-100.000	343.560
-96.210	343.700

-91.570	343.910
-91.184	343.931

Material Boundary

-34.272	346.056
-33.080	346.070
-32.927	346.109

Material Boundary

-68.821	344.873
-66.870	344.930
-64.213	345.067

Material Boundary

-48.218	345.740
-45.847	345.740

Material Boundary

-41.955	345.740
-16.398	345.740
-0.006	345.740
1.552	345.740
21.721	345.740
38.780	345.740

Material Boundary

-0.010	350.420
-0.006	345.740
0.000	337.370
-5.000	337.370
-5.000	335.370
10.250	335.370
10.250	337.370
1.917	337.370
1.552	345.740
1.000	358.380

Material Boundary

10.250	335.370
11.250	335.370
21.721	345.740
28.820	352.770

Material Boundary

-17.403	346.742
-16.398	345.740
-6.000	335.370
-5.000	335.370

External Boundary

-100.000	343.560
-100.000	289.240
100.000	289.240
100.000	331.880
97.900	331.880
81.050	331.930
63.630	333.660
52.810	338.220
46.940	340.900
38.780	345.740
38.240	346.060
32.950	350.100
31.520	351.260
28.820	352.770
25.870	354.300
24.870	354.840
16.230	358.740
12.370	360.510
11.110	360.410
4.719	360.171
1.438	358.888
1.000	358.380
0.950	359.370
0.000	359.370
-0.010	350.420
-0.350	350.420
-0.830	347.420
-7.290	347.160
-8.830	347.100
-9.210	347.080
-10.830	347.010
-17.403	346.742
-32.910	346.110
-32.927	346.109
-34.272	346.056
-36.980	345.950
-41.955	345.740
-43.140	345.690
-45.847	345.740
-47.495	345.770
-48.218	345.740
-64.213	345.067
-68.821	344.873
-91.184	343.931

Water Table

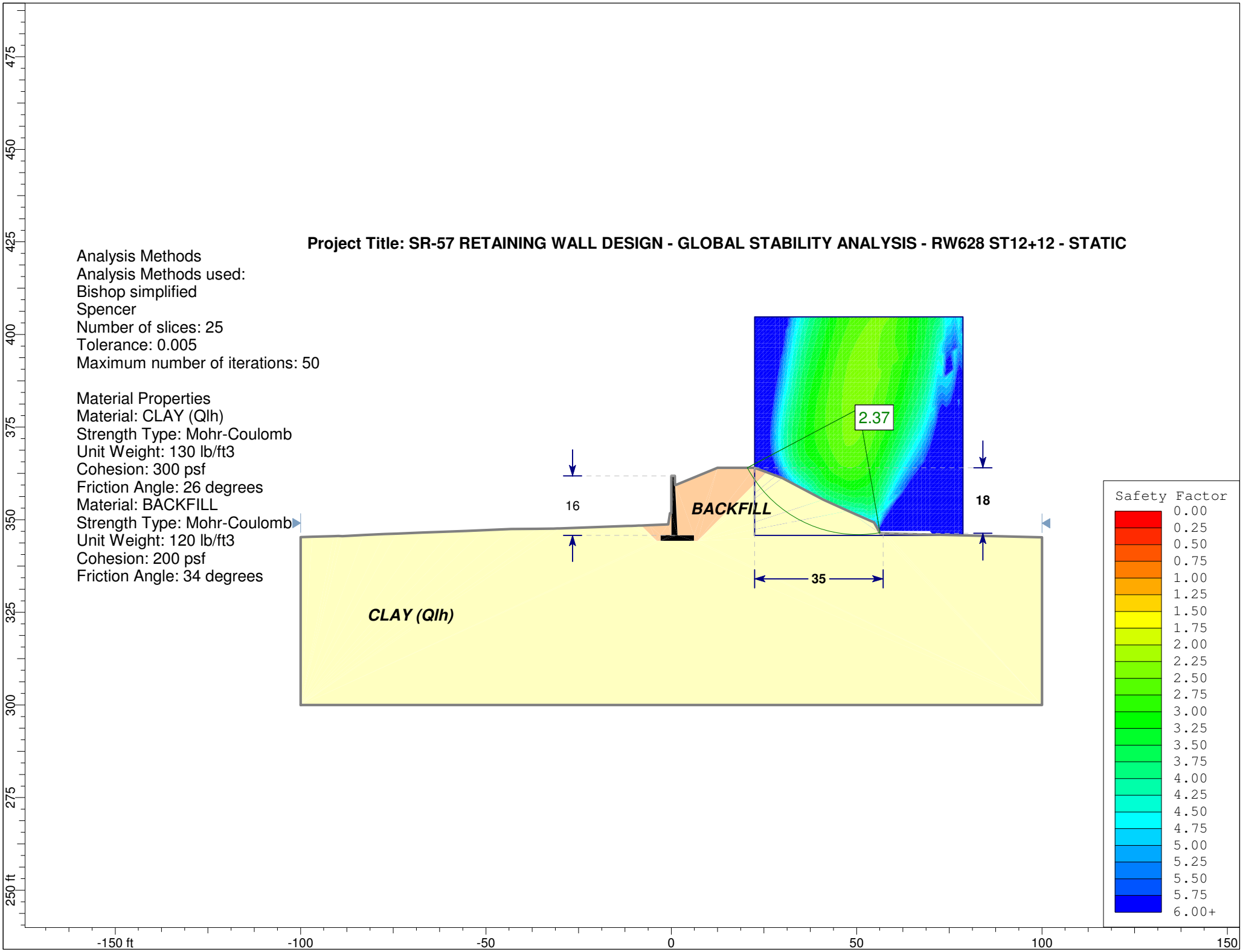
-100.000	290.900
100.000	290.900

Retaining Wall RW 628

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW628 ST12+12 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qlh)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 300 psf
Friction Angle: 26 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW628_ST12+12_Static_1.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW628 ST12+12 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: CLAY (Qlh)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 300 psf
Friction Angle: 26 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.368390
Center: 50.577, 379.966
Radius: 34.053
Left Slip Surface Endpoint: 20.483, 364.030
Right Slip Surface Endpoint: 56.294, 346.396
Resisting Moment=902346 lb-ft
Driving Moment=380996 lb-ft

Method: spencer
FS: 2.363190
Center: 50.577, 379.966
Radius: 34.053
Left Slip Surface Endpoint: 20.483, 364.030
Right Slip Surface Endpoint: 56.294, 346.396
Resisting Moment=900364 lb-ft
Driving Moment=380996 lb-ft
Resisting Horizontal Force=23146 lb
Driving Horizontal Force=9794.42 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 22558
Number of Invalid Surfaces: 6053
Error Codes:
Error Code -99 reported for 3417 surfaces
Error Code -103 reported for 885 surfaces
Error Code -105 reported for 5 surfaces
Error Code -106 reported for 132 surfaces
Error Code -109 reported for 207 surfaces
Error Code -112 reported for 1407 surfaces

Method: spencer
Number of Valid Surfaces: 20543
Number of Invalid Surfaces: 8068
Error Codes:
Error Code -99 reported for 3417 surfaces
Error Code -103 reported for 885 surfaces
Error Code -105 reported for 5 surfaces
Error Code -106 reported for 132 surfaces
Error Code -108 reported for 1032 surfaces
Error Code -109 reported for 207 surfaces
Error Code -111 reported for 965 surfaces
Error Code -112 reported for 1425 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite
strength material. If infinite strength regions
are defined for a model, a large number of
potential slip surfaces may show this error code.
This is Normal.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-105 = More than two surface / slope
intersections with no valid slip surface.

-106 = Average slice width is less than
0.0001 * (maximum horizontal extent of soil region).
This limitation is imposed to avoid numerical errors
which may result from too many slices, or too
small a slip region.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-109 = Soiltype for slice base not
located. This error should occur very rarely,
if at all. It may occur if a very low number of
slices is combined with certain soil geometries,
such that the midpoint of a slice base is
actually outside the soil region,even though
the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F)
< 0.2 for the final iteration of the safety factor calculation. This screens out
some slip surfaces which may not be valid in the context of the analysis, in
particular, deep seated slip surfaces with many high negative base angle
slices in the passive zone.

List of All Coordinates

Search Grid

22.459	345.756
78.696	345.756
78.696	404.738
22.459	404.738

Material Boundary

0.000	345.800
-2.917	345.800
-2.917	344.300
6.083	344.300
6.083	345.800
1.680	345.800
1.010	359.380

Material Boundary

0.000	345.800
0.000	351.730

Material Boundary

6.083	344.300
7.083	344.300
25.630	362.848

Material Boundary

-8.077	348.440
-3.917	344.300
-2.917	344.300

External Boundary

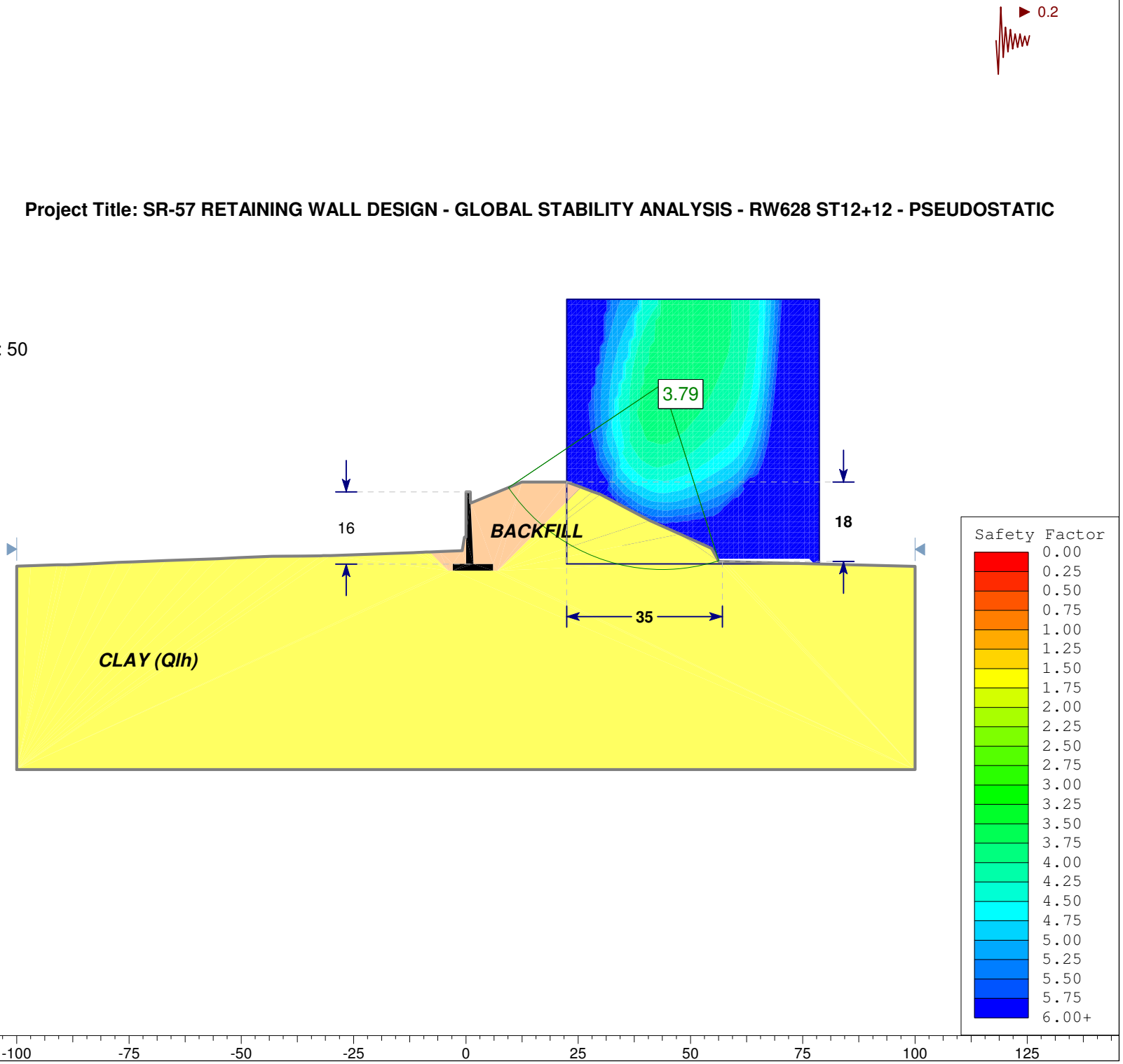
-100.000	300.000
100.000	300.000
100.000	345.220
57.900	346.280
57.130	346.300
56.400	346.320
56.350	346.320
56.330	346.320
56.330	346.330
54.720	349.250
47.660	352.400
40.990	355.430
29.940	361.240
28.225	361.880
25.630	362.848
22.459	364.030
12.480	364.030
1.180	359.380
1.010	359.380
0.960	361.800
0.000	361.800
0.000	351.730
-0.290	351.730
-0.340	351.730
-0.820	348.730
-5.860	348.530
-8.077	348.440
-8.820	348.410
-9.630	348.380
-10.820	348.330
-11.681	348.299
-30.150	347.640
-30.750	347.640

-31.800	347.610
-32.230	347.570
-36.290	347.540
-43.200	347.460
-50.460	347.160
-55.310	346.950
-59.560	346.800
-66.810	346.520
-74.160	346.240
-77.440	346.150
-82.980	345.850
-88.750	345.570
-89.850	345.590
-91.040	345.570
-96.890	345.390
-100.000	345.290

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW628 ST12+12 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qlh) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 1500 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW628_ST12+12_Pseudostatic_1.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW628 ST12+12 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2

Material Properties

Material: CLAY (Qlh) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 1500 psf
Friction Angle: 30 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 3.793110
Center: 43.829, 385.864
Radius: 41.402
Left Slip Surface Endpoint: 9.455, 362.785
Right Slip Surface Endpoint: 56.300, 346.384
Resisting Moment=4.08823e+006 lb-ft
Driving Moment=1.0778e+006 lb-ft

Method: spencer
FS: 3.777070
Center: 43.829, 385.864
Radius: 41.402
Left Slip Surface Endpoint: 9.455, 362.785
Right Slip Surface Endpoint: 56.300, 346.384
Resisting Moment=4.07093e+006 lb-ft
Driving Moment=1.0778e+006 lb-ft
Resisting Horizontal Force=91430.3 lb
Driving Horizontal Force=24206.7 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 22310
Number of Invalid Surfaces: 6301
Error Codes:
Error Code -99 reported for 3417 surfaces
Error Code -103 reported for 885 surfaces
Error Code -105 reported for 5 surfaces
Error Code -106 reported for 132 surfaces
Error Code -109 reported for 207 surfaces
Error Code -112 reported for 1655 surfaces

Method: spencer
Number of Valid Surfaces: 18904
Number of Invalid Surfaces: 9707
Error Codes:
Error Code -99 reported for 3417 surfaces
Error Code -103 reported for 885 surfaces
Error Code -105 reported for 5 surfaces
Error Code -106 reported for 132 surfaces
Error Code -108 reported for 1984 surfaces
Error Code -109 reported for 207 surfaces

Error Code -111 reported for 1417 surfaces
Error Code -112 reported for 1660 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

22.459	345.756
78.696	345.756
78.696	404.738
22.459	404.738

Material Boundary

0.000	345.800
-2.917	345.800
-2.917	344.300
6.083	344.300
6.083	345.800
1.680	345.800
1.010	359.380

Material Boundary

0.000	345.800
0.000	351.730

Material Boundary

6.083	344.300
7.083	344.300
25.630	362.848

Material Boundary

-8.077	348.440
-3.917	344.300
-2.917	344.300

External Boundary

-100.000	300.000
100.000	300.000
100.000	345.220
57.900	346.280
57.130	346.300
56.400	346.320
56.350	346.320
56.330	346.320
56.330	346.330
54.720	349.250
47.660	352.400
40.990	355.430
29.940	361.240
28.225	361.880
25.630	362.848
22.459	364.030
12.480	364.030
1.180	359.380
1.010	359.380
0.960	361.800
0.000	361.800
0.000	351.730
-0.290	351.730
-0.340	351.730
-0.820	348.730
-5.860	348.530
-8.077	348.440
-8.820	348.410

-9.630	348.380
-10.820	348.330
-11.681	348.299
-30.150	347.640
-30.750	347.640
-31.800	347.610
-32.230	347.570
-36.290	347.540
-43.200	347.460
-50.460	347.160
-55.310	346.950
-59.560	346.800
-66.810	346.520
-74.160	346.240
-77.440	346.150
-82.980	345.850
-88.750	345.570
-89.850	345.590
-91.040	345.570
-96.890	345.390
-100.000	345.290

Retaining Wall RW 630

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW630
Client: OCTA
Designer: RB
Station Number: 15+90

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....es\RW630_ST15+90.BEN
Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	33.0 °
Equivalent cohesion, $c_{equiv.}$	500.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 24.42 N γ= 9.31

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

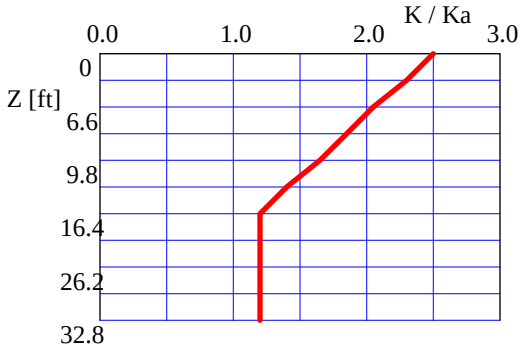
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

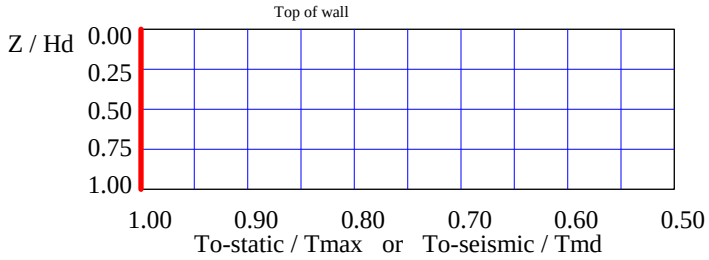


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

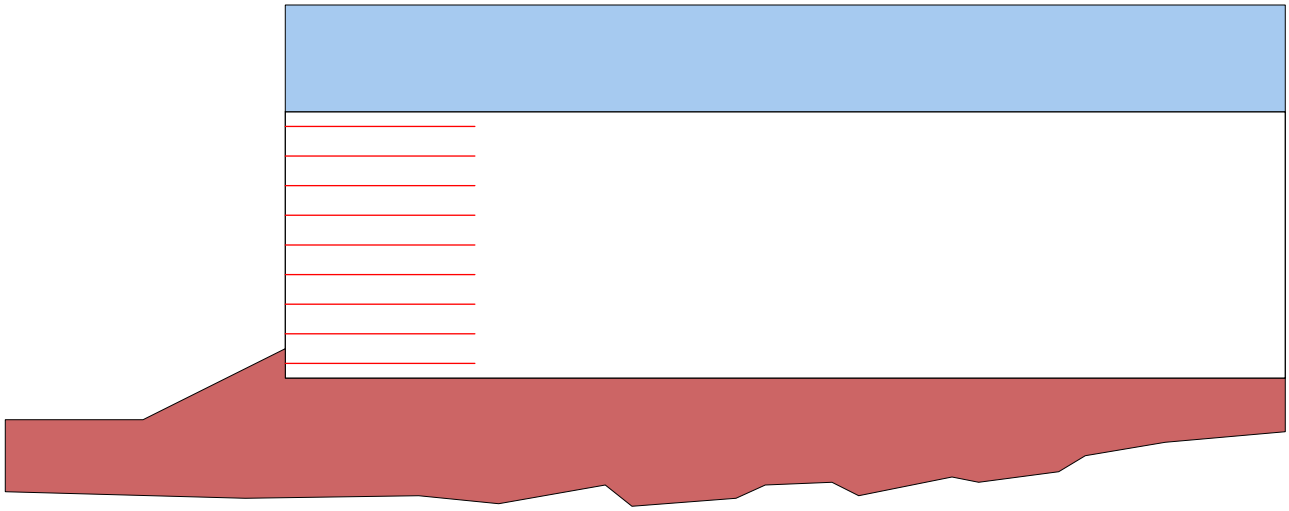
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	22.50	[ft]	{ Embedded depth is E = 2.50 ft, and height above top of finished bottom grade is H = 20.00 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 5.27, Meyerhof stress = 3754 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.137, Eccentricity, e/L = 0.1084, Fs-overturning = 4.61

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	16.00	1	N/A	6.93	7.70	7.697	22.394	3.308	0.0974	Caltrans W20
2	3.75	16.00	1	N/A	7.38	8.20	8.197	20.105	3.714	0.0772	Caltrans W20
3	6.25	16.00	1	N/A	7.49	8.32	8.321	17.934	4.234	0.0593	Caltrans W20
4	8.75	16.00	1	N/A	7.72	8.57	8.573	15.501	4.927	0.0436	Caltrans W20
5	11.25	16.00	1	N/A	8.30	9.22	9.224	13.252	5.896	0.0303	Caltrans W20
6	13.75	16.00	1	N/A	9.42	10.47	10.471	13.290	7.357	0.0193	Caltrans W20
7	16.25	16.00	1	N/A	11.33	12.59	12.589	13.264	9.832	0.0107	Caltrans W20
8	18.75	16.00	1	N/A	15.01	16.68	16.681	13.174	15.105	0.0044	Caltrans W20
9	21.25	16.00	1	N/A	24.83	27.59	27.594	13.182	37.810	0.0006	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

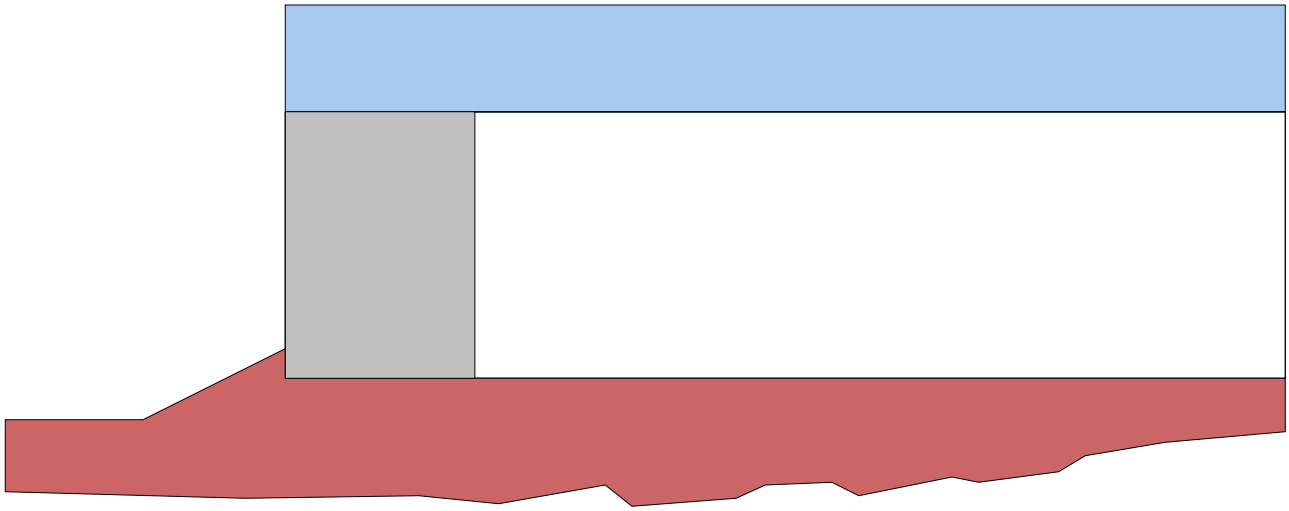
Bearing capacity, Fs = 2.64, Meyerhof stress = 6325 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.567, Eccentricity, e/L = 0.2676, Fs-overturning = 1.87

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	16.00	1	N/A	5.66	6.29	6.287	14.635	1.659	0.2387	Caltrans W20
2	3.75	16.00	1	N/A	6.07	6.74	6.745	13.235	1.882	0.1860	Caltrans W20
3	6.25	16.00	1	N/A	6.27	6.96	6.965	12.009	2.174	0.1398	Caltrans W20
4	8.75	16.00	1	N/A	6.56	7.29	7.290	10.545	2.573	0.1001	Caltrans W20
5	11.25	16.00	1	N/A	7.14	7.93	7.932	9.117	3.151	0.0671	Caltrans W20
6	13.75	16.00	1	N/A	7.95	8.84	8.837	8.973	4.064	0.0407	Caltrans W20
7	16.25	16.00	1	N/A	9.27	10.30	10.299	8.681	5.716	0.0208	Caltrans W20
8	18.75	16.00	1	N/A	11.60	12.88	12.884	8.141	9.613	0.0075	Caltrans W20
9	21.25	16.00	1	N/A	16.70	18.55	18.552	7.090	29.512	0.0008	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	19796	16712	[lb/ft ²]
Meyerhof stress, σ_V	3753.8	6325	[lb/ft ²]
Eccentricity, e	1.73	4.28	[ft]
Eccentricity, e/L	0.108	0.268	
Fs calculated	5.27	2.64	
Base length	16.00	16.00	[ft]



SCALE:

0 2 4 6 8 10[ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.137 and Fs-seismic = 1.567

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	16.00	3.308	1.659	1	Caltrans W20
2	3.75	16.00	3.714	1.882	1	Caltrans W20
3	6.25	16.00	4.234	2.174	1	Caltrans W20
4	8.75	16.00	4.927	2.573	1	Caltrans W20
5	11.25	16.00	5.896	3.151	1	Caltrans W20
6	13.75	16.00	7.357	4.064	1	Caltrans W20
7	16.25	16.00	9.832	5.716	1	Caltrans W20
8	18.75	16.00	15.105	9.613	1	Caltrans W20
9	21.25	16.00	37.810	29.512	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1084, e/L seismic = 0.2676; Overturning: Fs-static = 4.61, Fs-seismic = 1.87

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	16.00	0.0974	0.2387	1	Caltrans W20
2	3.75	16.00	0.0772	0.1860	1	Caltrans W20
3	6.25	16.00	0.0593	0.1398	1	Caltrans W20
4	8.75	16.00	0.0436	0.1001	1	Caltrans W20
5	11.25	16.00	0.0303	0.0671	1	Caltrans W20
6	13.75	16.00	0.0193	0.0407	1	Caltrans W20
7	16.25	16.00	0.0107	0.0208	1	Caltrans W20
8	18.75	16.00	0.0044	0.0075	1	Caltrans W20
9	21.25	16.00	0.0006	0.0008	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2366.32	530.40	N/A	7.697	N/A	6.287
2	3.75	1.000	0.500	18213	2222.03	478.23	N/A	8.197	N/A	6.745
3	6.25	1.000	0.500	18213	2188.91	426.06	N/A	8.321	N/A	6.965
4	8.75	1.000	0.500	18213	2124.39	373.89	N/A	8.573	N/A	7.290
5	11.25	1.000	0.500	18213	1974.51	321.72	N/A	9.224	N/A	7.932
6	13.75	1.000	0.500	18213	1739.39	321.72	N/A	10.471	N/A	8.837
7	16.25	1.000	0.500	18213	1446.71	321.72	N/A	12.589	N/A	10.299
8	18.75	1.000	0.500	18213	1091.87	321.72	N/A	16.681	N/A	12.884
9	21.25	1.000	0.500	18213	660.03	321.72	N/A	27.594	N/A	18.552

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2366.3	530.4	15.25	0.75	52992.5	N/A	22.394	42394.0	N/A	14.635
2	3.75	1.000	2222.0	478.2	13.75	2.25	44673.6	N/A	20.105	35738.9	N/A	13.235
3	6.25	1.000	2188.9	426.1	12.25	3.75	39255.1	N/A	17.934	31404.1	N/A	12.009
4	8.75	1.000	2124.4	373.9	10.75	5.25	32929.2	N/A	15.501	26343.3	N/A	10.545
5	11.25	1.000	1974.5	321.7	9.25	6.75	26167.0	N/A	13.252	20933.6	N/A	9.117
6	13.75	1.000	1739.4	321.7	9.25	6.75	23117.3	N/A	13.290	18493.8	N/A	8.973
7	16.25	1.000	1446.7	321.7	9.25	6.75	19189.7	N/A	13.264	15351.7	N/A	8.681
8	18.75	1.000	1091.9	321.7	9.25	6.75	14384.2	N/A	13.174	11507.3	N/A	8.141
9	21.25	1.000	660.0	321.7	9.25	6.75	8700.8	N/A	13.182	6960.6	N/A	7.090

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	1.000	0.500	2366	0.90	16392	18213	N/A	6.93	N/A	7.70	Caltrans W20
2	3.75	1.000	0.500	2222	0.90	16392	18213	N/A	7.38	N/A	8.20	Caltrans W20
3	6.25	1.000	0.500	2189	0.90	16392	18213	N/A	7.49	N/A	8.32	Caltrans W20
4	8.75	1.000	0.500	2124	0.90	16392	18213	N/A	7.72	N/A	8.57	Caltrans W20
5	11.25	1.000	0.500	1975	0.90	16392	18213	N/A	8.30	N/A	9.22	Caltrans W20
6	13.75	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
7	16.25	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
8	18.75	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
9	21.25	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	1.000	0.500	2897	0.90	16392	18213	N/A	5.66	N/A	6.29	Caltrans W20
2	3.75	1.000	0.500	2700	0.90	16392	18213	N/A	6.07	N/A	6.74	Caltrans W20
3	6.25	1.000	0.500	2615	0.90	16392	18213	N/A	6.27	N/A	6.96	Caltrans W20
4	8.75	1.000	0.500	2498	0.90	16392	18213	N/A	6.56	N/A	7.29	Caltrans W20
5	11.25	1.000	0.500	2296	0.90	16392	18213	N/A	7.14	N/A	7.93	Caltrans W20
6	13.75	1.000	0.500	2061	0.90	16392	18213	N/A	7.95	N/A	8.84	Caltrans W20
7	16.25	1.000	0.500	1768	0.90	16392	18213	N/A	9.27	N/A	10.30	Caltrans W20
8	18.75	1.000	0.500	1414	0.90	16392	18213	N/A	11.60	N/A	12.88	Caltrans W20
9	21.25	1.000	0.500	982	0.90	16392	18213	N/A	16.70	N/A	18.55	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW630
Client: OCTA
Designer: RB
Station Number: 16+80

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....es\RW630_ST16+80.BEN
Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	33.0 °
Equivalent cohesion, $c_{equiv.}$	500.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 18.35 N γ= 9.31

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

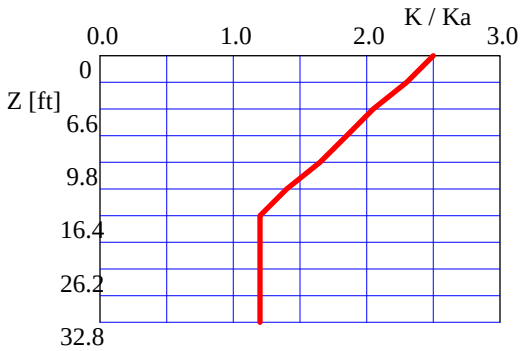
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

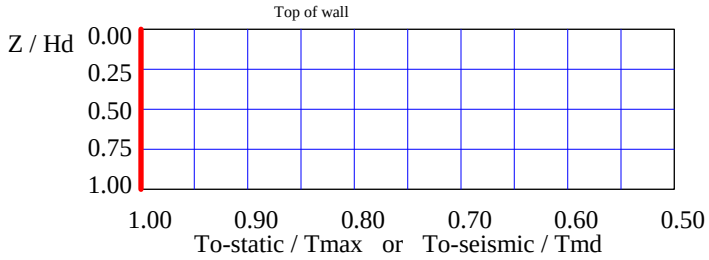


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

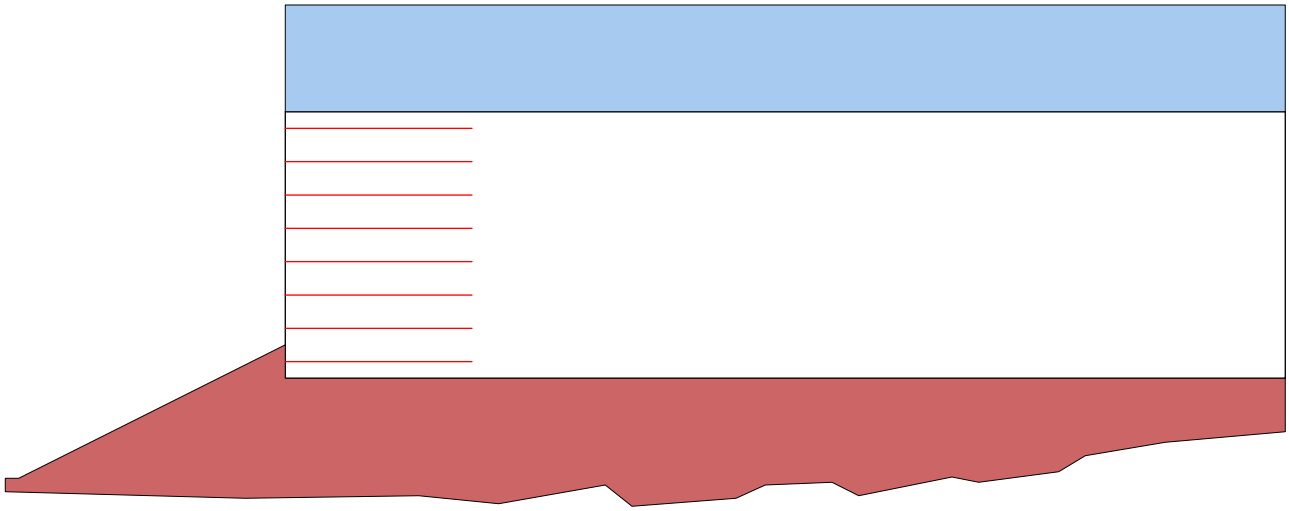
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	20.00	[ft]	{ Embedded depth is E = 2.50 ft, and height above top of finished bottom grade is H = 17.50 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 4.60, Meyerhof stress = 3417 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.062, Eccentricity, e/L = 0.1136, Fs-overturning = 4.40

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	14.00	1	N/A	7.38	8.20	8.197	19.370	3.250	0.1008	Caltrans W20
2	3.75	14.00	1	N/A	7.49	8.32	8.321	17.195	3.705	0.0774	Caltrans W20
3	6.25	14.00	1	N/A	7.72	8.57	8.573	14.779	4.311	0.0570	Caltrans W20
4	8.75	14.00	1	N/A	8.30	9.22	9.224	12.532	5.159	0.0396	Caltrans W20
5	11.25	14.00	1	N/A	9.42	10.47	10.471	11.490	6.437	0.0253	Caltrans W20
6	13.75	14.00	1	N/A	11.33	12.59	12.589	11.468	8.603	0.0139	Caltrans W20
7	16.25	14.00	1	N/A	15.01	16.68	16.681	11.390	13.217	0.0057	Caltrans W20
8	18.75	14.00	1	N/A	24.83	27.59	27.594	11.397	33.083	0.0008	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

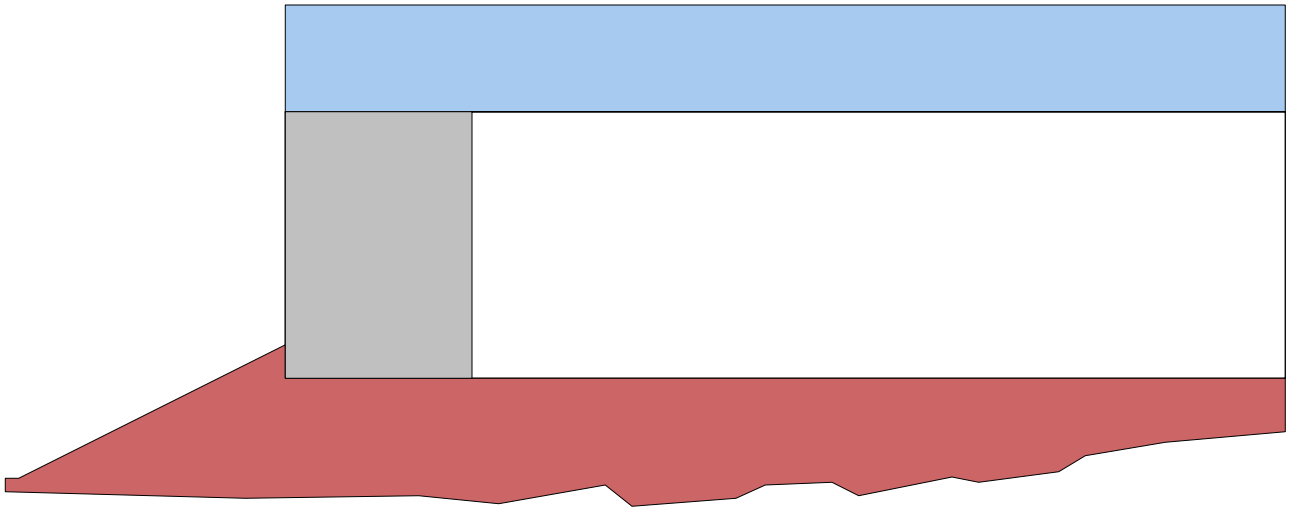
Bearing capacity, Fs = 2.20, Meyerhof stress = 5900 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.543, Eccentricity, e/L = 0.2763, Fs-overturning = 1.81

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	14.00	1	N/A	6.09	6.76	6.764	12.787	1.647	0.2429	Caltrans W20
2	3.75	14.00	1	N/A	6.29	6.99	6.988	11.553	1.902	0.1825	Caltrans W20
3	6.25	14.00	1	N/A	6.59	7.32	7.319	10.093	2.251	0.1308	Caltrans W20
4	8.75	14.00	1	N/A	7.17	7.97	7.969	8.662	2.757	0.0877	Caltrans W20
5	11.25	14.00	1	N/A	8.10	9.00	9.000	7.901	3.556	0.0531	Caltrans W20
6	13.75	14.00	1	N/A	9.47	10.52	10.522	7.668	5.002	0.0272	Caltrans W20
7	16.25	14.00	1	N/A	11.91	13.24	13.235	7.230	8.411	0.0098	Caltrans W20
8	18.75	14.00	1	N/A	17.36	19.29	19.288	6.373	25.823	0.0011	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	15724	12967	[lb/ft ²]
Meyerhof stress, σ_V	3416.6	5900	[lb/ft ²]
Eccentricity, e	1.59	3.87	[ft]
Eccentricity, e/L	0.114	0.276	
Fs calculated	4.60	2.20	
Base length	14.00	14.00	[ft]



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT
(for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.062 and Fs-seismic = 1.543

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	14.00	3.250	1.647	1	Caltrans W20
2	3.75	14.00	3.705	1.902	1	Caltrans W20
3	6.25	14.00	4.311	2.251	1	Caltrans W20
4	8.75	14.00	5.159	2.757	1	Caltrans W20
5	11.25	14.00	6.437	3.556	1	Caltrans W20
6	13.75	14.00	8.603	5.002	1	Caltrans W20
7	16.25	14.00	13.217	8.411	1	Caltrans W20
8	18.75	14.00	33.083	25.823	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1136, e/L seismic = 0.2763; Overturning: Fs-static = 4.40, Fs-seismic = 1.81

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	14.00	0.1008	0.2429	1	Caltrans W20
2	3.75	14.00	0.0774	0.1825	1	Caltrans W20
3	6.25	14.00	0.0570	0.1308	1	Caltrans W20
4	8.75	14.00	0.0396	0.0877	1	Caltrans W20
5	11.25	14.00	0.0253	0.0531	1	Caltrans W20
6	13.75	14.00	0.0139	0.0272	1	Caltrans W20
7	16.25	14.00	0.0057	0.0098	1	Caltrans W20
8	18.75	14.00	0.0008	0.0011	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2222.03	470.72	N/A	8.197	N/A	6.764
2	3.75	1.000	0.500	18213	2188.91	417.43	N/A	8.321	N/A	6.988
3	6.25	1.000	0.500	18213	2124.39	364.14	N/A	8.573	N/A	7.319
4	8.75	1.000	0.500	18213	1974.51	310.85	N/A	9.224	N/A	7.969
5	11.25	1.000	0.500	18213	1739.39	284.21	N/A	10.471	N/A	9.000
6	13.75	1.000	0.500	18213	1446.71	284.21	N/A	12.589	N/A	10.522
7	16.25	1.000	0.500	18213	1091.87	284.21	N/A	16.681	N/A	13.235
8	18.75	1.000	0.500	18213	660.03	284.21	N/A	27.594	N/A	19.288

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2222.0	470.7	13.25	0.75	43041.1	N/A	19.370	34432.9	N/A	12.787
2	3.75	1.000	2188.9	417.4	11.75	2.25	37637.7	N/A	17.195	30110.1	N/A	11.553
3	6.25	1.000	2124.4	364.1	10.25	3.75	31396.7	N/A	14.779	25117.3	N/A	10.093
4	8.75	1.000	1974.5	310.9	8.75	5.25	24745.4	N/A	12.532	19796.3	N/A	8.662
5	11.25	1.000	1739.4	284.2	8.00	6.00	19986.1	N/A	11.490	15988.9	N/A	7.901
6	13.75	1.000	1446.7	284.2	8.00	6.00	16590.5	N/A	11.468	13272.4	N/A	7.668
7	16.25	1.000	1091.9	284.2	8.00	6.00	12435.9	N/A	11.390	9948.7	N/A	7.230
8	18.75	1.000	660.0	284.2	8.00	6.00	7522.3	N/A	11.397	6017.8	N/A	6.373

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2222	0.90	16392	18213	N/A	7.38	N/A	8.20	Caltrans W20
2	3.75	1.000	0.500	2189	0.90	16392	18213	N/A	7.49	N/A	8.32	Caltrans W20
3	6.25	1.000	0.500	2124	0.90	16392	18213	N/A	7.72	N/A	8.57	Caltrans W20
4	8.75	1.000	0.500	1975	0.90	16392	18213	N/A	8.30	N/A	9.22	Caltrans W20
5	11.25	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
6	13.75	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
7	16.25	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
8	18.75	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2693	0.90	16392	18213	N/A	6.09	N/A	6.76	Caltrans W20
2	3.75	1.000	0.500	2606	0.90	16392	18213	N/A	6.29	N/A	6.99	Caltrans W20
3	6.25	1.000	0.500	2489	0.90	16392	18213	N/A	6.59	N/A	7.32	Caltrans W20
4	8.75	1.000	0.500	2285	0.90	16392	18213	N/A	7.17	N/A	7.97	Caltrans W20
5	11.25	1.000	0.500	2024	0.90	16392	18213	N/A	8.10	N/A	9.00	Caltrans W20
6	13.75	1.000	0.500	1731	0.90	16392	18213	N/A	9.47	N/A	10.52	Caltrans W20
7	16.25	1.000	0.500	1376	0.90	16392	18213	N/A	11.91	N/A	13.24	Caltrans W20
8	18.75	1.000	0.500	944	0.90	16392	18213	N/A	17.36	N/A	19.29	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW630
Client: OCTA
Designer: RB
Station Number: 18+45

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....es\RW630_ST18+45.BEN
Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	33.0 °
Equivalent cohesion, $c_{equiv.}$	500.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 3.70 N γ= 9.31

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

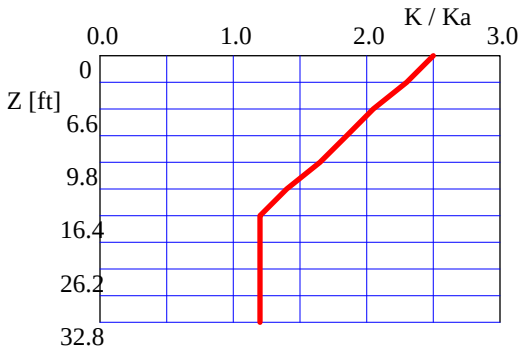
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

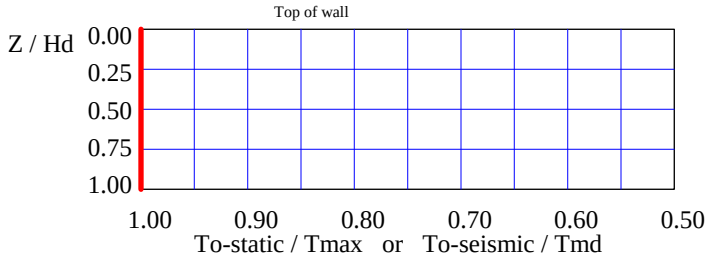


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

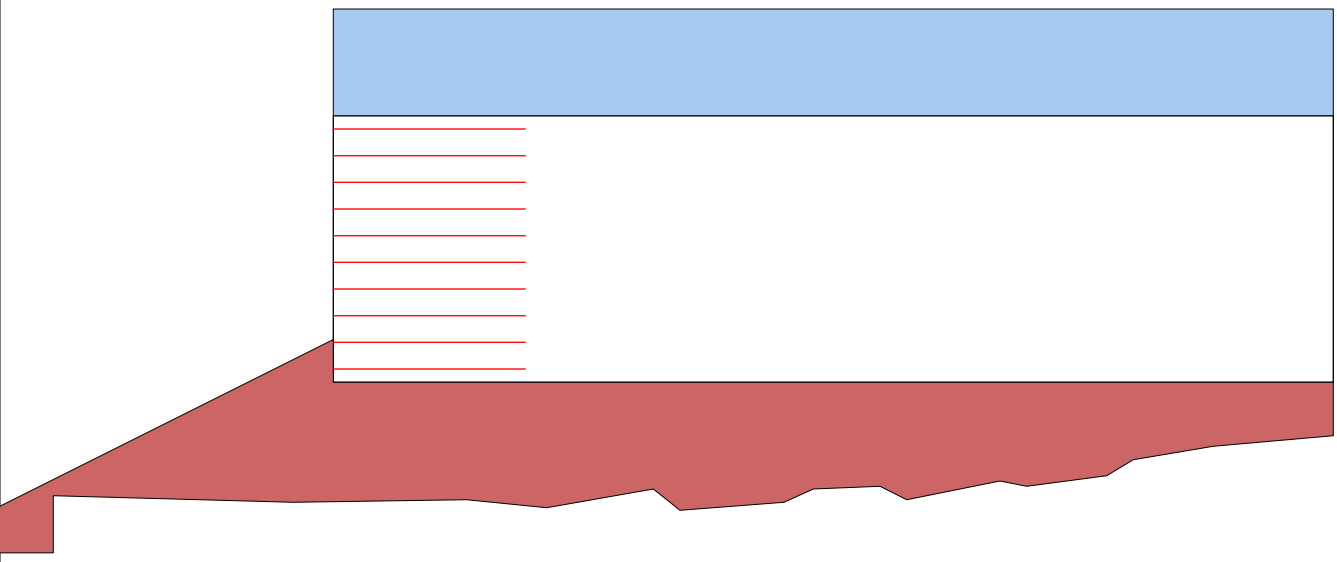
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	25.00	[ft]	{ Embedded depth is E = 4.00 ft, and height above top of finished bottom grade is H = 21.00 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10[ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 2.56, Meyerhof stress = 4095 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.199, Eccentricity, e/L = 0.1044, Fs-overturning = 4.79

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	18.00	1	N/A	6.25	6.95	6.950	25.342	3.356	0.0948	Caltrans W20
2	3.75	18.00	1	N/A	6.93	7.70	7.697	23.138	3.722	0.0770	Caltrans W20
3	6.25	18.00	1	N/A	7.38	8.20	8.197	20.842	4.178	0.0610	Caltrans W20
4	8.75	18.00	1	N/A	7.49	8.32	8.321	18.668	4.763	0.0468	Caltrans W20
5	11.25	18.00	1	N/A	7.72	8.57	8.573	16.231	5.543	0.0345	Caltrans W20
6	13.75	18.00	1	N/A	8.30	9.22	9.224	15.050	6.633	0.0240	Caltrans W20
7	16.25	18.00	1	N/A	9.42	10.47	10.471	15.093	8.276	0.0153	Caltrans W20
8	18.75	18.00	1	N/A	11.33	12.59	12.589	15.063	11.061	0.0084	Caltrans W20
9	21.25	18.00	1	N/A	15.01	16.68	16.681	14.960	16.993	0.0035	Caltrans W20
10	23.75	18.00	1	N/A	24.83	27.59	27.594	14.970	42.536	0.0005	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

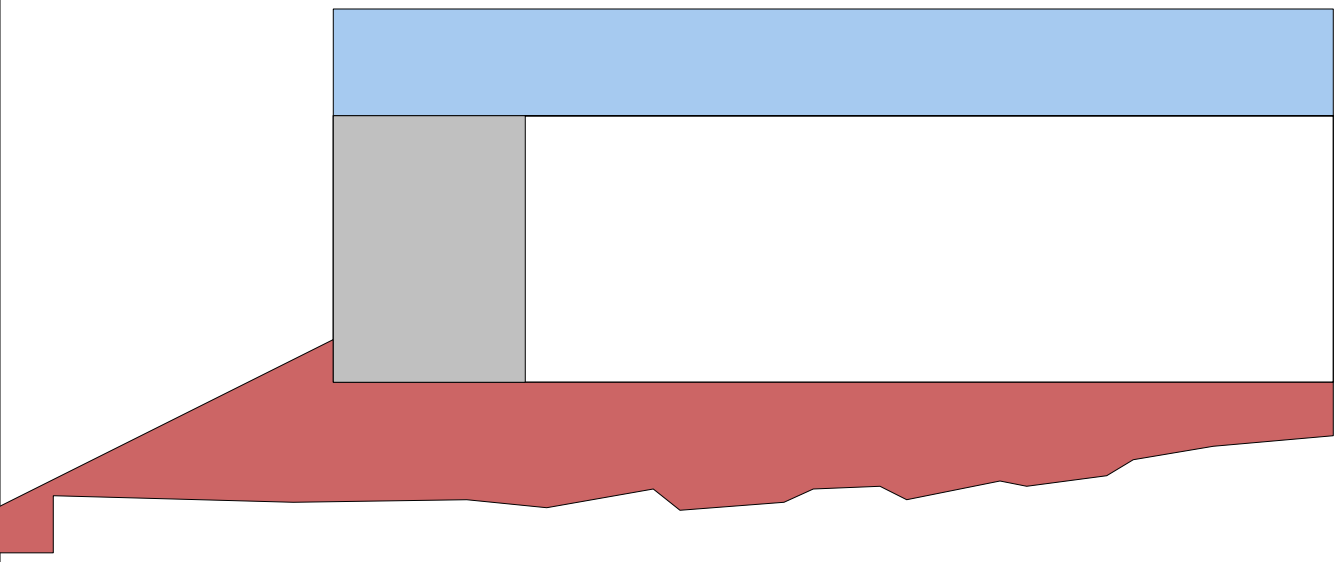
Bearing capacity, Fs = 1.04, Meyerhof stress = 6776 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.585, Eccentricity, e/L = 0.2609, Fs-overturning = 1.92

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	18.00	1	N/A	5.11	5.68	5.676	16.558	1.669	0.2355	Caltrans W20
2	3.75	18.00	1	N/A	5.65	6.27	6.273	15.087	1.867	0.1886	Caltrans W20
3	6.25	18.00	1	N/A	6.05	6.73	6.726	13.682	2.117	0.1469	Caltrans W20
4	8.75	18.00	1	N/A	6.25	6.94	6.942	12.460	2.446	0.1104	Caltrans W20
5	11.25	18.00	1	N/A	6.54	7.26	7.262	10.999	2.895	0.0791	Caltrans W20
6	13.75	18.00	1	N/A	7.03	7.81	7.808	10.192	3.545	0.0530	Caltrans W20
7	16.25	18.00	1	N/A	7.82	8.68	8.684	10.014	4.572	0.0321	Caltrans W20
8	18.75	18.00	1	N/A	9.08	10.09	10.092	9.660	6.431	0.0164	Caltrans W20
9	21.25	18.00	1	N/A	11.31	12.56	12.562	9.013	10.814	0.0059	Caltrans W20
10	23.75	18.00	1	N/A	16.10	17.89	17.891	7.765	33.201	0.0007	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	10472	7060	[lb/ft ²]
Meyerhof stress, σ_V	4094.6	6776	[lb/ft ²]
Eccentricity, e	1.88	4.70	[ft]
Eccentricity, e/L	0.104	0.261	
Fs calculated	2.56	1.04	
Base length	18.00	18.00	[ft]



SCALE:

0 2 4 6 8 10[ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.199 and Fs-seismic = 1.585

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	18.00	3.356	1.669	1	Caltrans W20
2	3.75	18.00	3.722	1.867	1	Caltrans W20
3	6.25	18.00	4.178	2.117	1	Caltrans W20
4	8.75	18.00	4.763	2.446	1	Caltrans W20
5	11.25	18.00	5.543	2.895	1	Caltrans W20
6	13.75	18.00	6.633	3.545	1	Caltrans W20
7	16.25	18.00	8.276	4.572	1	Caltrans W20
8	18.75	18.00	11.061	6.431	1	Caltrans W20
9	21.25	18.00	16.993	10.814	1	Caltrans W20
10	23.75	18.00	42.536	33.201	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1044, e/L seismic = 0.2609; Overturning: Fs-static = 4.79, Fs-seismic = 1.92

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	18.00	0.0948	0.2355	1	Caltrans W20
2	3.75	18.00	0.0770	0.1886	1	Caltrans W20
3	6.25	18.00	0.0610	0.1469	1	Caltrans W20
4	8.75	18.00	0.0468	0.1104	1	Caltrans W20
5	11.25	18.00	0.0345	0.0791	1	Caltrans W20
6	13.75	18.00	0.0240	0.0530	1	Caltrans W20
7	16.25	18.00	0.0153	0.0321	1	Caltrans W20
8	18.75	18.00	0.0084	0.0164	1	Caltrans W20
9	21.25	18.00	0.0035	0.0059	1	Caltrans W20
10	23.75	18.00	0.0005	0.0007	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2620.77	588.07	N/A	6.950	N/A	5.676
2	3.75	1.000	0.500	18213	2366.32	536.93	N/A	7.697	N/A	6.273
3	6.25	1.000	0.500	18213	2222.03	485.79	N/A	8.197	N/A	6.726
4	8.75	1.000	0.500	18213	2188.91	434.66	N/A	8.321	N/A	6.942
5	11.25	1.000	0.500	18213	2124.39	383.52	N/A	8.573	N/A	7.262
6	13.75	1.000	0.500	18213	1974.51	357.95	N/A	9.224	N/A	7.808
7	16.25	1.000	0.500	18213	1739.39	357.95	N/A	10.471	N/A	8.684
8	18.75	1.000	0.500	18213	1446.71	357.95	N/A	12.589	N/A	10.092
9	21.25	1.000	0.500	18213	1091.87	357.95	N/A	16.681	N/A	12.562
10	23.75	1.000	0.500	18213	660.03	357.95	N/A	27.594	N/A	17.891

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2620.8	588.1	17.25	0.75	66415.0	N/A	25.342	53132.0	N/A	16.558
2	3.75	1.000	2366.3	536.9	15.75	2.25	54752.4	N/A	23.138	43801.9	N/A	15.087
3	6.25	1.000	2222.0	485.8	14.25	3.75	46311.3	N/A	20.842	37049.0	N/A	13.682
4	8.75	1.000	2188.9	434.7	12.75	5.25	40862.6	N/A	18.668	32690.1	N/A	12.460
5	11.25	1.000	2124.4	383.5	11.25	6.75	34480.8	N/A	16.231	27584.6	N/A	10.999
6	13.75	1.000	1974.5	358.0	10.50	7.50	29715.7	N/A	15.050	23772.5	N/A	10.192
7	16.25	1.000	1739.4	358.0	10.50	7.50	26252.3	N/A	15.093	21001.9	N/A	10.014
8	18.75	1.000	1446.7	358.0	10.50	7.50	21792.1	N/A	15.063	17433.6	N/A	9.660
9	21.25	1.000	1091.9	358.0	10.50	7.50	16334.9	N/A	14.960	13067.9	N/A	9.013
10	23.75	1.000	660.0	358.0	10.50	7.50	9880.8	N/A	14.970	7904.6	N/A	7.765

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2621	0.90	16392	18213	N/A	6.25	N/A	6.95	Caltrans W20
2	3.75	1.000	0.500	2366	0.90	16392	18213	N/A	6.93	N/A	7.70	Caltrans W20
3	6.25	1.000	0.500	2222	0.90	16392	18213	N/A	7.38	N/A	8.20	Caltrans W20
4	8.75	1.000	0.500	2189	0.90	16392	18213	N/A	7.49	N/A	8.32	Caltrans W20
5	11.25	1.000	0.500	2124	0.90	16392	18213	N/A	7.72	N/A	8.57	Caltrans W20
6	13.75	1.000	0.500	1975	0.90	16392	18213	N/A	8.30	N/A	9.22	Caltrans W20
7	16.25	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
8	18.75	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
9	21.25	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
10	23.75	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	3209	0.90	16392	18213	N/A	5.11	N/A	5.68	Caltrans W20
2	3.75	1.000	0.500	2903	0.90	16392	18213	N/A	5.65	N/A	6.27	Caltrans W20
3	6.25	1.000	0.500	2708	0.90	16392	18213	N/A	6.05	N/A	6.73	Caltrans W20
4	8.75	1.000	0.500	2624	0.90	16392	18213	N/A	6.25	N/A	6.94	Caltrans W20
5	11.25	1.000	0.500	2508	0.90	16392	18213	N/A	6.54	N/A	7.26	Caltrans W20
6	13.75	1.000	0.500	2332	0.90	16392	18213	N/A	7.03	N/A	7.81	Caltrans W20
7	16.25	1.000	0.500	2097	0.90	16392	18213	N/A	7.82	N/A	8.68	Caltrans W20
8	18.75	1.000	0.500	1805	0.90	16392	18213	N/A	9.08	N/A	10.09	Caltrans W20
9	21.25	1.000	0.500	1450	0.90	16392	18213	N/A	11.31	N/A	12.56	Caltrans W20
10	23.75	1.000	0.500	1018	0.90	16392	18213	N/A	16.10	N/A	17.89	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW630
Client: OCTA
Designer: RB
Station Number: 18+60

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....es\RW630_ST18+60.BEN
Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	33.0 °
Equivalent cohesion, $c_{equiv.}$	500.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 6.10 N γ= 9.31

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

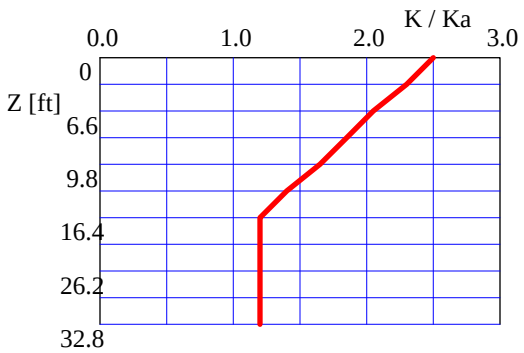
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

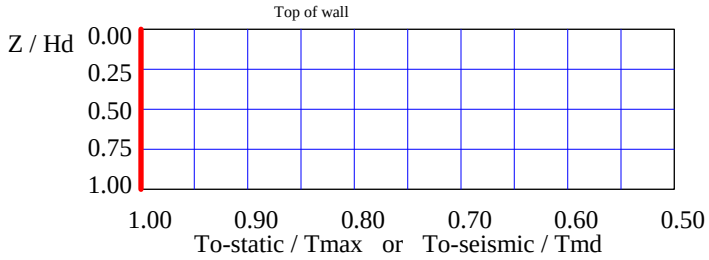


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

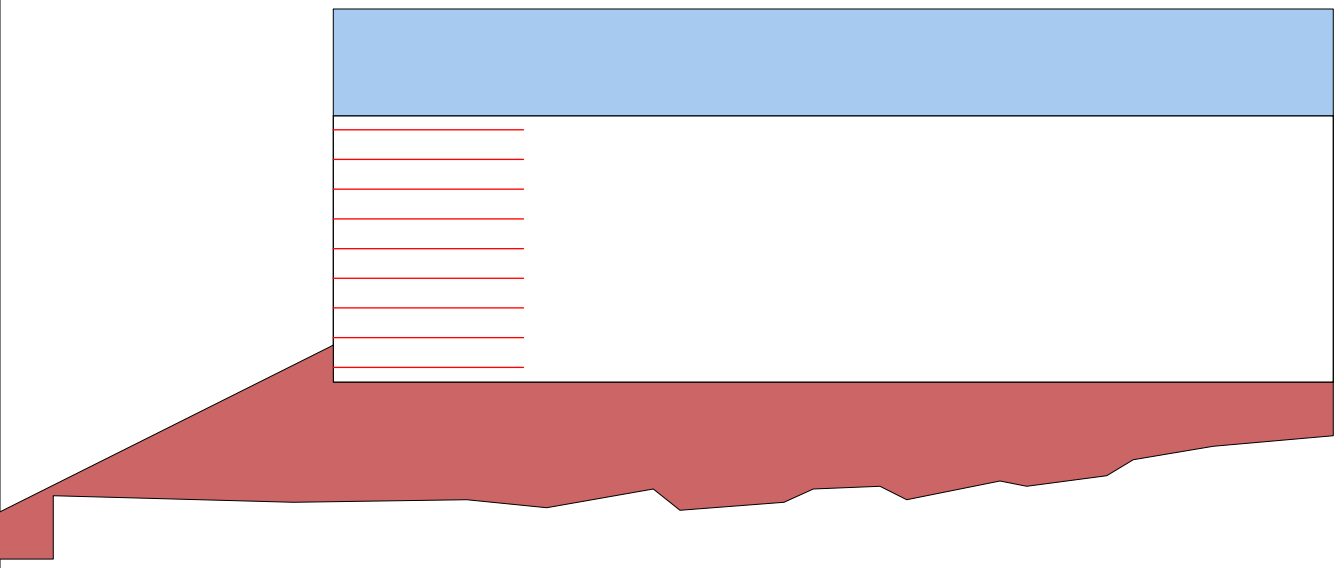
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	22.44	[ft]	{ Embedded depth is E = 3.12 ft, and height above top of finished bottom grade is H = 19.32 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10[ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 2.85, Meyerhof stress = 3739 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.145, Eccentricity, e/L = 0.1079, Fs-overturning = 4.64

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	16.00	1	N/A	6.95	7.72	7.717	22.397	3.317	0.0969	Caltrans W20
2	3.75	16.00	1	N/A	7.39	8.21	8.209	20.134	3.725	0.0767	Caltrans W20
3	6.25	16.00	1	N/A	7.49	8.32	8.324	17.922	4.249	0.0589	Caltrans W20
4	8.75	16.00	1	N/A	7.73	8.58	8.584	15.496	4.946	0.0433	Caltrans W20
5	11.25	16.00	1	N/A	8.32	9.25	9.247	13.278	5.924	0.0300	Caltrans W20
6	13.75	16.00	1	N/A	9.46	10.51	10.510	13.316	7.401	0.0191	Caltrans W20
7	16.25	16.00	1	N/A	11.39	12.66	12.657	13.288	9.913	0.0105	Caltrans W20
8	18.75	16.00	1	N/A	15.14	16.83	16.826	13.197	15.309	0.0043	Caltrans W20
9	21.25	16.00	1	N/A	25.65	28.50	28.501	13.410	39.433	0.0006	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

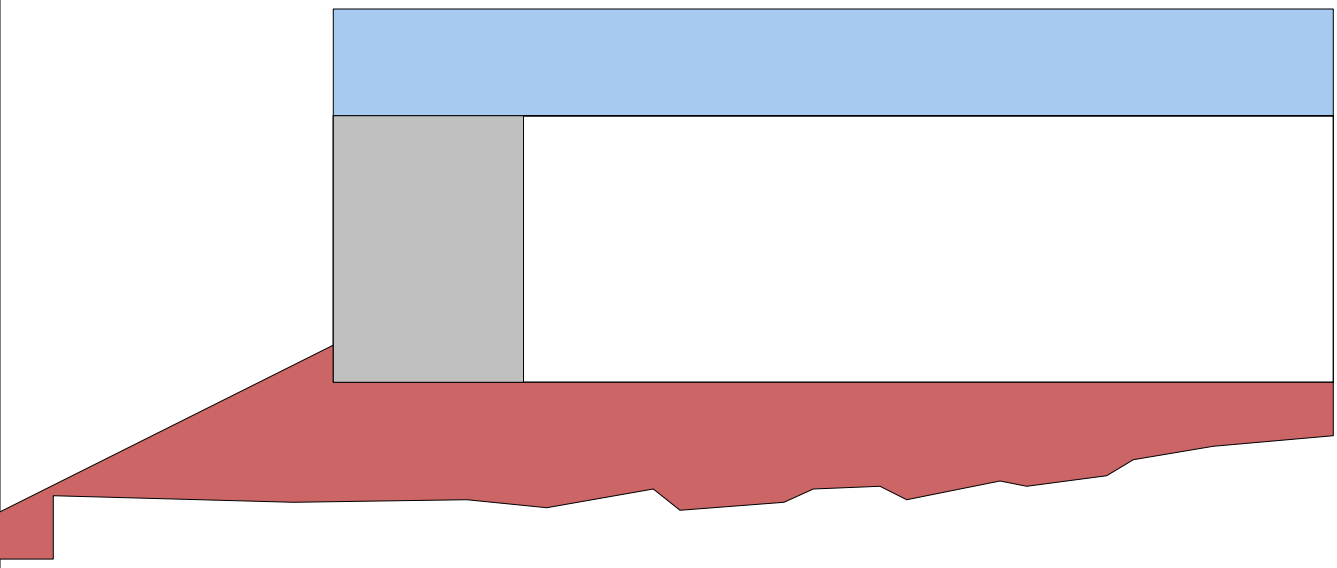
Bearing capacity, Fs = 1.21, Meyerhof stress = 6271 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.571, Eccentricity, e/L = 0.2662, Fs-overturning = 1.88

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	16.00	1	N/A	5.68	6.31	6.308	14.646	1.664	0.2374	Caltrans W20
2	3.75	16.00	1	N/A	6.08	6.76	6.761	13.265	1.888	0.1848	Caltrans W20
3	6.25	16.00	1	N/A	6.28	6.97	6.974	12.013	2.182	0.1387	Caltrans W20
4	8.75	16.00	1	N/A	6.57	7.30	7.305	10.549	2.585	0.0993	Caltrans W20
5	11.25	16.00	1	N/A	7.16	7.95	7.953	9.137	3.168	0.0664	Caltrans W20
6	13.75	16.00	1	N/A	7.98	8.87	8.870	8.991	4.092	0.0401	Caltrans W20
7	16.25	16.00	1	N/A	9.32	10.35	10.353	8.695	5.772	0.0204	Caltrans W20
8	18.75	16.00	1	N/A	11.69	12.98	12.984	8.147	9.772	0.0073	Caltrans W20
9	21.25	16.00	1	N/A	17.09	18.98	18.984	7.146	31.032	0.0008	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	10649	7582	[lb/ft ²]
Meyerhof stress, σ_V	3739.4	6271	[lb/ft ²]
Eccentricity, e	1.73	4.26	[ft]
Eccentricity, e/L	0.108	0.266	
Fs calculated	2.85	1.21	
Base length	16.00	16.00	[ft]



SCALE:

0 2 4 6 8 10[ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT
(for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.145 and Fs-seismic = 1.571

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	16.00	3.317	1.664	1	Caltrans W20
2	3.75	16.00	3.725	1.888	1	Caltrans W20
3	6.25	16.00	4.249	2.182	1	Caltrans W20
4	8.75	16.00	4.946	2.585	1	Caltrans W20
5	11.25	16.00	5.924	3.168	1	Caltrans W20
6	13.75	16.00	7.401	4.092	1	Caltrans W20
7	16.25	16.00	9.913	5.772	1	Caltrans W20
8	18.75	16.00	15.309	9.772	1	Caltrans W20
9	21.25	16.00	39.433	31.032	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1079, e/L seismic = 0.2662; Overturning: Fs-static = 4.64, Fs-seismic = 1.88

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	16.00	0.0969	0.2374	1	Caltrans W20
2	3.75	16.00	0.0767	0.1848	1	Caltrans W20
3	6.25	16.00	0.0589	0.1387	1	Caltrans W20
4	8.75	16.00	0.0433	0.0993	1	Caltrans W20
5	11.25	16.00	0.0300	0.0664	1	Caltrans W20
6	13.75	16.00	0.0191	0.0401	1	Caltrans W20
7	16.25	16.00	0.0105	0.0204	1	Caltrans W20
8	18.75	16.00	0.0043	0.0073	1	Caltrans W20
9	21.25	16.00	0.0006	0.0008	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2360.22	527.09	N/A	7.717	N/A	6.308
2	3.75	1.000	0.500	18213	2218.60	475.25	N/A	8.209	N/A	6.761
3	6.25	1.000	0.500	18213	2187.98	423.40	N/A	8.324	N/A	6.974
4	8.75	1.000	0.500	18213	2121.78	371.56	N/A	8.584	N/A	7.305
5	11.25	1.000	0.500	18213	1969.63	320.33	N/A	9.247	N/A	7.953
6	13.75	1.000	0.500	18213	1732.95	320.33	N/A	10.510	N/A	8.870
7	16.25	1.000	0.500	18213	1438.93	320.33	N/A	12.657	N/A	10.353
8	18.75	1.000	0.500	18213	1082.41	320.33	N/A	16.826	N/A	12.984
9	21.25	1.000	0.500	18213	639.04	320.33	N/A	28.501	N/A	18.984

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2360.2	527.1	15.25	0.75	52860.7	N/A	22.397	42288.6	N/A	14.646
2	3.75	1.000	2218.6	475.2	13.75	2.25	44668.9	N/A	20.134	35735.1	N/A	13.265
3	6.25	1.000	2188.0	423.4	12.25	3.75	39212.8	N/A	17.922	31370.3	N/A	12.013
4	8.75	1.000	2121.8	371.6	10.75	5.25	32878.7	N/A	15.496	26303.0	N/A	10.549
5	11.25	1.000	1969.6	320.3	9.27	6.73	26153.3	N/A	13.278	20922.6	N/A	9.137
6	13.75	1.000	1733.0	320.3	9.27	6.73	23076.7	N/A	13.316	18461.4	N/A	8.991
7	16.25	1.000	1438.9	320.3	9.27	6.73	19120.6	N/A	13.288	15296.4	N/A	8.695
8	18.75	1.000	1082.4	320.3	9.27	6.73	14284.9	N/A	13.197	11427.9	N/A	8.147
9	21.25	1.000	639.0	320.3	9.27	6.73	8569.7	N/A	13.410	6855.8	N/A	7.146

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2360	0.90	16392	18213	N/A	6.95	N/A	7.72	Caltrans W20
2	3.75	1.000	0.500	2219	0.90	16392	18213	N/A	7.39	N/A	8.21	Caltrans W20
3	6.25	1.000	0.500	2188	0.90	16392	18213	N/A	7.49	N/A	8.32	Caltrans W20
4	8.75	1.000	0.500	2122	0.90	16392	18213	N/A	7.73	N/A	8.58	Caltrans W20
5	11.25	1.000	0.500	1970	0.90	16392	18213	N/A	8.32	N/A	9.25	Caltrans W20
6	13.75	1.000	0.500	1733	0.90	16392	18213	N/A	9.46	N/A	10.51	Caltrans W20
7	16.25	1.000	0.500	1439	0.90	16392	18213	N/A	11.39	N/A	12.66	Caltrans W20
8	18.75	1.000	0.500	1082	0.90	16392	18213	N/A	15.14	N/A	16.83	Caltrans W20
9	21.25	1.000	0.500	639	0.90	16392	18213	N/A	25.65	N/A	28.50	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

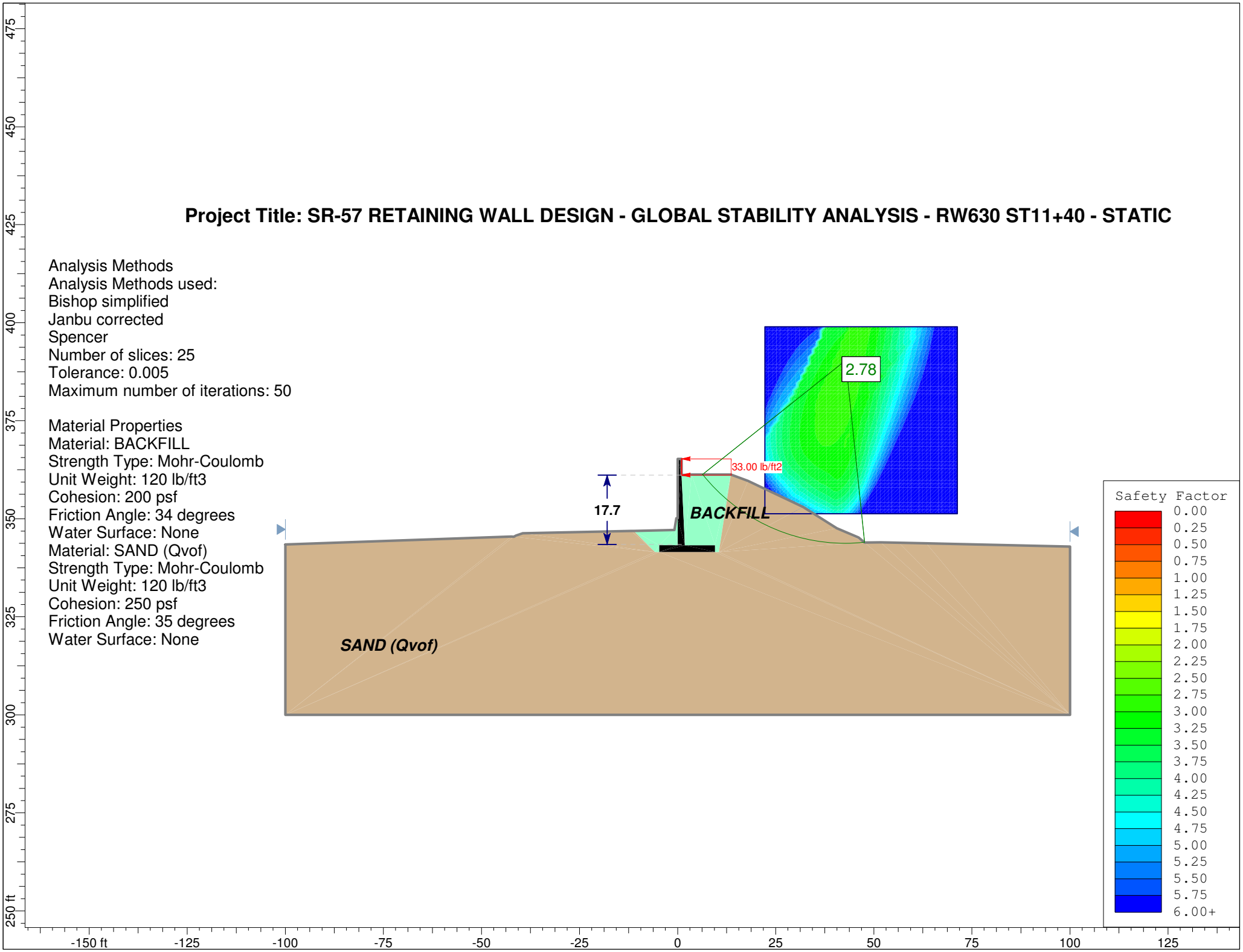
#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2887	0.90	16392	18213	N/A	5.68	N/A	6.31	Caltrans W20
2	3.75	1.000	0.500	2694	0.90	16392	18213	N/A	6.08	N/A	6.76	Caltrans W20
3	6.25	1.000	0.500	2611	0.90	16392	18213	N/A	6.28	N/A	6.97	Caltrans W20
4	8.75	1.000	0.500	2493	0.90	16392	18213	N/A	6.57	N/A	7.30	Caltrans W20
5	11.25	1.000	0.500	2290	0.90	16392	18213	N/A	7.16	N/A	7.95	Caltrans W20
6	13.75	1.000	0.500	2053	0.90	16392	18213	N/A	7.98	N/A	8.87	Caltrans W20
7	16.25	1.000	0.500	1759	0.90	16392	18213	N/A	9.32	N/A	10.35	Caltrans W20
8	18.75	1.000	0.500	1403	0.90	16392	18213	N/A	11.69	N/A	12.98	Caltrans W20
9	21.25	1.000	0.500	959	0.90	16392	18213	N/A	17.09	N/A	18.98	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST11+40 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None
Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 250 psf
Friction Angle: 35 degrees
Water Surface: None



Slide Analysis Information

Document Name

File Name: RW630_ST11+40_STATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST11+40 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 33 lb/ft2

Material Properties

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 250 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 2.778930
Center: 42.825, 390.378
Radius: 46.670
Left Slip Surface Endpoint: 6.329, 361.290
Right Slip Surface Endpoint: 47.640, 343.957
Resisting Moment=1.47907e+006 lb-ft
Driving Moment=532242 lb-ft

Method: janbu corrected
FS: 2.766950
Center: 38.898, 376.077
Radius: 34.319
Left Slip Surface Endpoint: 7.928, 361.290
Right Slip Surface Endpoint: 51.075, 343.991
Resisting Horizontal Force=36846.7 lb
Driving Horizontal Force=13316.7 lb

Method: spencer
FS: 2.775650
Center: 42.825, 390.378
Radius: 46.670
Left Slip Surface Endpoint: 6.329, 361.290
Right Slip Surface Endpoint: 47.640, 343.957
Resisting Moment=1.47732e+006 lb-ft
Driving Moment=532242 lb-ft
Resisting Horizontal Force=28605.3 lb
Driving Horizontal Force=10305.8 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 21165
Number of Invalid Surfaces: 7446
Error Codes:
Error Code -99 reported for 5810 surfaces
Error Code -103 reported for 798 surfaces
Error Code -105 reported for 20 surfaces
Error Code -106 reported for 180 surfaces
Error Code -107 reported for 1 surface
Error Code -109 reported for 481 surfaces

Error Code -112 reported for 156 surfaces

Method: janbu corrected
Number of Valid Surfaces: 20956
Number of Invalid Surfaces: 7655
Error Codes:
Error Code -99 reported for 5810 surfaces
Error Code -103 reported for 798 surfaces
Error Code -105 reported for 20 surfaces
Error Code -106 reported for 180 surfaces
Error Code -107 reported for 1 surface
Error Code -108 reported for 31 surfaces
Error Code -109 reported for 481 surfaces
Error Code -111 reported for 229 surfaces
Error Code -112 reported for 105 surfaces

Method: spencer
Number of Valid Surfaces: 20853
Number of Invalid Surfaces: 7758
Error Codes:
Error Code -99 reported for 5810 surfaces
Error Code -103 reported for 798 surfaces
Error Code -105 reported for 20 surfaces
Error Code -106 reported for 180 surfaces
Error Code -107 reported for 1 surface
Error Code -108 reported for 34 surfaces
Error Code -109 reported for 481 surfaces
Error Code -111 reported for 272 surfaces
Error Code -112 reported for 162 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

22.208	351.288
71.296	351.288
71.296	398.958
22.208	398.958

Material Boundary

0.000	350.120
0.000	343.250
-4.750	343.250
-4.750	341.500
9.500	341.500
9.500	343.250
1.843	343.250
1.010	361.110

Material Boundary

9.500	341.500
10.500	341.500
13.540	361.290

Material Boundary

-11.188	346.905
-5.750	341.500
-4.750	341.500

External Boundary

-100.000	343.420
-100.000	300.000
100.000	300.000
100.000	342.920
63.370	343.750
56.410	343.890
51.710	344.000
47.660	343.940
46.130	345.210
40.540	347.600
31.980	353.020
17.940	359.640
13.540	361.290
3.550	361.290
1.010	361.110
1.010	365.250
0.000	365.250
0.000	350.120
-0.340	350.120
-0.430	349.550
-0.820	347.120
-11.188	346.905
-11.862	346.891
-39.526	346.318
-41.210	345.720
-41.760	345.420
-42.388	345.452

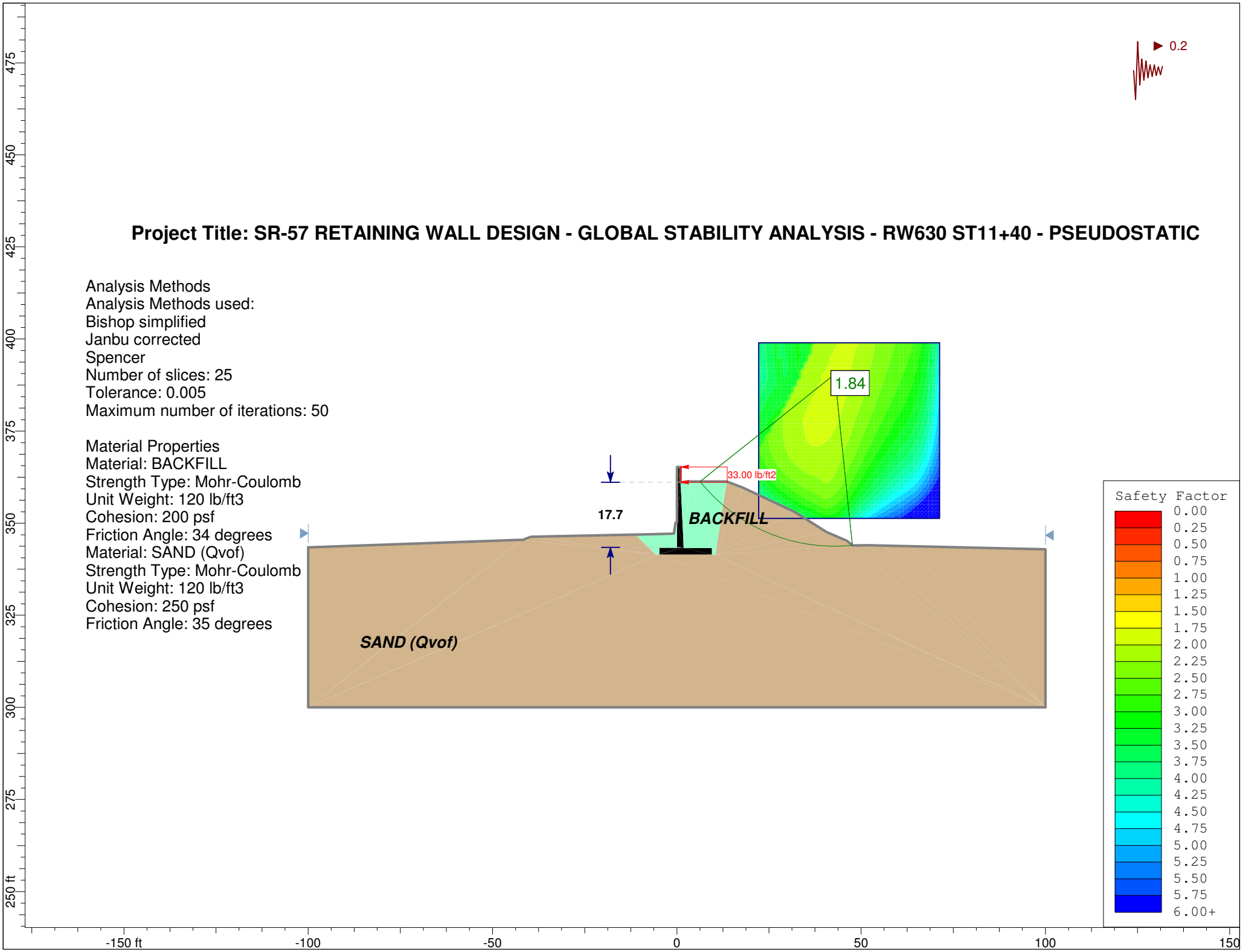
Distributed Load

1.010	361.110
1.010	365.250

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST11+40 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 250 psf
Friction Angle: 35 degrees



Slide Analysis Information

Document Name

File Name: RW630_ST11+40_PSEUDOSTATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST11+40 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 33 lb/ft2

Material Properties

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 250 psf
Friction Angle: 35 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.840100
Center: 42.825, 390.378
Radius: 46.670
Left Slip Surface Endpoint: 6.329, 361.290
Right Slip Surface Endpoint: 47.640, 343.957
Resisting Moment=1.41228e+006 lb-ft
Driving Moment=767503 lb-ft

Method: janbu corrected
FS: 1.796390
Center: 39.880, 384.657
Radius: 41.462
Left Slip Surface Endpoint: 5.630, 361.290
Right Slip Surface Endpoint: 47.703, 343.941
Resisting Horizontal Force=32226.7 lb
Driving Horizontal Force=17939.7 lb

Method: spencer
FS: 1.842250
Center: 42.825, 390.378
Radius: 46.670
Left Slip Surface Endpoint: 6.329, 361.290
Right Slip Surface Endpoint: 47.640, 343.957
Resisting Moment=1.41393e+006 lb-ft
Driving Moment=767503 lb-ft
Resisting Horizontal Force=27567.8 lb
Driving Horizontal Force=14964.2 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 21200
Number of Invalid Surfaces: 7411
Error Codes:
Error Code -99 reported for 5810 surfaces
Error Code -103 reported for 798 surfaces
Error Code -105 reported for 20 surfaces
Error Code -106 reported for 180 surfaces
Error Code -109 reported for 482 surfaces

Error Code -112 reported for 121 surfaces

Method: janbu corrected
Number of Valid Surfaces: 20643
Number of Invalid Surfaces: 7968
Error Codes:
Error Code -99 reported for 5810 surfaces
Error Code -103 reported for 798 surfaces
Error Code -105 reported for 20 surfaces
Error Code -106 reported for 180 surfaces
Error Code -108 reported for 26 surfaces
Error Code -109 reported for 482 surfaces
Error Code -111 reported for 36 surfaces
Error Code -112 reported for 616 surfaces

Method: spencer
Number of Valid Surfaces: 20318
Number of Invalid Surfaces: 8293
Error Codes:
Error Code -99 reported for 5810 surfaces
Error Code -103 reported for 798 surfaces
Error Code -105 reported for 20 surfaces
Error Code -106 reported for 180 surfaces
Error Code -108 reported for 40 surfaces
Error Code -109 reported for 482 surfaces
Error Code -111 reported for 339 surfaces
Error Code -112 reported for 624 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

22.208	351.288
71.296	351.288
71.296	398.958
22.208	398.958

Material Boundary

0.000	350.120
0.000	343.250
-4.750	343.250
-4.750	341.500
9.500	341.500
9.500	343.250
1.843	343.250
1.010	361.110

Material Boundary

9.500	341.500
10.500	341.500
13.540	361.290

Material Boundary

-11.188	346.905
-5.750	341.500
-4.750	341.500

External Boundary

-100.000	343.420
-100.000	300.000
100.000	300.000
100.000	342.920
63.370	343.750
56.410	343.890

51.710	344.000
47.660	343.940
46.130	345.210
40.540	347.600
31.980	353.020
17.940	359.640
13.540	361.290
3.550	361.290
1.010	361.110
1.010	365.250
0.000	365.250
0.000	350.120
-0.340	350.120
-0.430	349.550
-0.820	347.120
-11.188	346.905
-11.862	346.891
-39.526	346.318
-41.210	345.720
-41.760	345.420
-42.388	345.452

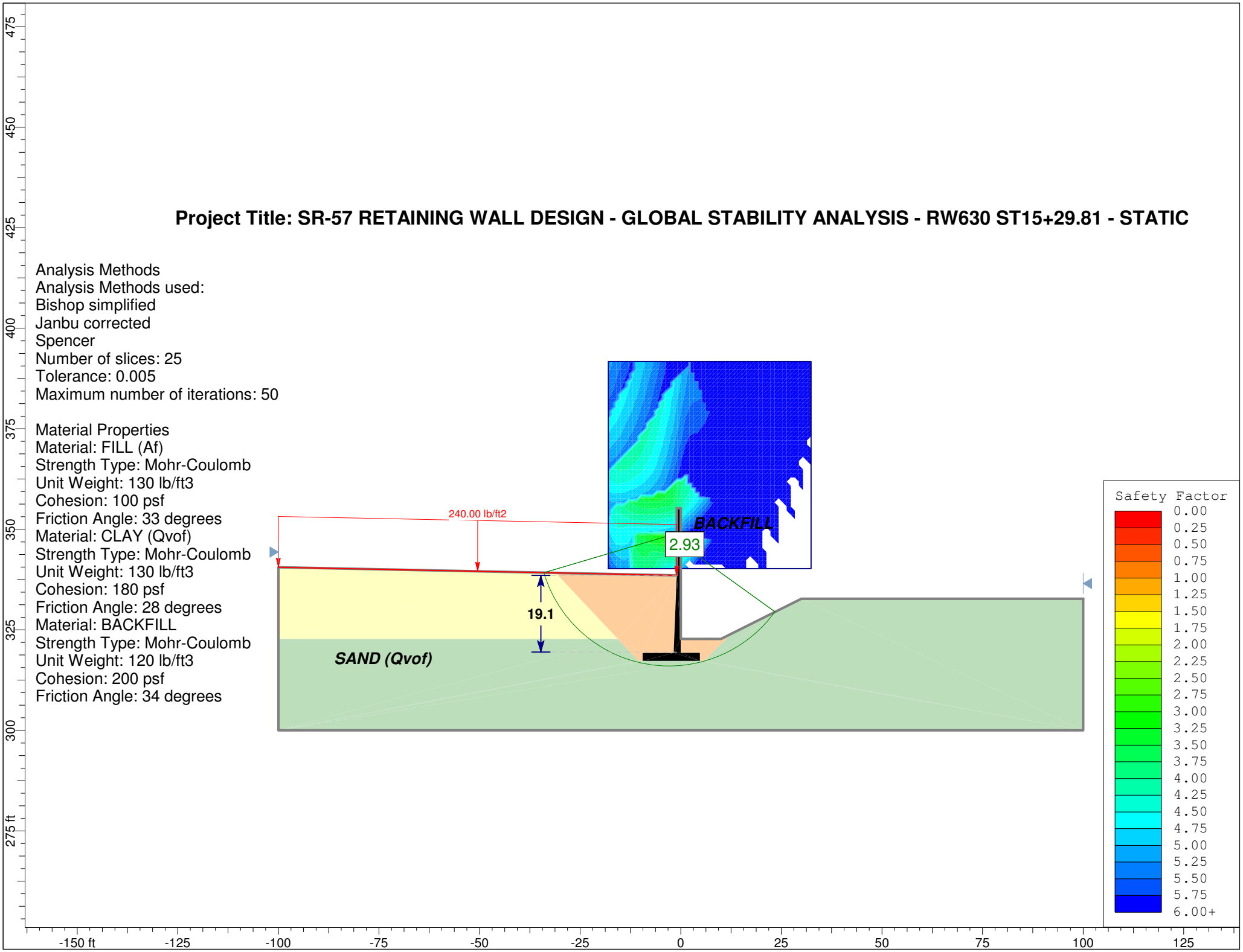
Distributed Load

1.010	361.110
1.010	365.250

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST15+29.81 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW630_ST15+30_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST15+29.81 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 33 degrees
Water Surface: None

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Global Minimums

Method: bishop simplified
FS: 2.934340
Center: -2.885, 348.449
Radius: 32.469
Left Slip Surface Endpoint: -34.012, 339.210
Right Slip Surface Endpoint: 23.437, 329.439
Resisting Moment=2.23677e+006 lb-ft
Driving Moment=762273 lb-ft

Method: spencer
FS: 2.933350
Center: -2.885, 348.449
Radius: 32.469
Left Slip Surface Endpoint: -34.012, 339.210
Right Slip Surface Endpoint: 23.437, 329.439
Resisting Moment=2.23601e+006 lb-ft
Driving Moment=762273 lb-ft
Resisting Horizontal Force=59439.5 lb
Driving Horizontal Force=20263.4 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 4853
Number of Invalid Surfaces: 23758
Error Codes:
Error Code -99 reported for 9076 surfaces
Error Code -103 reported for 10043 surfaces
Error Code -105 reported for 66 surfaces
Error Code -106 reported for 5 surfaces
Error Code -107 reported for 1694 surfaces
Error Code -109 reported for 2860 surfaces
Error Code -112 reported for 14 surfaces

Method: spencer

Number of Valid Surfaces: 4804
Number of Invalid Surfaces: 23807
Error Codes:
Error Code -99 reported for 9076 surfaces
Error Code -103 reported for 10043 surfaces
Error Code -105 reported for 66 surfaces
Error Code -106 reported for 5 surfaces
Error Code -107 reported for 1694 surfaces
Error Code -108 reported for 8 surfaces
Error Code -109 reported for 2860 surfaces
Error Code -111 reported for 40 surfaces
Error Code -112 reported for 15 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

-17.996	340.212
32.374	340.212
32.374	391.691
-17.996	391.691

Material Boundary

-0.989	338.550
-1.793	319.250
-9.500	319.250
-9.500	317.250
4.750	317.250
4.750	319.250
0.000	319.250
0.000	322.720

Material Boundary

4.750	317.250
5.750	317.250
12.488	323.964

Material Boundary

-31.118	339.152
-15.649	322.720
-10.500	317.250
-9.500	317.250

Material Boundary

-100.000	322.720
-15.649	322.720

External Boundary

100.000	332.720
30.000	332.720
12.488	323.964
10.000	322.720
0.000	322.720
0.000	355.250
-0.989	355.250
-0.989	338.550
-31.118	339.152
-100.000	340.530

-100.000	322.720
-100.000	300.000
100.000	300.000

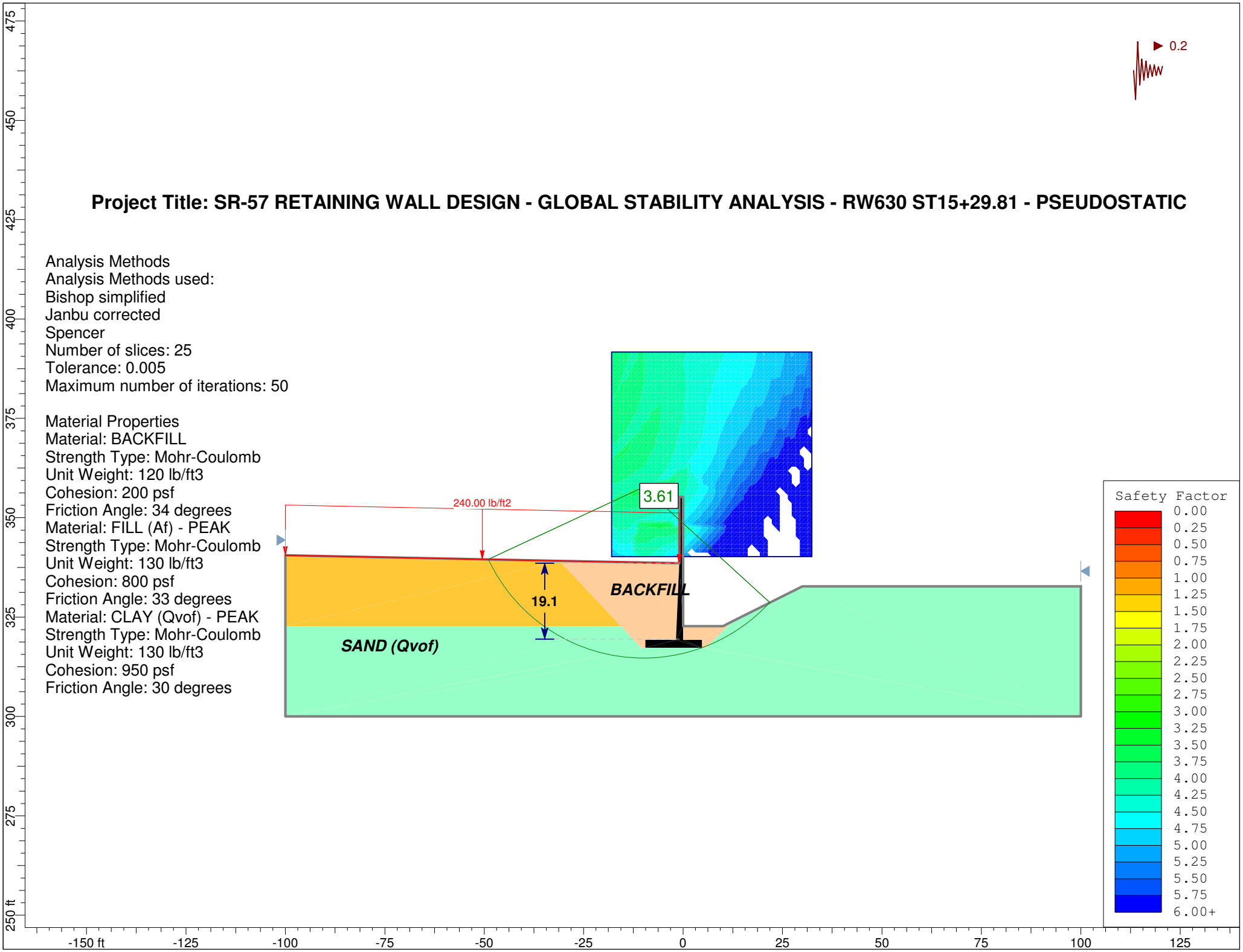
Distributed Load

-100.000	340.530
-31.118	339.152
-0.989	338.550

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST15+29.81 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees



Slide Analysis Information

Document Name

File Name: RW630_ST15+30_Pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST15+29.81 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Water Surface: None

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 3.608050
Center: -9.937, 357.715
Radius: 43.068
Left Slip Surface Endpoint: -48.968, 339.509
Right Slip Surface Endpoint: 21.832, 328.636
Resisting Moment=6.96839e+006 lb-ft
Driving Moment=1.93134e+006 lb-ft

Method: spencer
FS: 3.620770
Center: -9.937, 357.715
Radius: 43.068
Left Slip Surface Endpoint: -48.968, 339.509
Right Slip Surface Endpoint: 21.832, 328.636
Resisting Moment=6.99295e+006 lb-ft
Driving Moment=1.93134e+006 lb-ft
Resisting Horizontal Force=142921 lb
Driving Horizontal Force=39472.5 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 5090
Number of Invalid Surfaces: 23521
Error Codes:
Error Code -99 reported for 9076 surfaces
Error Code -103 reported for 10043 surfaces
Error Code -105 reported for 66 surfaces
Error Code -106 reported for 5 surfaces
Error Code -107 reported for 1126 surfaces
Error Code -108 reported for 1 surface
Error Code -109 reported for 3197 surfaces
Error Code -112 reported for 7 surfaces

Method: spencer
Number of Valid Surfaces: 4896
Number of Invalid Surfaces: 23715
Error Codes:
Error Code -99 reported for 9076 surfaces
Error Code -103 reported for 10043 surfaces
Error Code -105 reported for 66 surfaces
Error Code -106 reported for 5 surfaces
Error Code -107 reported for 1126 surfaces
Error Code -108 reported for 24 surfaces
Error Code -109 reported for 3197 surfaces
Error Code -111 reported for 171 surfaces
Error Code -112 reported for 7 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

-17.996	340.212
32.374	340.212
32.374	391.691
-17.996	391.691

Material Boundary

-0.989	338.550
-1.793	319.250
-9.500	319.250
-9.500	317.250
4.750	317.250
4.750	319.250
0.000	319.250
0.000	322.720

Material Boundary

4.750	317.250
5.750	317.250
12.488	323.964

Material Boundary

-31.118	339.152
-15.649	322.720
-10.500	317.250
-9.500	317.250

Material Boundary

-100.000	322.720
-15.649	322.720

External Boundary

100.000	332.720
30.000	332.720
12.488	323.964
10.000	322.720
0.000	322.720
0.000	355.250
-0.989	355.250
-0.989	338.550

-31.118	339.152
-100.000	340.530
-100.000	322.720
-100.000	300.000
100.000	300.000

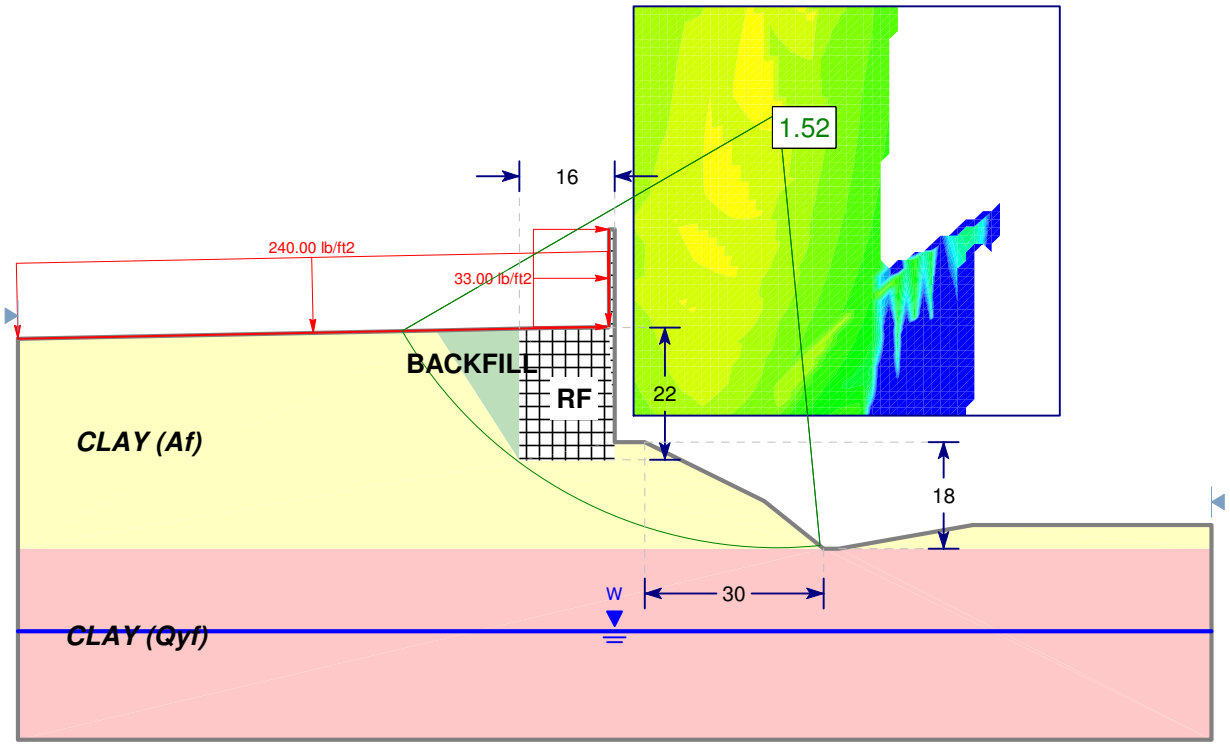
Distributed Load

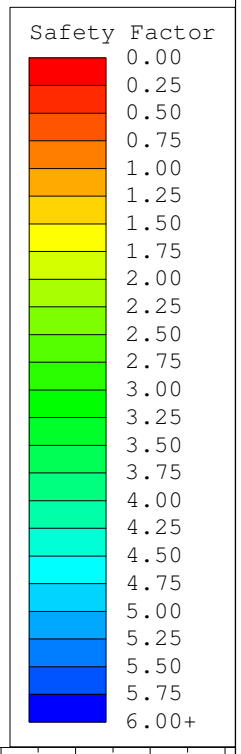
-100.000	340.530
-31.118	339.152
-0.989	338.550

Project Title: SR-57 - RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST18+60 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: CLAY (Qyf)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 900 psf
Friction Angle: 15 degrees





Slide Analysis Information

Document Name

File Name: RW630_ST18+60_Static.sli

Project Settings

Project Title: SR-57 - RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST18+60 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Normal to boundary, Magnitude: 33 lb/ft2

Material Properties

Material: CLAY (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: CLAY (Qyf)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 900 psf
Friction Angle: 15 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.518770
Center: 27.425, 365.051
Radius: 72.908
Left Slip Surface Endpoint: -35.653, 328.490
Right Slip Surface Endpoint: 34.403, 292.478
Resisting Moment=6.83106e+006 lb-ft
Driving Moment=4.49775e+006 lb-ft

Method: spencer
FS: 1.517000
Center: 27.425, 365.051
Radius: 72.908
Left Slip Surface Endpoint: -35.653, 328.490
Right Slip Surface Endpoint: 34.403, 292.478
Resisting Moment=6.82307e+006 lb-ft
Driving Moment=4.49775e+006 lb-ft
Resisting Horizontal Force=81537.1 lb
Driving Horizontal Force=53749.1 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 7453
Number of Invalid Surfaces: 21158
Error Codes:
Error Code -99 reported for 5913 surfaces
Error Code -100 reported for 117 surfaces
Error Code -103 reported for 1796 surfaces

Error Code -105 reported for 24 surfaces
Error Code -106 reported for 103 surfaces
Error Code -107 reported for 4586 surfaces
Error Code -108 reported for 526 surfaces
Error Code -109 reported for 8035 surfaces
Error Code -112 reported for 30 surfaces
Error Code -113 reported for 28 surfaces

Method: spencer
Number of Valid Surfaces: 7206
Number of Invalid Surfaces: 21405
Error Codes:
Error Code -99 reported for 5913 surfaces
Error Code -100 reported for 117 surfaces
Error Code -103 reported for 1796 surfaces
Error Code -105 reported for 24 surfaces
Error Code -106 reported for 103 surfaces
Error Code -107 reported for 4586 surfaces
Error Code -108 reported for 629 surfaces
Error Code -109 reported for 8035 surfaces
Error Code -111 reported for 36 surfaces
Error Code -112 reported for 138 surfaces
Error Code -113 reported for 28 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

3.144	314.303
74.558	314.303
74.558	382.881
3.144	382.881

Material Boundary

-16.000	328.887
-16.000	306.750
0.000	306.750
0.000	309.870

Material Boundary

-100.000	292.000
35.000	292.000

Material Boundary

37.500	292.000
100.000	292.000

Material Boundary

-29.997	328.604
-16.000	306.750

External Boundary

-100.000	327.190
-100.000	292.000
-100.000	260.000
100.000	260.000
100.000	292.000
100.000	296.000
60.000	296.000
37.500	292.000
35.000	292.000
25.000	300.000
5.000	309.870
0.000	309.870
0.000	345.520
-1.000	345.520
-1.000	329.190
-16.000	328.887
-29.997	328.604

Water Table

-100.000	278.200
100.000	278.200

Distributed Load

-1.000	329.190
-16.000	328.887
-100.000	327.190

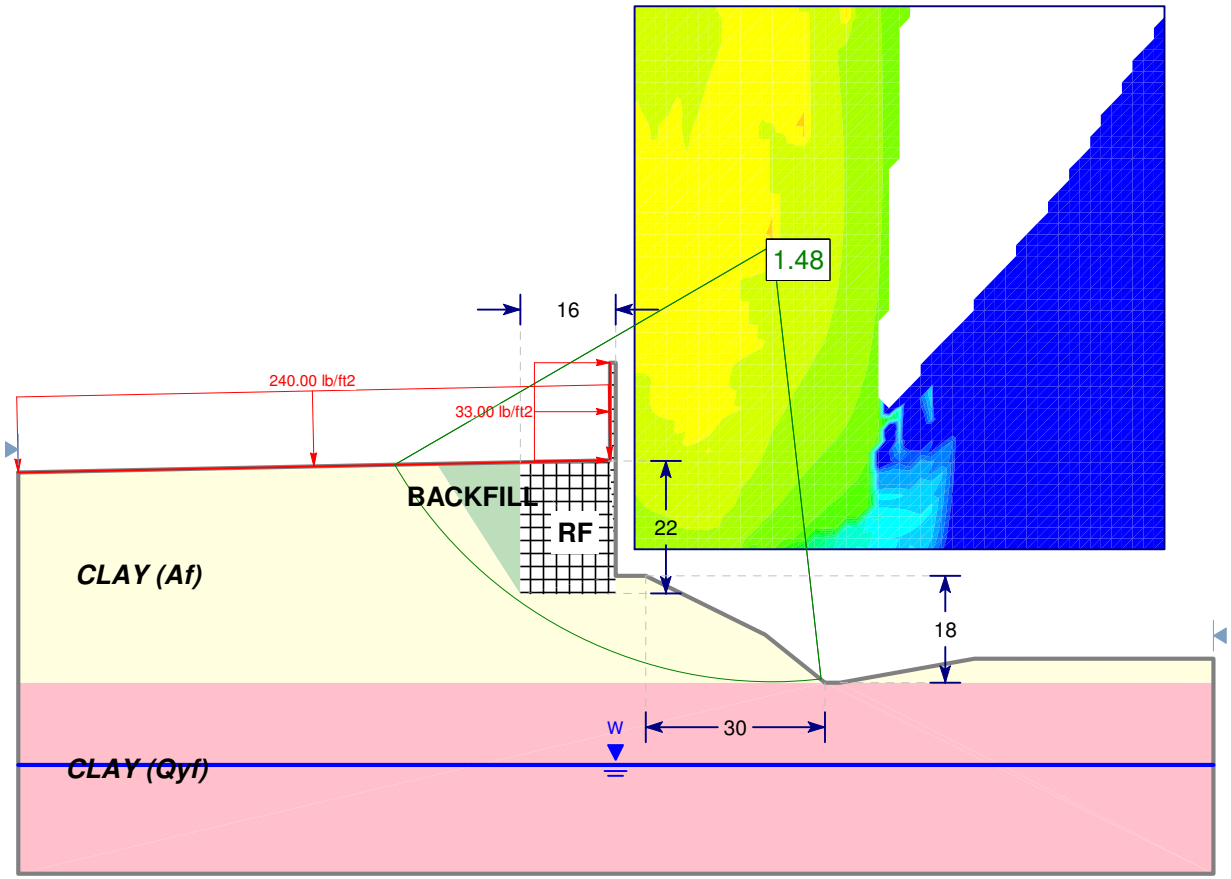
Distributed Load

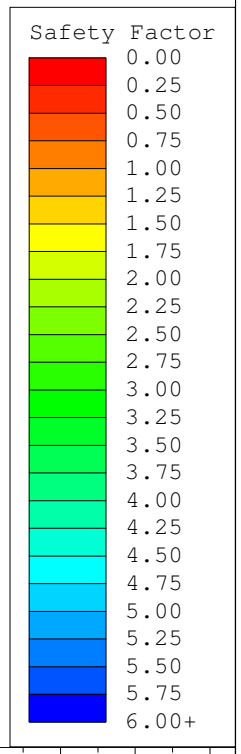
-1.000	345.520
-1.000	329.190

Project Title: SR-57 - RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST18+60 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: CLAY (Qyf) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1400 psf
Friction Angle: 14 degrees
Material: CLAY (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 500 psf
Friction Angle: 33 degrees





Slide Analysis Information

Document Name

File Name: RW630_ST18+60_Psedostatic.sli

Project Settings

Project Title: SR-57 - RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW630 ST18+60 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Normal to boundary, Magnitude: 33 lb/ft2

Material Properties

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: CLAY (Qyf) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1400 psf
Friction Angle: 14 degrees
Water Surface: Water Table
Custom Hu value: 0

Material: CLAY (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 500 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.479600
Center: 26.197, 365.185
Radius: 73.115
Left Slip Surface Endpoint: -37.027, 328.462
Right Slip Surface Endpoint: 34.343, 292.525
Resisting Moment=9.04046e+006 lb-ft
Driving Moment=6.11009e+006 lb-ft

Method: spencer
FS: 1.485320
Center: 31.517, 383.357
Radius: 91.238
Left Slip Surface Endpoint: -41.295, 328.376
Right Slip Surface Endpoint: 34.779, 292.177
Resisting Moment=1.16406e+007 lb-ft
Driving Moment=7.83709e+006 lb-ft
Resisting Horizontal Force=113739 lb
Driving Horizontal Force=76575.4 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 13485
Number of Invalid Surfaces: 15126
Error Codes:
Error Code -99 reported for 5031 surfaces
Error Code -100 reported for 76 surfaces

Error Code -103 reported for 1103 surfaces
Error Code -105 reported for 12 surfaces
Error Code -106 reported for 165 surfaces
Error Code -109 reported for 8645 surfaces
Error Code -112 reported for 74 surfaces
Error Code -113 reported for 20 surfaces

Method: spencer
Number of Valid Surfaces: 13154
Number of Invalid Surfaces: 15457
Error Codes:
Error Code -99 reported for 5031 surfaces
Error Code -100 reported for 76 surfaces
Error Code -103 reported for 1103 surfaces
Error Code -105 reported for 12 surfaces
Error Code -106 reported for 165 surfaces
Error Code -108 reported for 20 surfaces
Error Code -109 reported for 8645 surfaces
Error Code -111 reported for 118 surfaces
Error Code -112 reported for 267 surfaces
Error Code -113 reported for 20 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

3.144	314.303
91.809	314.303
91.809	405.163
3.144	405.163

Material Boundary

-16.000	328.887
-16.000	306.750
0.000	306.750
0.000	309.870

Material Boundary

-100.000	292.000
35.000	292.000

Material Boundary

37.500	292.000
100.000	292.000

Material Boundary

-29.997	328.604
-16.000	306.750

External Boundary

-100.000	327.190
-100.000	292.000
-100.000	260.000
100.000	260.000
100.000	292.000
100.000	296.000
60.000	296.000

37.500	292.000
35.000	292.000
25.000	300.000
5.000	309.870
0.000	309.870
0.000	345.520
-1.000	345.520
-1.000	329.190
-16.000	328.887
-29.997	328.604

Water Table

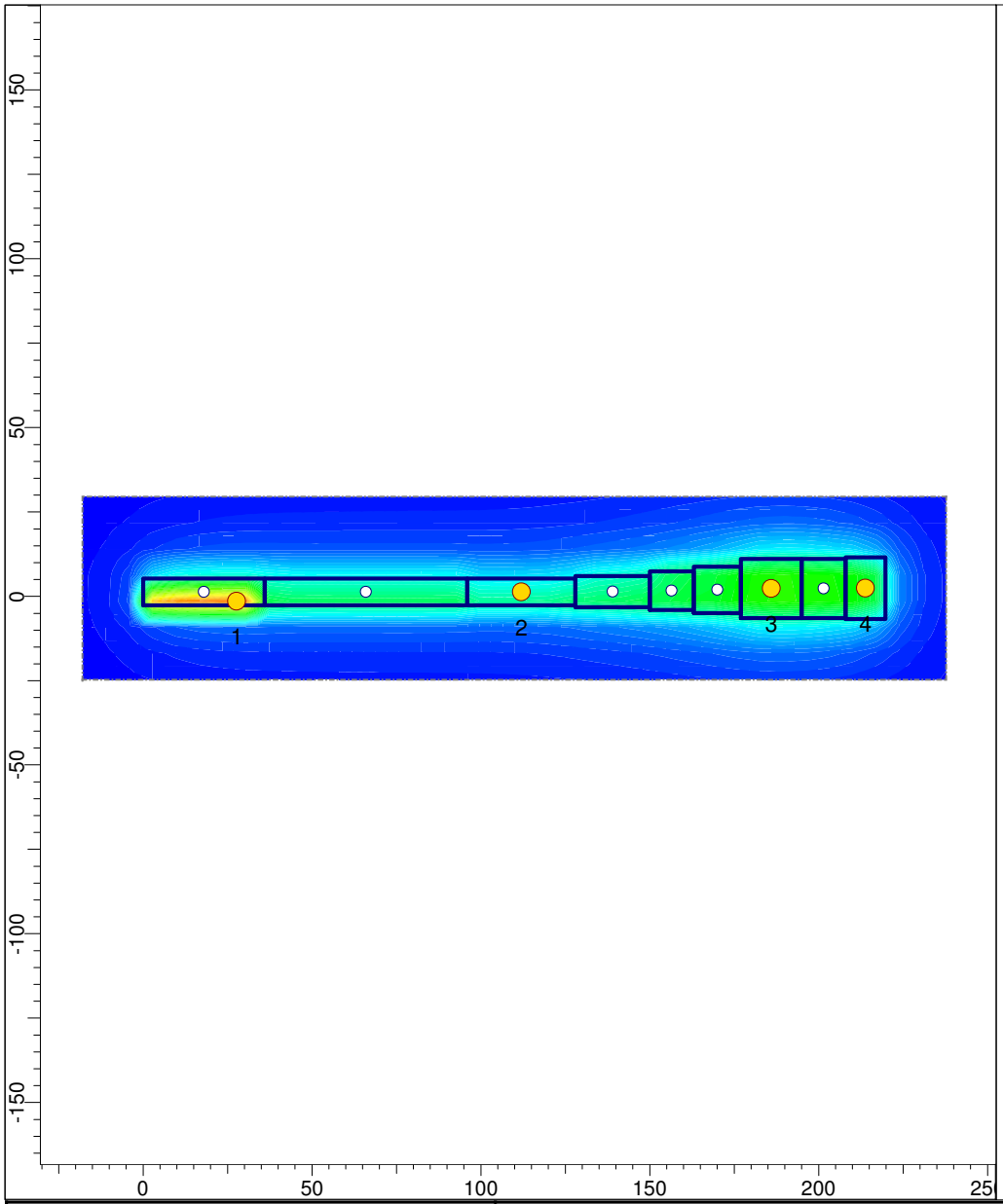
-100.000	278.200
100.000	278.200

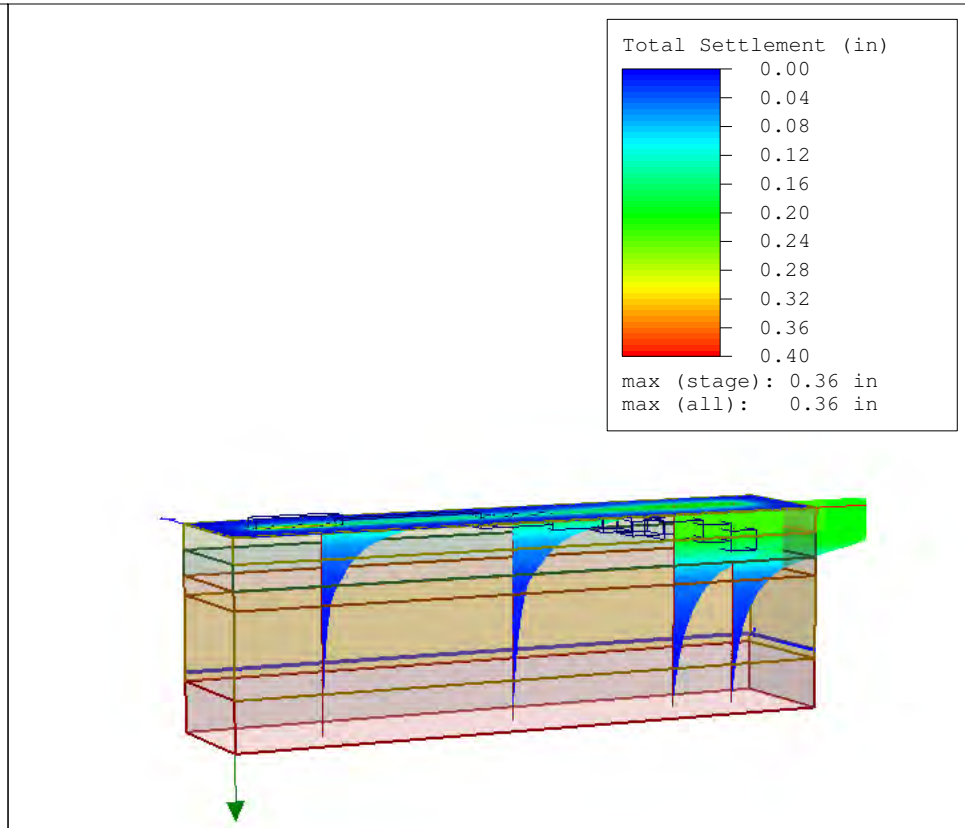
Distributed Load

-1.000	329.190
-16.000	328.887
-100.000	327.190

Distributed Load

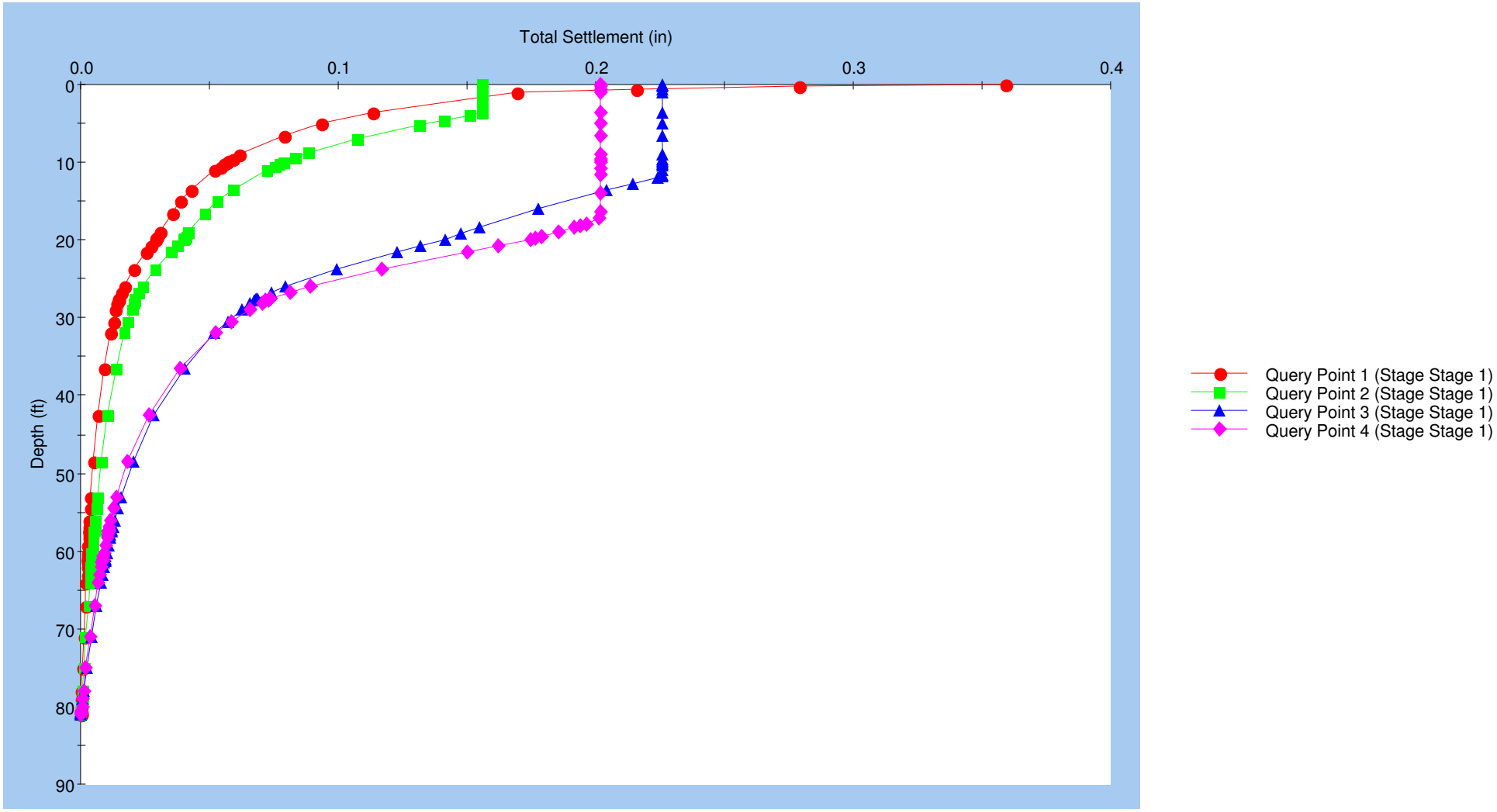
-1.000	345.520
-1.000	329.190





rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW630 ST13+10 to ST15+29.81	
	Drawn By RB	*Company*	CH2M HILL
	Date 2/26/2009, 10:07:04 AM	*File Name*	RW630_ST13+10_ST15+30.s3z

Total Settlement vs. Depth



Reference Stage: None

rocscience	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW630 ST13+10 to ST15+29.81	
	Drawn By	RB	*Company* CH2M HILL
SETTLE3D 1.011	*Date*	2/26/2009, 10:07:04 AM	*File Name* RW630_ST13+10_ST15+30.s3z

Settle3D Analysis Information

Project Settings

Project Title: SR-57 Settlement Analysis
Analysis: RW630 ST13+10 to ST15+29.81
Author: RB
Company: CH2M HILL
Date Created: 2/26/2009, 10:07:04 AM
Stress Computation Method: Boussinesq
Groundwater method: Water Table
Water Unit Weight: 0.0624 kips/ft^3
Depth to water table: 57.55 [ft]

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.359091
Consolidation Settlement [in]	0	0.359091
Immediate Settlement [in]	0	0
Loading Stress [ksf]	0	2.74052
Effective Stress [ksf]	0	9.26843
Total Stress [ksf]	0	10.7317
Total Strain	0	0.0335054
Pore Water Pressure [ksf]	0	1.46328
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 36 ft
Width: 8 ft
Rotation angle: 0 degrees
Load: 1.155 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
0	-2.75
36	-2.75
36	5.25
0	5.25

Rectangular Load

Length: 60 ft
Width: 8 ft
Rotation angle: 0 degrees
Load: 1.155 ksf
Depth: 2 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
36	-2.75
96	-2.75
96	5.25
36	5.25

Rectangular Load

Length: 32 ft
Width: 8 ft
Rotation angle: 0 degrees
Load: 1.155 ksf
Depth: 4 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
96	-2.75
128	-2.75
128	5.25
96	5.25

Rectangular Load

Length: 22 ft
Width: 9.25 ft
Rotation angle: 0 degrees
Load: 1.443 ksf
Depth: 6 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
128	-3.25
150	-3.25
150	6
128	6

Rectangular Load

Length: 13 ft
Width: 11.5 ft
Rotation angle: 0 degrees
Load: 1.495 ksf
Depth: 8 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
150	-4.125
163	-4.125
163	7.375
150	7.375

Rectangular Load

Length: 14 ft
Width: 13.75 ft
Rotation angle: 0 degrees
Load: 1.67 ksf
Depth: 10 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
163	-5
177	-5
177	8.75
163	8.75

Rectangular Load

Length: 18 ft
Width: 17.5 ft
Rotation angle: 0 degrees
Load: 2.032 ksf
Depth: 12 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
177	-6.5
195	-6.5
195	11
177	11

Rectangular Load

Length: 13 ft
Width: 17.5 ft
Rotation angle: 0 degrees
Load: 2.032 ksf
Depth: 14 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
195	-6.5
208	-6.5
208	11
195	11

Rectangular Load

Length: 11.81 ft
Width: 18.25 ft
Rotation angle: 0 degrees
Load: 2.323 ksf
Depth: 18 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
208	-6.75
219.81	-6.75
219.81	11.5
208	11.5

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	CLAY 1 (Qvof)	10	0
2	CLAY 2 (Qvof)	10	10
3	FAT CLAY (Qvof)	7.5	20
4	CLAY 3 (Qvof)	33.5	27.5
5	CLAY 4 (Qvof)	20	61

Soil Properties

CLAY 1 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.03

Cre	0.003
OCR	8.5

CLAY 2 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.03
Cre	0.003
OCR	6

FAT CLAY (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.05
Cre	0.005
OCR	2.5

CLAY 3 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.03
Cre	0.003
OCR	5

CLAY 4 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.03
Cre	0.003
OCR	2

Query Points

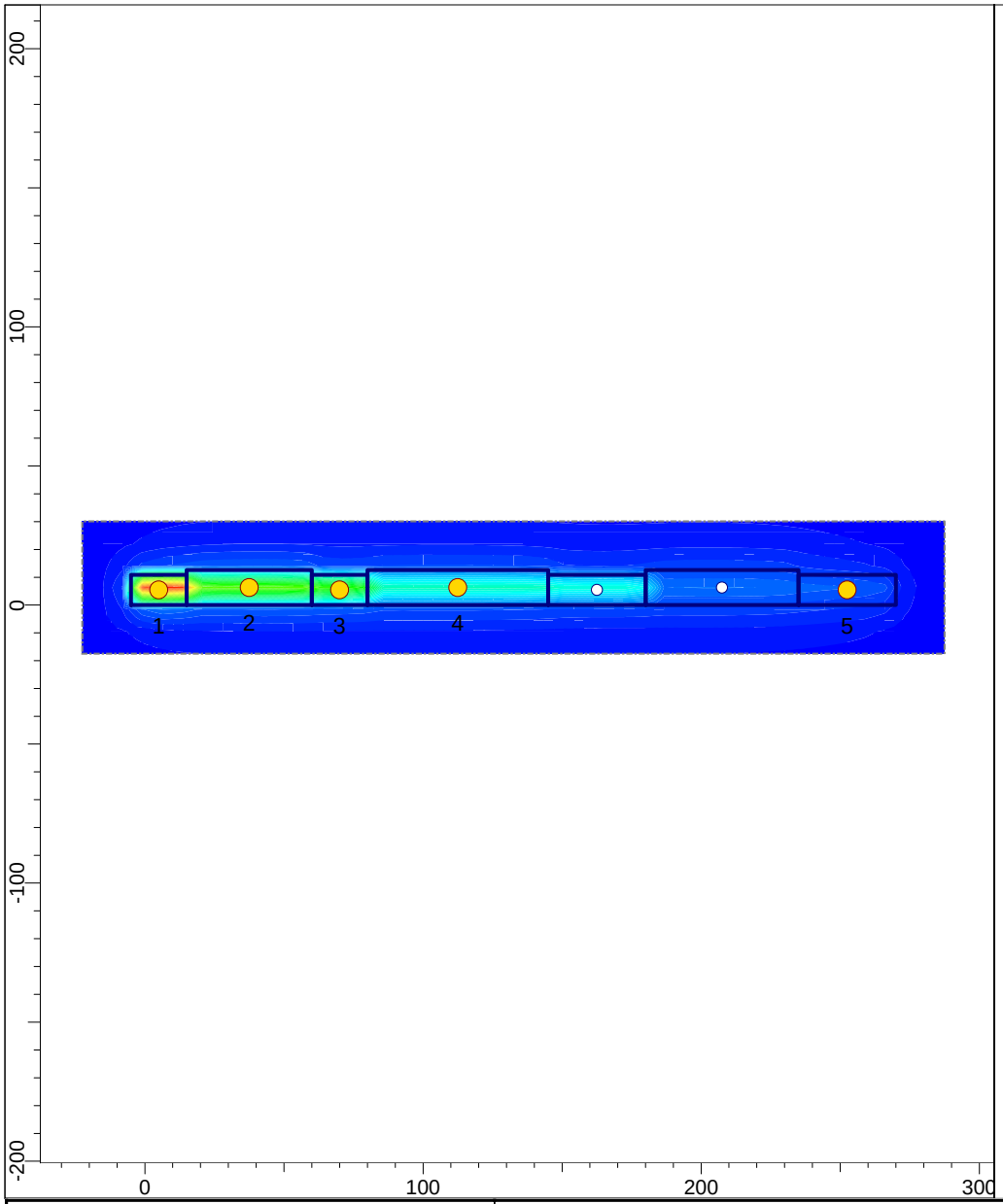
String #	**(X,Y) Location**	**Number of Divisions**
1	27.676, -1.485	69
2	112, 1.25	71
3	186, 2.25	71
4	213.905, 2.375	71

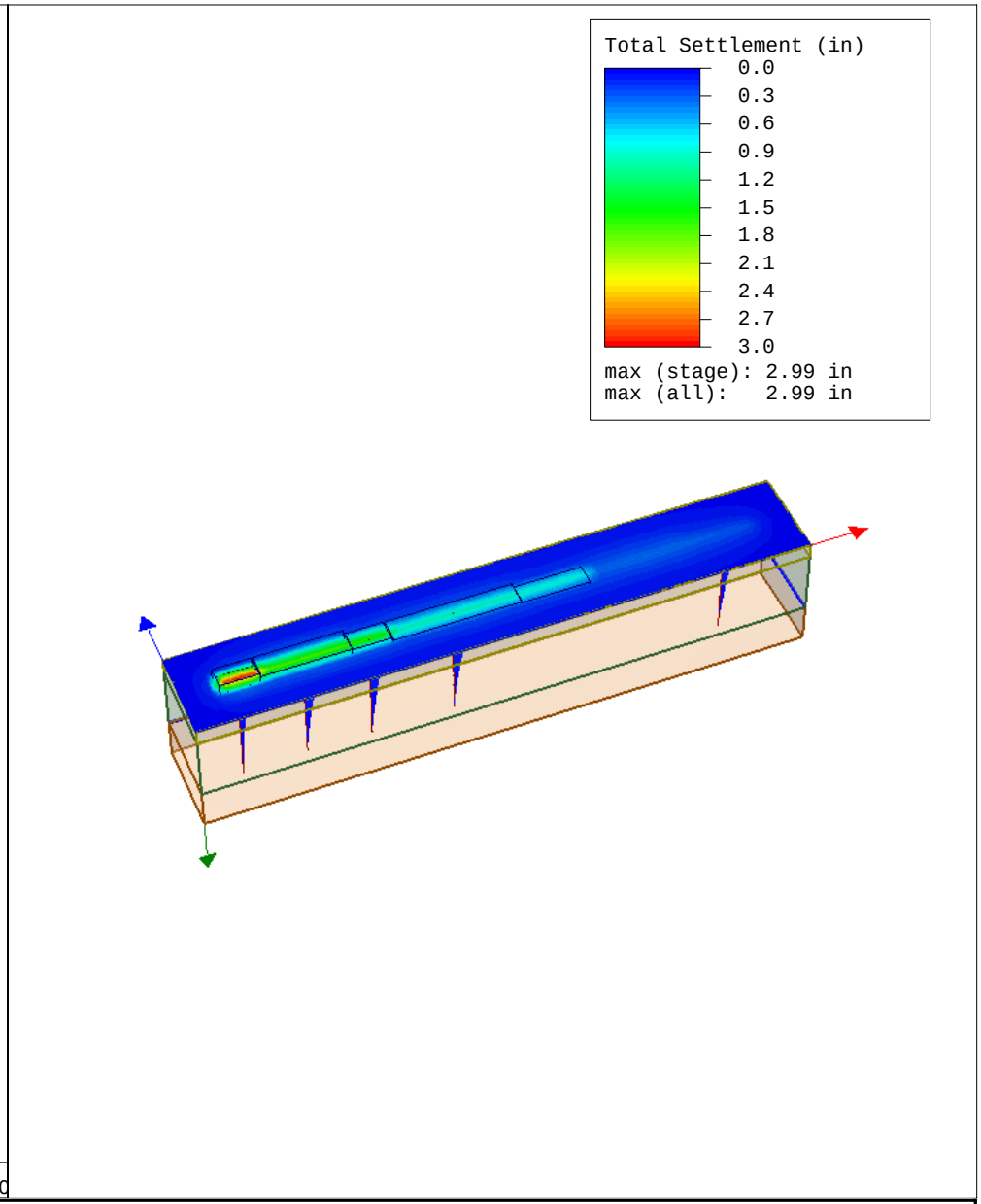
Grid

Number of points: 304
Expansion Factor: 2

Grid Coordinates

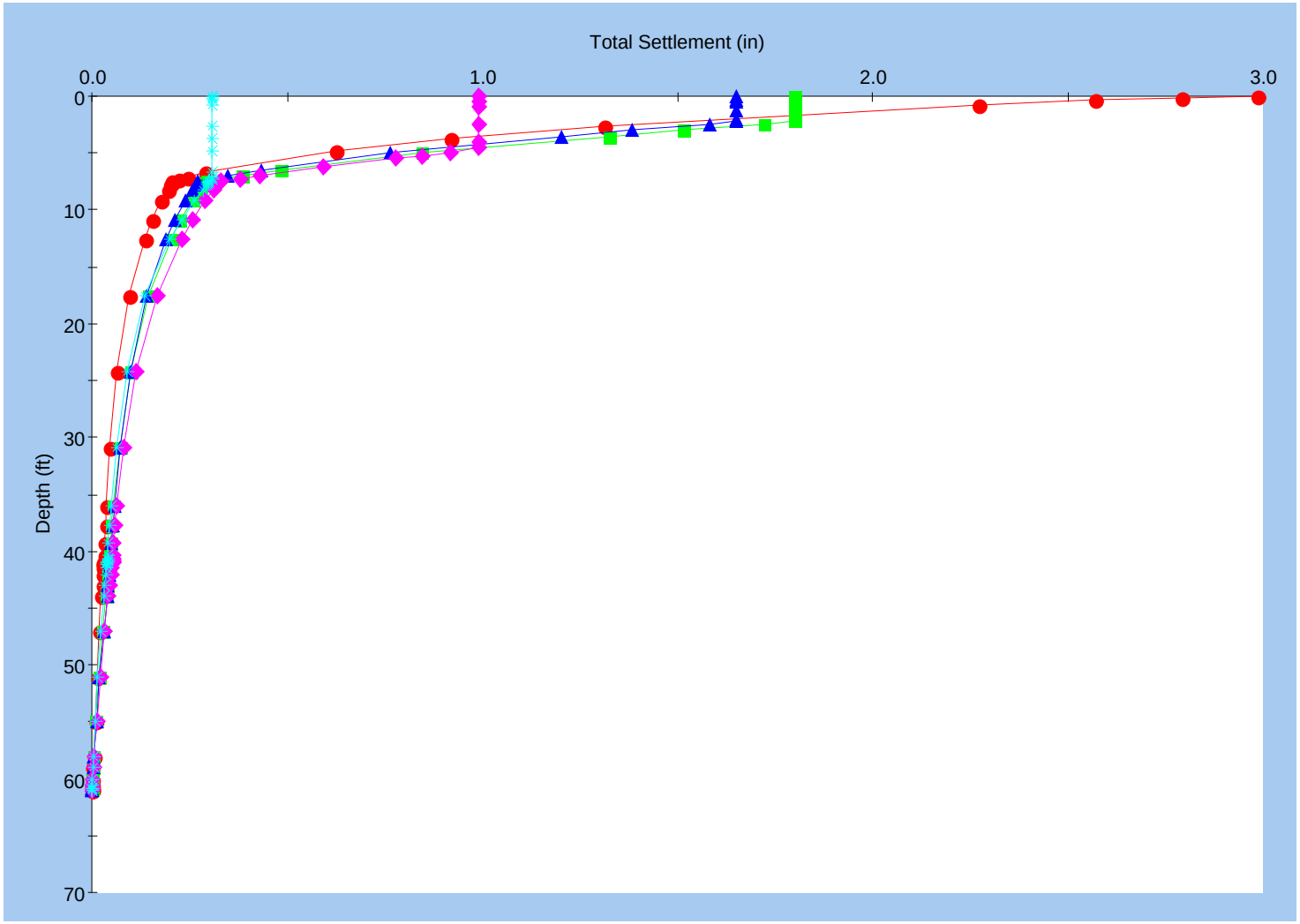
X [ft]	**Y [ft]**
237.81	29.5
237.81	-24.75
-18	-24.75
-18	29.5





rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW630 ST15+29.81 to ST18+04.81	
	Drawn By RB	*Company*	CH2M HILL
	Date 2/11/2009, 9:34:28 AM	*File Name*	RW630_ST15+30toST18+05.s3z

Total Settlement vs. Depth



Reference Stage: None

rocscience	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW630 ST15+29.81 to ST18+04.81	
	Drawn By	RB	*Company* CH2M HILL
	Date	2/11/2009, 9:34:28 AM	*File Name* RW630_ST15+30toST18+05.s3z

SETTLE3D 1.011

Settle3D Analysis Information

Project Settings

Project Title: SR-57 Settlement Analysis
Analysis: RW630 ST15+29.81 to ST18+04.81
Author: RB
Company: CH2M HILL
Date Created: 2/11/2009, 9:34:28 AM
Stress Computation Method: Boussinesq
Groundwater method: Water Table
Water Unit Weight: 0.0624 kips/ft^3
Depth to water table: 41 [ft]

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	2.98813
Consolidation Settlement [in]	0	2.98813
Immediate Settlement [in]	0	0
Loading Stress [ksf]	0	3.82512
Effective Stress [ksf]	0	7.18422
Total Stress [ksf]	0	8.43222
Total Strain	0	0.109406
Pore Water Pressure [ksf]	0	1.248
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 35 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.42 ksf
Depth: 7.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
235	-3.55271e-015
270	-3.55271e-015
270	10.82
235	10.82

Rectangular Load

Length: 55 ft
Width: 12.54 ft
Rotation angle: 0 degrees
Load: 3.75 ksf
Depth: 7.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
180	-3.55271e-015
235	-3.55271e-015
235	12.54
180	12.54

Rectangular Load

Length: 35 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.42 ksf
Depth: 5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
145	-1.24345e-014
180	-1.24345e-014
180	10.82
145	10.82

Rectangular Load

Length: 65 ft
Width: 12.54 ft
Rotation angle: 0 degrees
Load: 3.75 ksf
Depth: 5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
80	-1.42109e-014
145	-1.42109e-014
145	12.54
80	12.54

Rectangular Load

Length: 20 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.42 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
60	-1.24345e-014
80	-1.24345e-014
80	10.82
60	10.82

Rectangular Load

Length: 45 ft
Width: 12.54 ft
Rotation angle: 0 degrees
Load: 3.75 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
15	-1.24345e-014
60	-1.24345e-014
60	12.54
15	12.54

Rectangular Load

Length: 20 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.42 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-5	-1.33227e-014
15	-1.33227e-014
15	10.82
-5	10.82

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	FAT CLAY (Qvof)	7.5	0
2	CLAY 1 (Qvof)	33.5	7.5
3	CLAY 2 (Qvof)	20	41

Soil Properties

FAT CLAY (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.05
Cre	0.005
OCR	2.5

CLAY 1 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.03
Cre	0.003
OCR	5

CLAY 2 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.05
Cre	0.005
OCR	2

Query Points

String #	(X,Y) Location	Number of Divisions
1	5, 5.41	47
2	37.5, 6.27	49
3	70, 5.41	49
4	112.5, 6.27	49

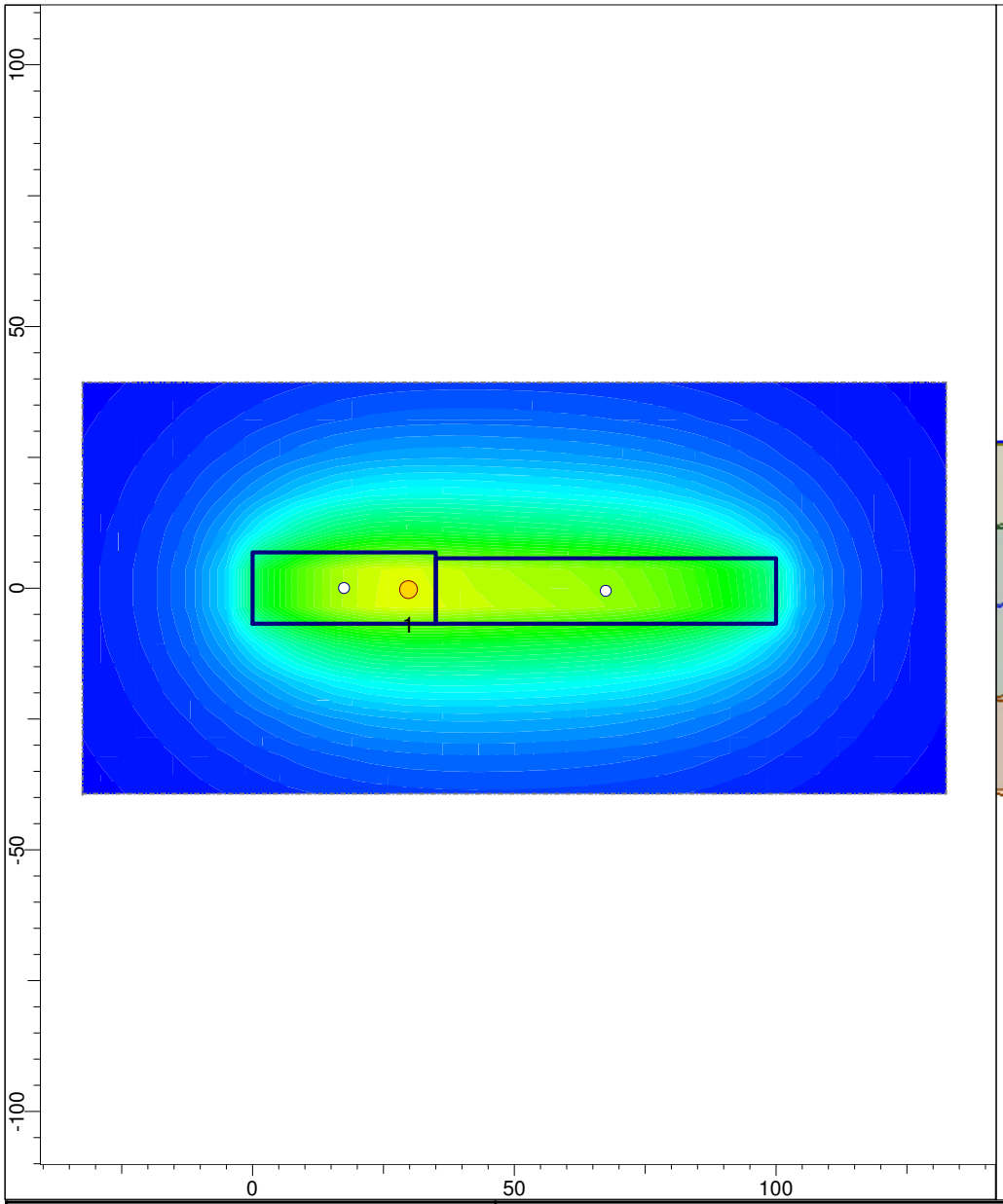
5	252.5, 5.41	47

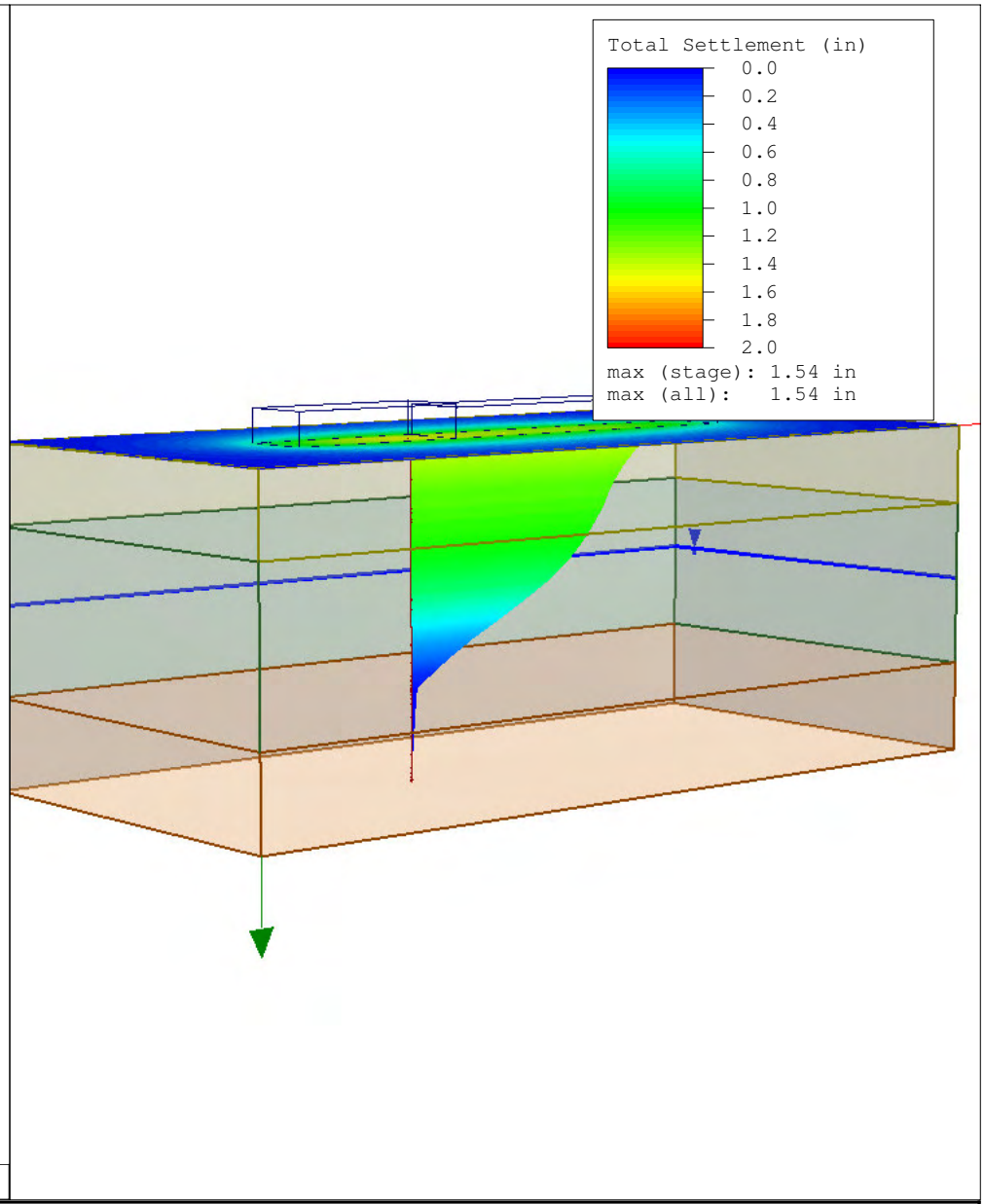
Grid

Number of points: 308
Expansion Factor: 2

Grid Coordinates

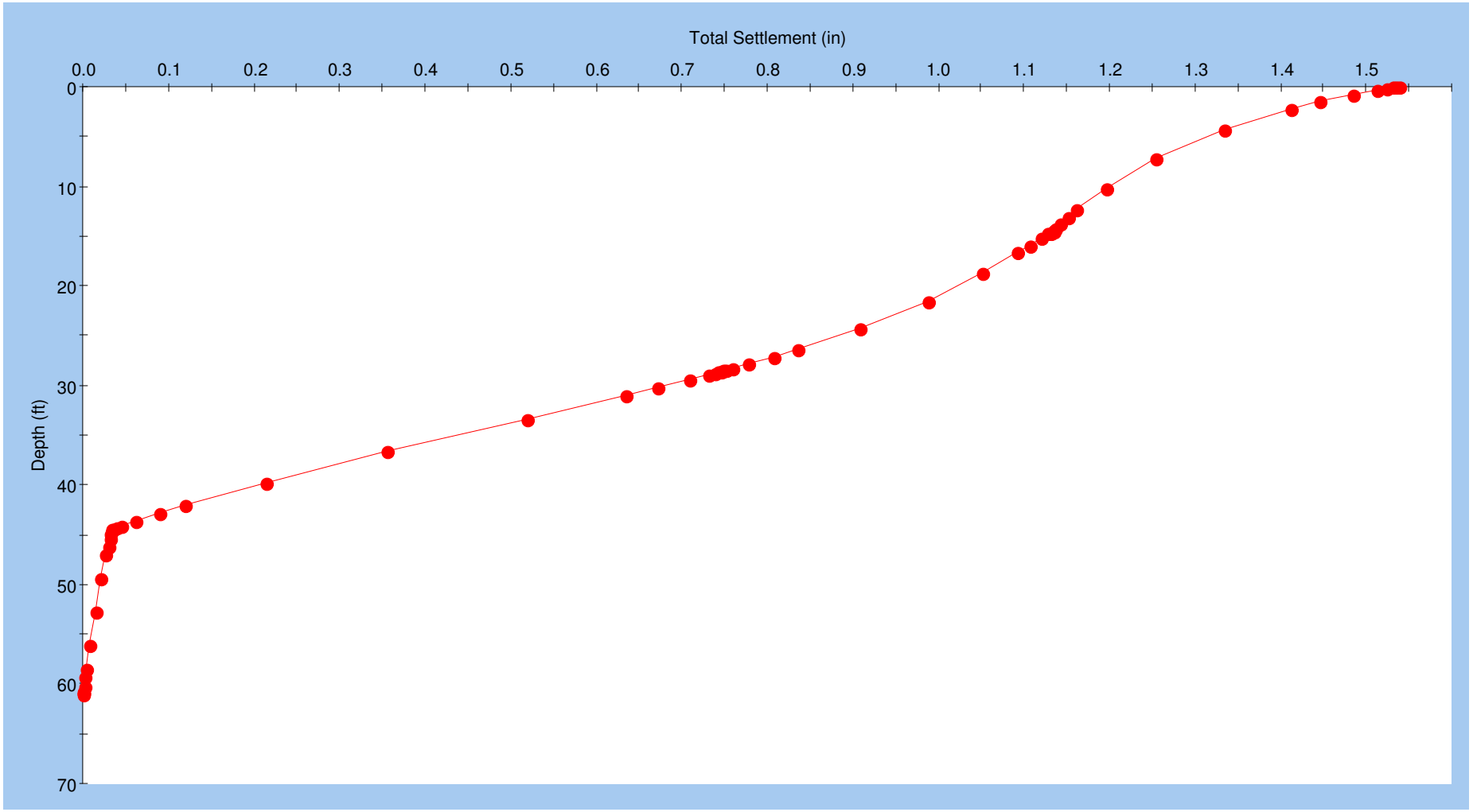
X [ft]	Y [ft]
287.5	30.04
287.5	-17.5
-22.5	-17.5
-22.5	30.04





rocscience	Project		
	Analysis Description		
	Drawn By	Company	
SETTLE3D 1.011	Date 2/25/2009, 2:08:23 PM	File Name	RW630_ST18+25_ST19+25.s3z

Total Settlement vs. Depth



Query Point 1 (Stage Stage 1)
Reference Stage: None

rocscience	*Project*		
	Analysis Description		
	Drawn By	*Company*	
SETTLE3D 1.011	*Date* 2/25/2009, 2:08:23 PM	*File Name*	RW630_ST18+25_ST19+25.s3z

Settle3D Analysis Information

Project Settings

Date Created: 2/25/2009, 2:08:23 PM
Stress Computation Method: Boussinesq
Groundwater method: Water Table
Water Unit Weight: 0.0624 kips/ft^3
Depth to water table: 28.55 [ft]

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	1.53853
Consolidation Settlement [in]	0	1.53853
Immediate Settlement [in]	0	0
Loading Stress [ksf]	0	4.16012
Effective Stress [ksf]	0	6.0293
Total Stress [ksf]	0	8.05418
Total Strain	0	0.0100319
Pore Water Pressure [ksf]	0	2.02488
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 35 ft
Width: 13.64 ft
Rotation angle: 0 degrees
Load: 4.16 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-1.77636e-015	-6.82
35	-6.82
35	6.82
-1.77636e-015	6.82

Rectangular Load

Length: 65 ft
Width: 12.54 ft
Rotation angle: 0 degrees
Load: 3.754 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
35	-6.82
100	-6.82
100	5.72
35	5.72

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	FILL (Af)	14.5	0
2	CLAY (Qyf)	30	14.5
3	CLAY (Qvof)	16.5	44.5

Soil Properties

FILL (Af)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.03
Cre	0.003
Pc [ksf]	8.53125

CLAY (Qyf)	
Unit Weight [kips/ft^3]	0.12
Saturated Unit Weight [kips/ft^3]	0.12
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.05
Cre	0.005
Pc [ksf]	3.9375

CLAY (Qvof)	

Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.04
Cre	0.004
Pc [ksf]	22.3125

Query Points

String #	(X,Y) Location	Number of Divisions
1	29.819, -0.29	73

Grid

Number of points: 300
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
132.5	39.32
132.5	-39.32
-32.5	-39.32
-32.5	39.32

Retaining Wall RW 642

AASHTO DESIGN METHOD
SR57 MSE ANALYSES

PROJECT IDENTIFICATION

Title: SR57 MSE ANALYSES
Project Number: RW642
Client: OCTA
Designer: RB
Station Number: ST10+20

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive, #800

Santa Ana, CA 92707
Telephone #: 714-424-2900
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....es\RW642_ST10+20.BEN
Original date and time of creating this file: Wed Dec 17 16:36:11 2008

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	33.0 °
Equivalent cohesion, $c_{equiv.}$	800.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (eq. 17 is utilized to calculate Ka for all batters)
(For internal stability user specified $\delta = 0.00°$)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 38.64 N γ= 35.19

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

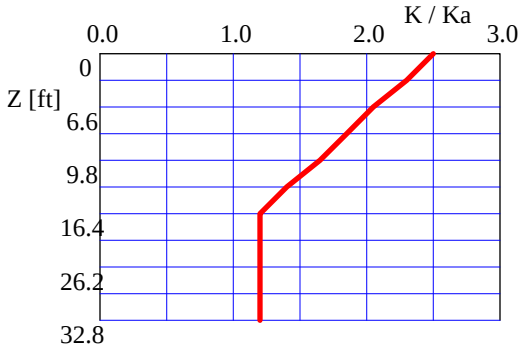
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	12.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

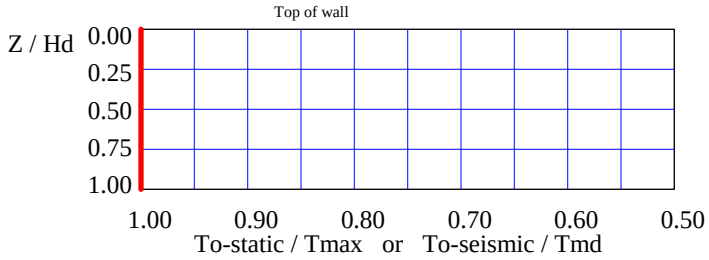


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	CALTRANS	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

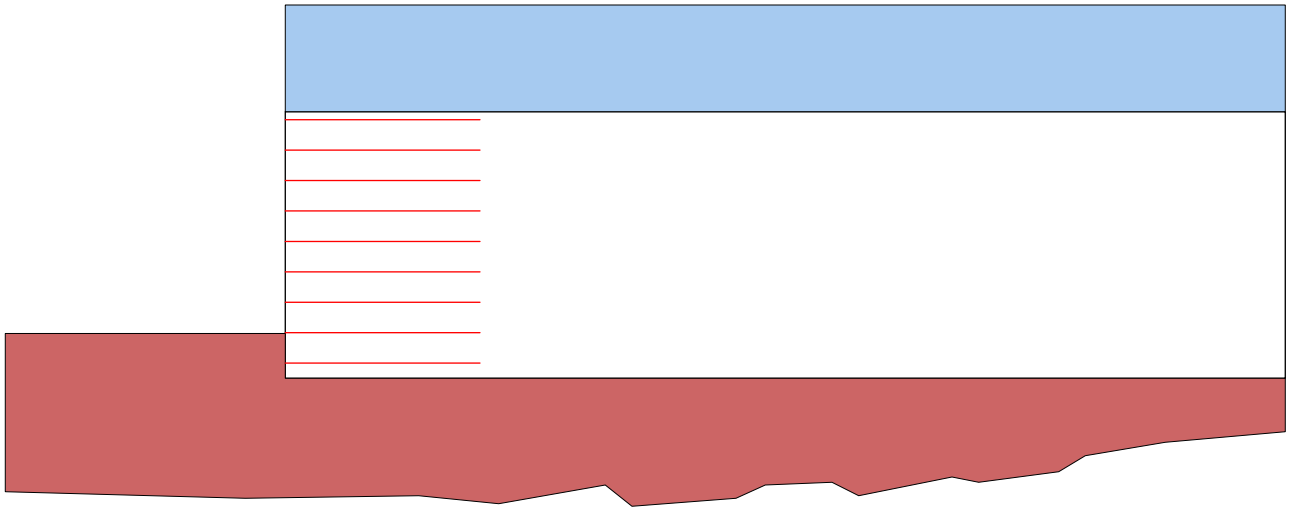
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	21.91	[ft]	{ Embedded depth is E = 3.67 ft, and height above top of finished bottom grade is H = 18.24 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 16.59, Meyerhof stress = 3615 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.216, Eccentricity, e/L = 0.1031, Fs-overturning = 4.85

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	16.00	1	N/A	7.07	7.85	7.850	44.508	3.396	0.0924	CALTRANS
2	3.75	16.00	1	N/A	7.45	8.27	8.274	40.544	3.825	0.0727	CALTRANS
3	6.25	16.00	1	N/A	7.53	8.37	8.368	35.774	4.379	0.0554	CALTRANS
4	8.75	16.00	1	N/A	7.82	8.69	8.691	30.943	5.125	0.0403	CALTRANS
5	11.25	16.00	1	N/A	8.52	9.47	9.468	27.026	6.185	0.0275	CALTRANS
6	13.75	16.00	1	N/A	9.80	10.88	10.884	27.103	7.817	0.0171	CALTRANS
7	16.25	16.00	1	N/A	11.99	13.32	13.318	27.007	10.696	0.0090	CALTRANS
8	18.75	16.00	1	N/A	16.45	18.28	18.279	26.821	17.412	0.0033	CALTRANS
9	21.25	16.00	1	N/A	35.35	39.28	39.282	31.764	66.030	0.0002	CALTRANS

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

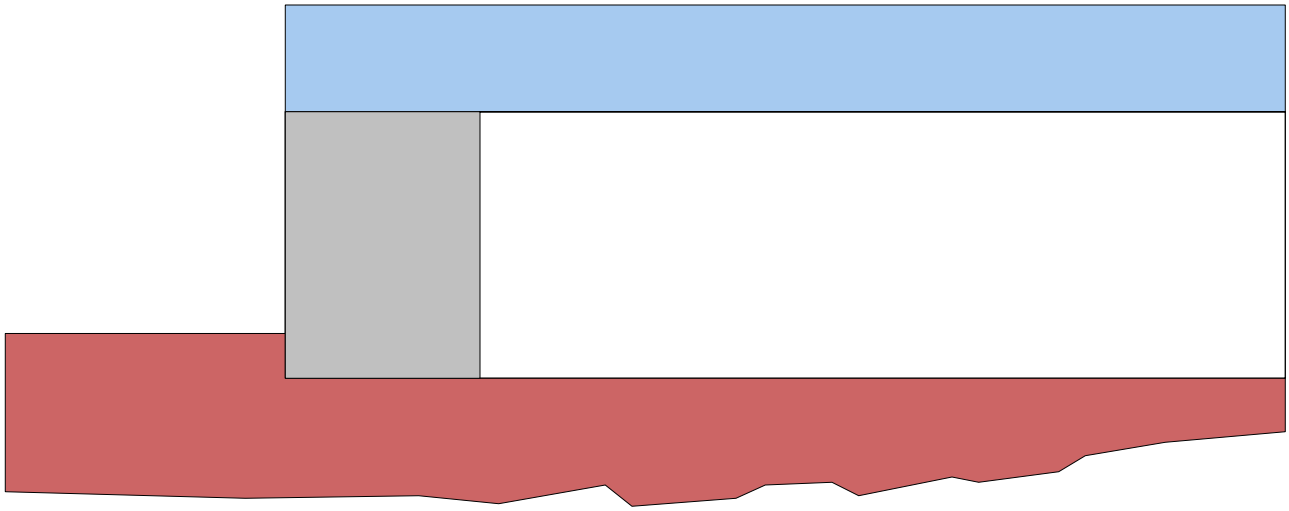
Bearing capacity, Fs = 8.40, Meyerhof stress = 5826 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.609, Eccentricity, e/L = 0.2538, Fs-overturning = 1.97

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	16.00	1	N/A	5.82	6.46	6.463	29.312	1.707	0.2257	CALTRANS
2	3.75	16.00	1	N/A	6.18	6.87	6.872	26.939	1.944	0.1745	CALTRANS
3	6.25	16.00	1	N/A	6.36	7.07	7.068	24.175	2.257	0.1298	CALTRANS
4	8.75	16.00	1	N/A	6.70	7.44	7.444	21.202	2.690	0.0918	CALTRANS
5	11.25	16.00	1	N/A	7.35	8.16	8.162	18.637	3.328	0.0603	CALTRANS
6	13.75	16.00	1	N/A	8.27	9.19	9.192	18.312	4.361	0.0354	CALTRANS
7	16.25	16.00	1	N/A	9.78	10.87	10.871	17.635	6.322	0.0171	CALTRANS
8	18.75	16.00	1	N/A	12.57	13.96	13.963	16.391	11.446	0.0054	CALTRANS
9	21.25	16.00	1	N/A	21.24	23.60	23.605	15.270	56.569	0.0002	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	59957	48933	[lb/ft ²]
Meyerhof stress, σ_V	3614.9	5826	[lb/ft ²]
Eccentricity, e	1.65	4.06	[ft]
Eccentricity, e/L	0.103	0.254	
Fs calculated	16.59	8.40	
Base length	16.00	16.00	[ft]



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.216 and Fs-seismic = 1.609

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	16.00	3.396	1.707	1	CALTRANS
2	3.75	16.00	3.825	1.944	1	CALTRANS
3	6.25	16.00	4.379	2.257	1	CALTRANS
4	8.75	16.00	5.125	2.690	1	CALTRANS
5	11.25	16.00	6.185	3.328	1	CALTRANS
6	13.75	16.00	7.817	4.361	1	CALTRANS
7	16.25	16.00	10.696	6.322	1	CALTRANS
8	18.75	16.00	17.412	11.446	1	CALTRANS
9	21.25	16.00	66.030	56.569	1	CALTRANS

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1031, e/L seismic = 0.2538; Overturning: Fs-static = 4.85, Fs-seismic = 1.97

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	16.00	0.0924	0.2257	1	CALTRANS
2	3.75	16.00	0.0727	0.1745	1	CALTRANS
3	6.25	16.00	0.0554	0.1298	1	CALTRANS
4	8.75	16.00	0.0403	0.0918	1	CALTRANS
5	11.25	16.00	0.0275	0.0603	1	CALTRANS
6	13.75	16.00	0.0171	0.0354	1	CALTRANS
7	16.25	16.00	0.0090	0.0171	1	CALTRANS
8	18.75	16.00	0.0033	0.0054	1	CALTRANS
9	21.25	16.00	0.0002	0.0002	1	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	2.000	0.500	18225	2321.50	498.46	N/A	7.850	N/A	6.463
2	3.75	2.000	0.500	18225	2202.71	449.43	N/A	8.274	N/A	6.872
3	6.25	2.000	0.500	18225	2177.97	400.40	N/A	8.368	N/A	7.068
4	8.75	2.000	0.500	18225	2096.95	351.37	N/A	8.691	N/A	7.444
5	11.25	2.000	0.500	18225	1924.85	308.13	N/A	9.468	N/A	8.162
6	13.75	2.000	0.500	18225	1674.48	308.13	N/A	10.884	N/A	9.192
7	16.25	2.000	0.500	18225	1368.39	308.13	N/A	13.318	N/A	10.871
8	18.75	2.000	0.500	18225	997.04	308.13	N/A	18.279	N/A	13.963
9	21.25	2.000	0.500	18225	463.95	308.13	N/A	39.282	N/A	23.605

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	2.000	2321.5	498.5	15.25	0.75	103324.3	N/A	44.508	82659.4	N/A	29.312
2	3.75	2.000	2202.7	449.4	13.75	2.25	89306.4	N/A	40.544	71445.1	N/A	26.939
3	6.25	2.000	2178.0	400.4	12.25	3.75	77914.8	N/A	35.774	62331.9	N/A	24.175
4	8.75	2.000	2097.0	351.4	10.75	5.25	64886.3	N/A	30.943	51909.1	N/A	21.202
5	11.25	2.000	1924.9	308.1	9.43	6.57	52020.3	N/A	27.026	41616.2	N/A	18.637
6	13.75	2.000	1674.5	308.1	9.43	6.57	45383.0	N/A	27.103	36306.4	N/A	18.312
7	16.25	2.000	1368.4	308.1	9.43	6.57	36956.7	N/A	27.007	29565.3	N/A	17.635
8	18.75	2.000	997.0	308.1	9.43	6.57	26741.4	N/A	26.821	21393.1	N/A	16.391
9	21.25	2.000	463.9	308.1	9.43	6.57	14737.0	N/A	31.764	11789.6	N/A	15.270

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.000	0.500	2321	0.90	16402	18225	N/A	7.07	N/A	7.85	CALTRANS
2	3.75	2.000	0.500	2203	0.90	16402	18225	N/A	7.45	N/A	8.27	CALTRANS
3	6.25	2.000	0.500	2178	0.90	16402	18225	N/A	7.53	N/A	8.37	CALTRANS
4	8.75	2.000	0.500	2097	0.90	16402	18225	N/A	7.82	N/A	8.69	CALTRANS
5	11.25	2.000	0.500	1925	0.90	16402	18225	N/A	8.52	N/A	9.47	CALTRANS
6	13.75	2.000	0.500	1674	0.90	16402	18225	N/A	9.80	N/A	10.88	CALTRANS
7	16.25	2.000	0.500	1368	0.90	16402	18225	N/A	11.99	N/A	13.32	CALTRANS
8	18.75	2.000	0.500	997	0.90	16402	18225	N/A	16.45	N/A	18.28	CALTRANS
9	21.25	2.000	0.500	464	0.90	16402	18225	N/A	35.35	N/A	39.28	CALTRANS

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.000	0.500	2820	0.90	16402	18225	N/A	5.82	N/A	6.46	CALTRANS
2	3.75	2.000	0.500	2652	0.90	16402	18225	N/A	6.18	N/A	6.87	CALTRANS
3	6.25	2.000	0.500	2578	0.90	16402	18225	N/A	6.36	N/A	7.07	CALTRANS
4	8.75	2.000	0.500	2448	0.90	16402	18225	N/A	6.70	N/A	7.44	CALTRANS
5	11.25	2.000	0.500	2233	0.90	16402	18225	N/A	7.35	N/A	8.16	CALTRANS
6	13.75	2.000	0.500	1983	0.90	16402	18225	N/A	8.27	N/A	9.19	CALTRANS
7	16.25	2.000	0.500	1677	0.90	16402	18225	N/A	9.78	N/A	10.87	CALTRANS
8	18.75	2.000	0.500	1305	0.90	16402	18225	N/A	12.57	N/A	13.96	CALTRANS
9	21.25	2.000	0.500	772	0.90	16402	18225	N/A	21.24	N/A	23.60	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR57 MSE ANALYSES

PROJECT IDENTIFICATION

Title: SR57 MSE ANALYSES
Project Number: RW642
Client: OCTA
Designer: RB
Station Number: ST10+70

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive, #800

Santa Ana, CA 92707
Telephone #: 714-424-2900
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....es\RW642_ST10+70.BEN
Original date and time of creating this file: Wed Dec 17 16:36:11 2008

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	33.0 °
Equivalent cohesion, $c_{equiv.}$	800.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (eq. 17 is utilized to calculate Ka for all batters)
(For internal stability user specified $\delta = 0.00°$)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 38.64 N γ= 35.19

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

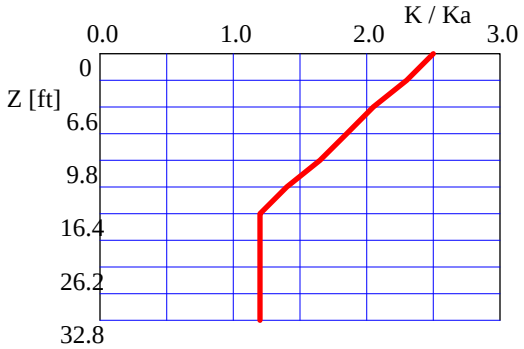
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	12.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

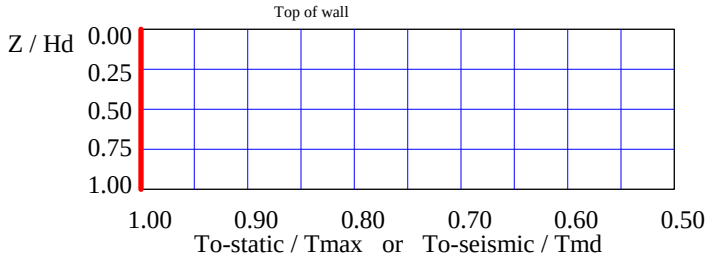


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	CALTRANS	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

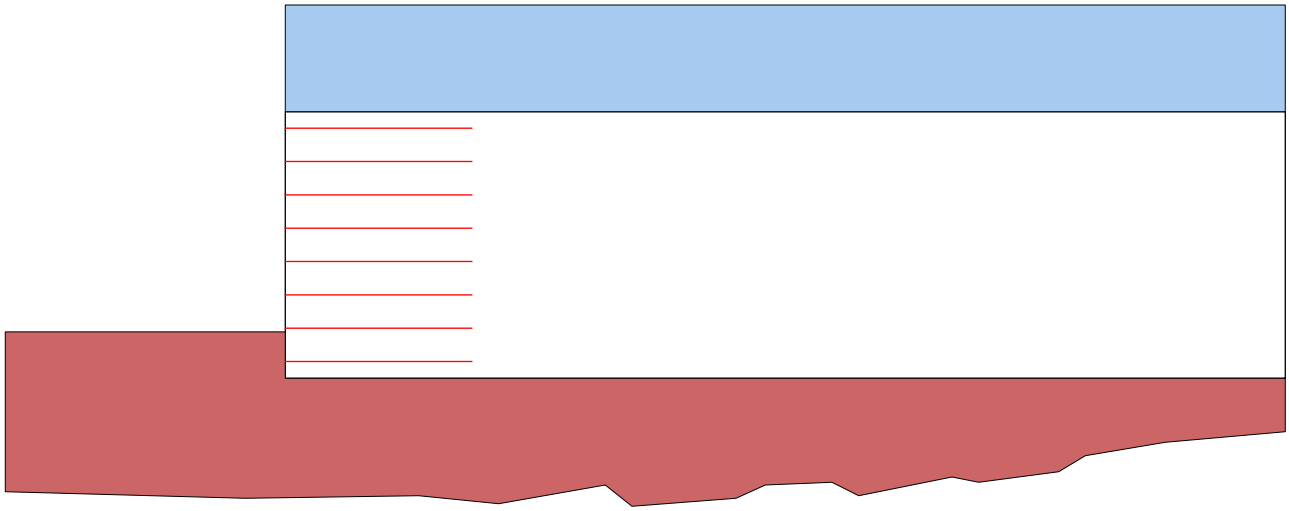
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	19.99	[ft]	{ Embedded depth is E = 3.47 ft, and height above top of finished bottom grade is H = 16.52 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 16.30, Meyerhof stress = 3414 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.063, Eccentricity, e/L = 0.1135, Fs-overturning = 4.40

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	14.00	1	N/A	7.38	8.20	8.204	38.768	3.251	0.1007	CALTRANS
2	3.75	14.00	1	N/A	7.49	8.33	8.327	34.389	3.707	0.0773	CALTRANS
3	6.25	14.00	1	N/A	7.72	8.58	8.581	29.560	4.314	0.0569	CALTRANS
4	8.75	14.00	1	N/A	8.31	9.23	9.234	25.070	5.163	0.0395	CALTRANS
5	11.25	14.00	1	N/A	9.44	10.48	10.484	23.005	6.443	0.0252	CALTRANS
6	13.75	14.00	1	N/A	11.35	12.61	12.609	22.960	8.615	0.0139	CALTRANS
7	16.25	14.00	1	N/A	15.04	16.72	16.715	22.803	13.246	0.0057	CALTRANS
8	18.75	14.00	1	N/A	24.98	27.76	27.760	22.876	33.311	0.0008	CALTRANS

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

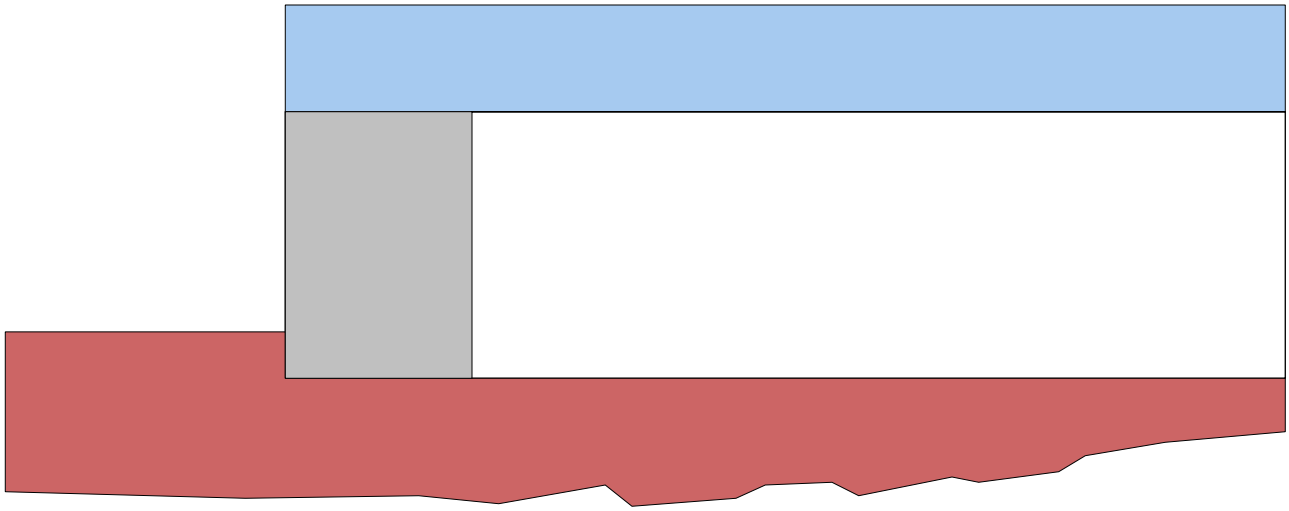
Bearing capacity, Fs = 7.68, Meyerhof stress = 5890 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.544, Eccentricity, e/L = 0.2760, Fs-overturning = 1.81

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	14.00	1	N/A	6.09	6.77	6.771	25.597	1.648	0.2426	CALTRANS
2	3.75	14.00	1	N/A	6.29	6.99	6.994	23.109	1.904	0.1823	CALTRANS
3	6.25	14.00	1	N/A	6.59	7.33	7.326	20.191	2.253	0.1306	CALTRANS
4	8.75	14.00	1	N/A	7.18	7.98	7.979	17.330	2.760	0.0875	CALTRANS
5	11.25	14.00	1	N/A	8.11	9.01	9.012	15.820	3.560	0.0530	CALTRANS
6	13.75	14.00	1	N/A	9.48	10.54	10.538	15.351	5.010	0.0271	CALTRANS
7	16.25	14.00	1	N/A	11.94	13.26	13.261	14.473	8.434	0.0098	CALTRANS
8	18.75	14.00	1	N/A	17.44	19.38	19.378	12.775	26.036	0.0011	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	55660	45257	[lb/ft ²]
Meyerhof stress, σ_V	3414.1	5890	[lb/ft ²]
Eccentricity, e	1.59	3.86	[ft]
Eccentricity, e/L	0.114	0.276	
Fs calculated	16.30	7.68	
Base length	14.00	14.00	[ft]



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.063 and Fs-seismic = 1.544

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	14.00	3.251	1.648	1	CALTRANS
2	3.75	14.00	3.707	1.904	1	CALTRANS
3	6.25	14.00	4.314	2.253	1	CALTRANS
4	8.75	14.00	5.163	2.760	1	CALTRANS
5	11.25	14.00	6.443	3.560	1	CALTRANS
6	13.75	14.00	8.615	5.010	1	CALTRANS
7	16.25	14.00	13.246	8.434	1	CALTRANS
8	18.75	14.00	33.311	26.036	1	CALTRANS

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1135, e/L seismic = 0.2760; Overturning: Fs-static = 4.40, Fs-seismic = 1.81

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	14.00	0.1007	0.2426	1	CALTRANS
2	3.75	14.00	0.0773	0.1823	1	CALTRANS
3	6.25	14.00	0.0569	0.1306	1	CALTRANS
4	8.75	14.00	0.0395	0.0875	1	CALTRANS
5	11.25	14.00	0.0252	0.0530	1	CALTRANS
6	13.75	14.00	0.0139	0.0271	1	CALTRANS
7	16.25	14.00	0.0057	0.0098	1	CALTRANS
8	18.75	14.00	0.0008	0.0011	1	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	2.000	0.500	18225	2221.46	470.18	N/A	8.204	N/A	6.771
2	3.75	2.000	0.500	18225	2188.76	416.95	N/A	8.327	N/A	6.994
3	6.25	2.000	0.500	18225	2123.96	363.72	N/A	8.581	N/A	7.326
4	8.75	2.000	0.500	18225	1973.70	310.49	N/A	9.234	N/A	7.979
5	11.25	2.000	0.500	18225	1738.32	283.99	N/A	10.484	N/A	9.012
6	13.75	2.000	0.500	18225	1445.41	283.99	N/A	12.609	N/A	10.538
7	16.25	2.000	0.500	18225	1090.29	283.99	N/A	16.715	N/A	13.261
8	18.75	2.000	0.500	18225	656.52	283.99	N/A	27.760	N/A	19.378

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	2.000	2221.5	470.2	13.25	0.75	86120.5	N/A	38.768	68896.4	N/A	25.597
2	3.75	2.000	2188.8	416.9	11.75	2.25	75269.0	N/A	34.389	60215.2	N/A	23.109
3	6.25	2.000	2124.0	363.7	10.25	3.75	62784.9	N/A	29.560	50227.9	N/A	20.191
4	8.75	2.000	1973.7	310.5	8.75	5.25	49481.6	N/A	25.070	39585.3	N/A	17.330
5	11.25	2.000	1738.3	284.0	8.00	6.00	39990.6	N/A	23.005	31992.5	N/A	15.820
6	13.75	2.000	1445.4	284.0	8.00	6.00	33186.0	N/A	22.960	26548.8	N/A	15.351
7	16.25	2.000	1090.3	284.0	8.00	6.00	24861.9	N/A	22.803	19889.5	N/A	14.473
8	18.75	2.000	656.5	284.0	8.00	6.00	15018.2	N/A	22.876	12014.6	N/A	12.775

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	2.000	0.500	2221	0.90	16402	18225	N/A	7.38	N/A	8.20	CALTRANS
2	3.75	2.000	0.500	2189	0.90	16402	18225	N/A	7.49	N/A	8.33	CALTRANS
3	6.25	2.000	0.500	2124	0.90	16402	18225	N/A	7.72	N/A	8.58	CALTRANS
4	8.75	2.000	0.500	1974	0.90	16402	18225	N/A	8.31	N/A	9.23	CALTRANS
5	11.25	2.000	0.500	1738	0.90	16402	18225	N/A	9.44	N/A	10.48	CALTRANS
6	13.75	2.000	0.500	1445	0.90	16402	18225	N/A	11.35	N/A	12.61	CALTRANS
7	16.25	2.000	0.500	1090	0.90	16402	18225	N/A	15.04	N/A	16.72	CALTRANS
8	18.75	2.000	0.500	657	0.90	16402	18225	N/A	24.98	N/A	27.76	CALTRANS

RESULTS for CONNECTION (seismic conditions)

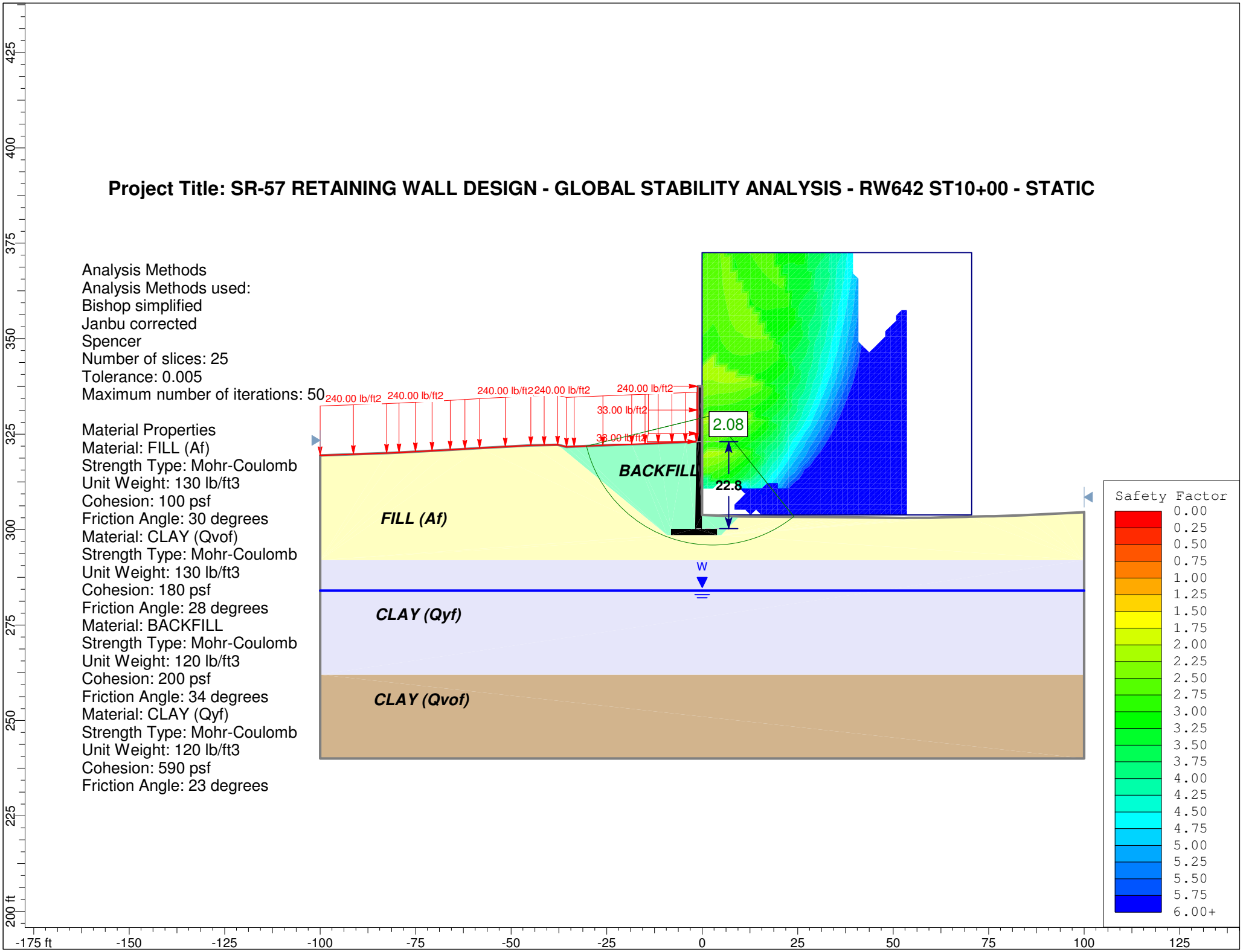
#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	2.000	0.500	2692	0.90	16402	18225	N/A	6.09	N/A	6.77	CALTRANS
2	3.75	2.000	0.500	2606	0.90	16402	18225	N/A	6.29	N/A	6.99	CALTRANS
3	6.25	2.000	0.500	2488	0.90	16402	18225	N/A	6.59	N/A	7.33	CALTRANS
4	8.75	2.000	0.500	2284	0.90	16402	18225	N/A	7.18	N/A	7.98	CALTRANS
5	11.25	2.000	0.500	2022	0.90	16402	18225	N/A	8.11	N/A	9.01	CALTRANS
6	13.75	2.000	0.500	1729	0.90	16402	18225	N/A	9.48	N/A	10.54	CALTRANS
7	16.25	2.000	0.500	1374	0.90	16402	18225	N/A	11.94	N/A	13.26	CALTRANS
8	18.75	2.000	0.500	941	0.90	16402	18225	N/A	17.44	N/A	19.38	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW642 ST10+00 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CLAY (Qyf)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 590 psf
Friction Angle: 23 degrees



Slide Analysis Information

Document Name

File Name: RW642_ST10+00_STATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW642 ST10+00 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qyf)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 590 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.084190
Center: 2.812, 329.943
Radius: 34.065
Left Slip Surface Endpoint: -30.280, 321.859
Right Slip Surface Endpoint: 24.040, 303.302
Resisting Moment=2.26251e+006 lb-ft
Driving Moment=1.08556e+006 lb-ft

Method: spencer
FS: 2.084720
Center: 2.812, 329.943
Radius: 34.065
Left Slip Surface Endpoint: -30.280, 321.859
Right Slip Surface Endpoint: 24.040, 303.302
Resisting Moment=2.26308e+006 lb-ft
Driving Moment=1.08556e+006 lb-ft
Resisting Horizontal Force=57511.9 lb
Driving Horizontal Force=27587.4 lb

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 8711
Number of Invalid Surfaces: 19900
Error Codes:
Error Code -99 reported for 7644 surfaces
Error Code -100 reported for 26 surfaces
Error Code -103 reported for 613 surfaces
Error Code -105 reported for 13 surfaces
Error Code -106 reported for 73 surfaces
Error Code -107 reported for 7145 surfaces
Error Code -108 reported for 1 surface
Error Code -109 reported for 3096 surfaces
Error Code -112 reported for 1288 surfaces
Error Code -113 reported for 1 surface

Method: spencer
Number of Valid Surfaces: 7326
Number of Invalid Surfaces: 21285
Error Codes:
Error Code -99 reported for 7644 surfaces
Error Code -100 reported for 26 surfaces
Error Code -103 reported for 613 surfaces
Error Code -105 reported for 13 surfaces
Error Code -106 reported for 73 surfaces
Error Code -107 reported for 7145 surfaces
Error Code -108 reported for 849 surfaces
Error Code -109 reported for 3096 surfaces
Error Code -111 reported for 399 surfaces
Error Code -112 reported for 1426 surfaces
Error Code -113 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

-0.010	303.820
70.529	303.820
70.529	372.564
-0.010	372.564

Material Boundary

-1.500	323.010
-1.877	300.170
-8.167	300.170
-8.167	298.500
3.917	298.500
3.917	300.170
-0.010	300.170
-0.010	303.820

Material Boundary

3.917	298.500

4.917	298.500
9.741	303.402

Material Boundary

-37.850	322.200
-9.167	298.500
-8.167	298.500

Material Boundary

-100.000	291.970
100.000	291.970

Material Boundary

-100.000	261.970
100.000	261.970

External Boundary

100.000	304.530
93.040	304.180
86.800	303.890
83.480	303.750
76.350	303.490
74.450	303.480
70.040	303.350
69.130	303.320
63.890	303.200
59.740	303.090
57.640	303.080
54.040	303.060
52.820	303.040
45.710	303.140
41.675	303.178
37.238	303.219
31.840	303.270
21.980	303.310
9.741	303.402
-0.010	303.820
-0.010	337.510
-1.160	337.510
-1.160	325.140
-1.500	323.010
-4.390	322.890
-11.500	322.610
-18.450	322.330
-33.537	321.729
-35.500	321.650
-37.850	322.200
-44.860	322.020
-58.270	321.330
-65.940	320.880
-70.730	320.630
-79.360	320.180
-82.610	320.030
-100.000	319.420
-100.000	291.970
-100.000	261.970
-100.000	240.000
100.000	240.000
100.000	261.970
100.000	291.970

Water Table

-100.000	284.000
100.000	284.000

Distributed Load

-1.160	337.510
-1.160	325.140
-1.500	323.010

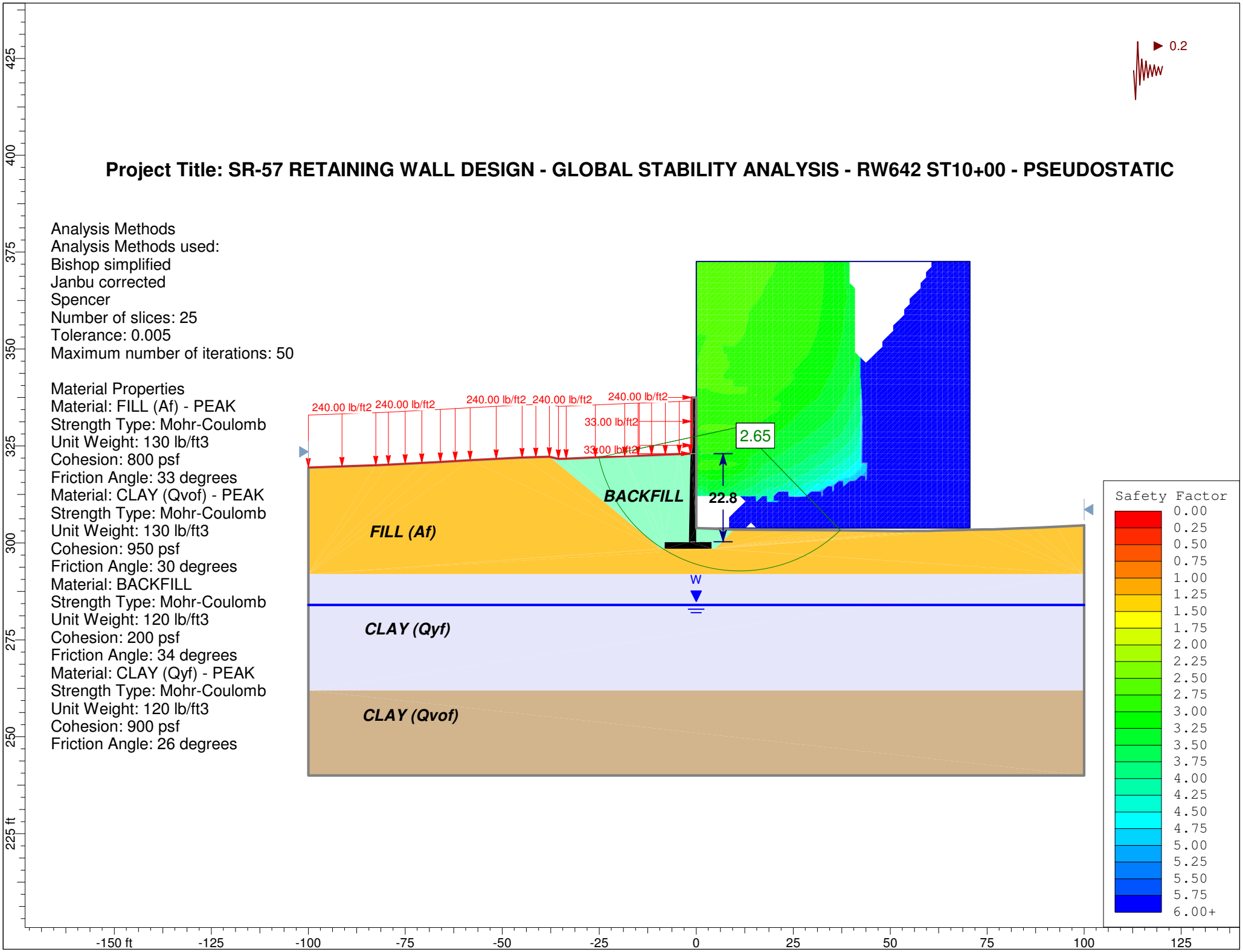
Distributed Load

-100.000	319.420
-82.610	320.030
-79.360	320.180
-70.730	320.630
-65.940	320.880
-58.270	321.330
-44.860	322.020
-37.850	322.200
-35.500	321.650
-33.537	321.729
-18.450	322.330
-11.500	322.610
-4.390	322.890
-1.500	323.010

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW642 ST10+00 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CLAY (Qyf) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 900 psf
Friction Angle: 26 degrees



Slide Analysis Information

Document Name

File Name: RW642_ST10+00_PSEUDOSTATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW642 ST10+00 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qyf) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 900 psf
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.652200
Center: 11.276, 329.943
Radius: 37.208
Left Slip Surface Endpoint: -25.088, 322.066
Right Slip Surface Endpoint: 37.167, 303.220
Resisting Moment=4.55368e+006 lb-ft
Driving Moment=1.71695e+006 lb-ft

Method: spencer
FS: 2.668940
Center: 5.633, 342.317
Radius: 46.050
Left Slip Surface Endpoint: -35.522, 321.655
Right Slip Surface Endpoint: 30.058, 303.277
Resisting Moment=5.94468e+006 lb-ft
Driving Moment=2.22735e+006 lb-ft
Resisting Horizontal Force=115049 lb
Driving Horizontal Force=43106.4 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 15199
Number of Invalid Surfaces: 13412
Error Codes:
Error Code -99 reported for 7644 surfaces
Error Code -100 reported for 26 surfaces
Error Code -103 reported for 613 surfaces
Error Code -105 reported for 13 surfaces
Error Code -106 reported for 73 surfaces
Error Code -109 reported for 3096 surfaces
Error Code -112 reported for 1946 surfaces
Error Code -113 reported for 1 surface

Method: spencer
Number of Valid Surfaces: 13333
Number of Invalid Surfaces: 15278
Error Codes:
Error Code -99 reported for 7644 surfaces
Error Code -100 reported for 26 surfaces
Error Code -103 reported for 613 surfaces
Error Code -105 reported for 13 surfaces
Error Code -106 reported for 73 surfaces
Error Code -108 reported for 620 surfaces
Error Code -109 reported for 3096 surfaces
Error Code -111 reported for 1017 surfaces
Error Code -112 reported for 2175 surfaces
Error Code -113 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

-0.010	303.820
70.529	303.820
70.529	372.564
-0.010	372.564

Material Boundary

-1.500	323.010
-1.877	300.170
-8.167	300.170
-8.167	298.500
3.917	298.500
3.917	300.170
-0.010	300.170
-0.010	303.820

Material Boundary

3.917	298.500
4.917	298.500
9.741	303.402

Material Boundary

-37.850	322.200
-9.167	298.500
-8.167	298.500

Material Boundary

-100.000	291.970
100.000	291.970

Material Boundary

-100.000	261.970
100.000	261.970

External Boundary

100.000	304.530
93.040	304.180
86.800	303.890
83.480	303.750
76.350	303.490
74.450	303.480
70.040	303.350
69.130	303.320
63.890	303.200
59.740	303.090
57.640	303.080
54.040	303.060
52.820	303.040
45.710	303.140
41.675	303.178
37.238	303.219
31.840	303.270
21.980	303.310
9.741	303.402
-0.010	303.820
-0.010	337.510
-1.160	337.510
-1.160	325.140
-1.500	323.010
-4.390	322.890
-11.500	322.610
-18.450	322.330
-33.537	321.729
-35.500	321.650
-37.850	322.200
-44.860	322.020
-58.270	321.330
-65.940	320.880
-70.730	320.630
-79.360	320.180
-82.610	320.030
-100.000	319.420
-100.000	291.970
-100.000	261.970
-100.000	240.000
100.000	240.000
100.000	261.970
100.000	291.970

Water Table

-100.000	284.000
100.000	284.000

Distributed Load

-1.160	337.510
-1.160	325.140
-1.500	323.010

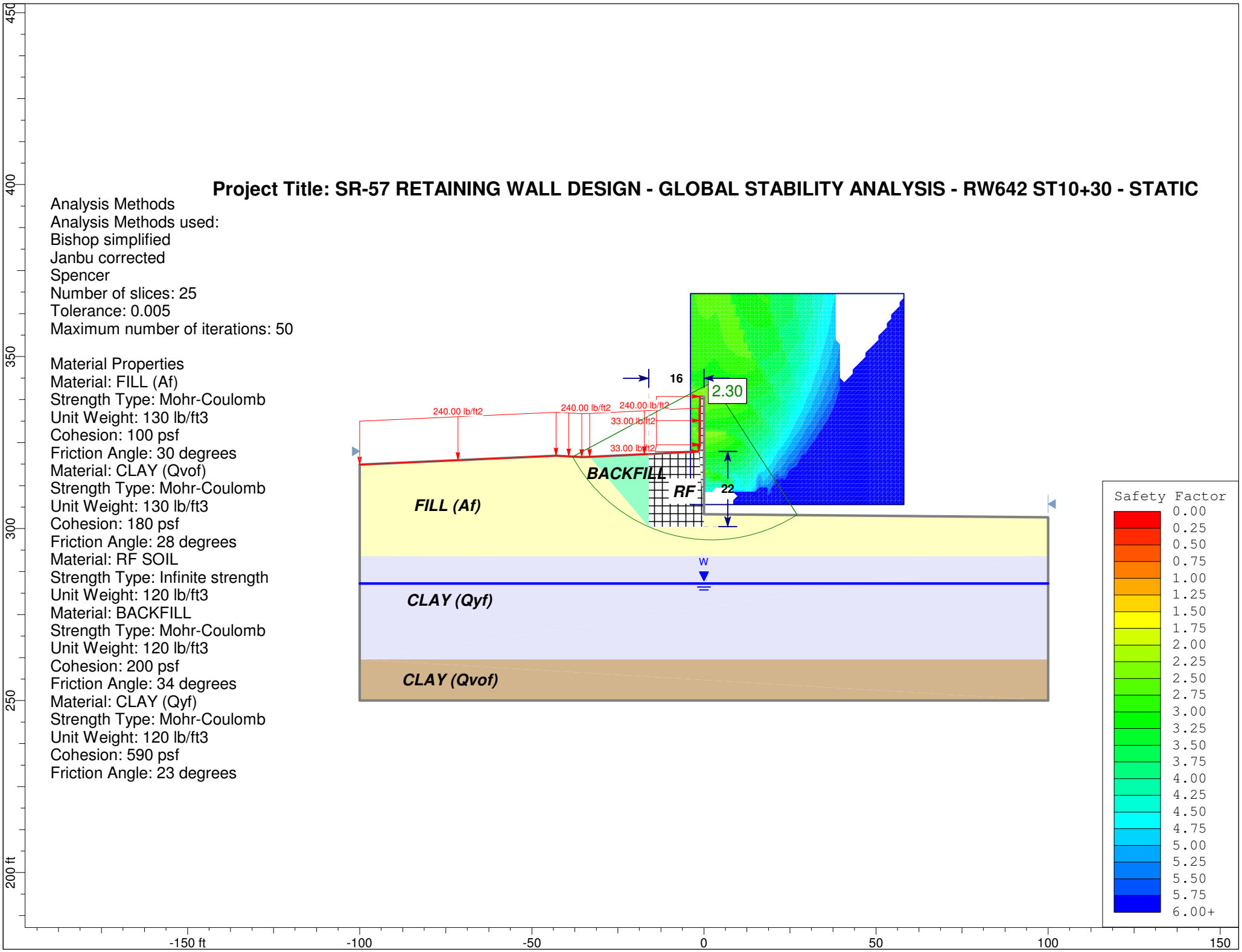
Distributed Load

-100.000	319.420
-82.610	320.030
-79.360	320.180
-70.730	320.630
-65.940	320.880
-58.270	321.330
-44.860	322.020
-37.850	322.200
-35.500	321.650
-33.537	321.729
-18.450	322.330
-11.500	322.610
-4.390	322.890
-1.500	323.010

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW642 ST10+30 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CLAY (Qyf)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 590 psf
Friction Angle: 23 degrees



Slide Analysis Information

Document Name

File Name: RW642+ST10+20_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW642 ST10+20 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qyf)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 590 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.304570
Center: 2.316, 342.542
Radius: 45.892
Left Slip Surface Endpoint: -38.153, 320.901
Right Slip Surface Endpoint: 27.104, 303.921
Resisting Moment=3.34578e+006 lb-ft
Driving Moment=1.4518e+006 lb-ft

Method: spencer
FS: 2.305670
Center: 2.316, 342.542
Radius: 45.892
Left Slip Surface Endpoint: -38.153, 320.901
Right Slip Surface Endpoint: 27.104, 303.921
Resisting Moment=3.34737e+006 lb-ft
Driving Moment=1.4518e+006 lb-ft
Resisting Horizontal Force=66045.9 lb
Driving Horizontal Force=28645 lb

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 12683
Number of Invalid Surfaces: 15928
Error Codes:
Error Code -99 reported for 6378 surfaces
Error Code -100 reported for 140 surfaces
Error Code -103 reported for 1739 surfaces
Error Code -105 reported for 24 surfaces
Error Code -106 reported for 64 surfaces
Error Code -107 reported for 38 surfaces
Error Code -109 reported for 6826 surfaces
Error Code -112 reported for 708 surfaces
Error Code -113 reported for 11 surfaces

Method: spencer
Number of Valid Surfaces: 11849
Number of Invalid Surfaces: 16762
Error Codes:
Error Code -99 reported for 6378 surfaces
Error Code -100 reported for 140 surfaces
Error Code -103 reported for 1739 surfaces
Error Code -105 reported for 24 surfaces
Error Code -106 reported for 64 surfaces
Error Code -107 reported for 38 surfaces
Error Code -108 reported for 200 surfaces
Error Code -109 reported for 6826 surfaces
Error Code -111 reported for 511 surfaces
Error Code -112 reported for 831 surfaces
Error Code -113 reported for 11 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

-3.884	306.956
58.114	306.956
58.114	368.312
-3.884	368.312

Material Boundary

-16.000	321.692
-16.000	300.500
0.000	300.500
0.000	304.170

Material Boundary

-33.185	320.840
-16.000	300.500

Material Boundary

-100.000	291.970
100.000	291.970

Material Boundary

-100.000	261.970
100.000	261.970

External Boundary

-100.000	318.610
-100.000	291.970
-100.000	261.970
-100.000	250.000
100.000	250.000
100.000	261.970
100.000	291.970
100.000	303.250
0.000	304.170
0.000	338.380
-1.130	338.380
-1.130	324.390
-1.500	322.410
-16.000	321.692
-33.185	320.840
-35.500	320.760
-42.958	321.157

Water Table

-100.000	284.000
100.000	284.000

Distributed Load

-1.130	338.380
-1.130	324.390
-1.500	322.410

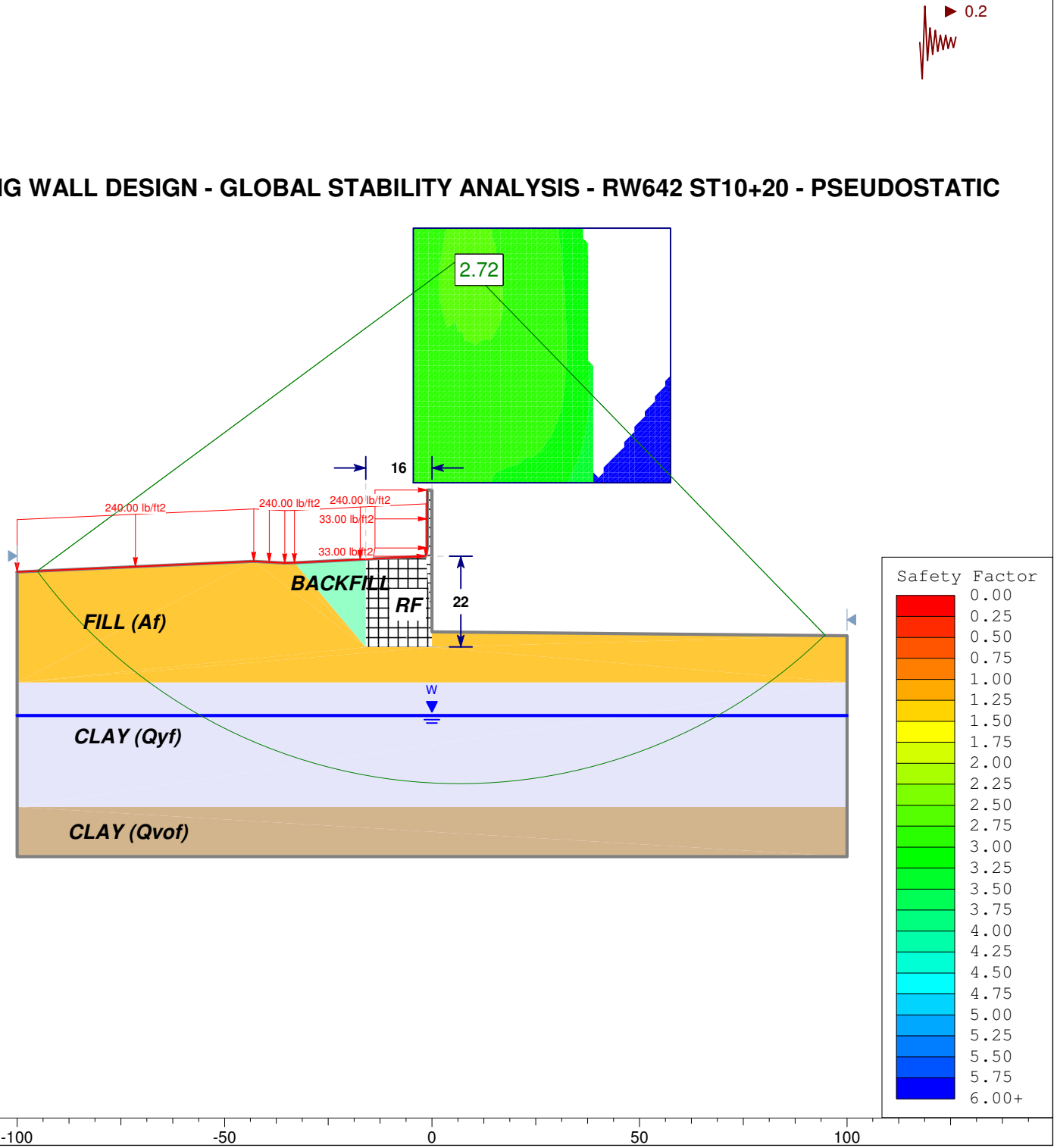
Distributed Load

-1.500	322.410
-16.000	321.692
-33.185	320.840
-35.500	320.760
-42.958	321.157
-100.000	318.610

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW642 ST10+20 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CLAY (Qyf) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 900 psf
Friction Angle: 26 degrees



Slide Analysis Information

Document Name

File Name: RW642+ST10+20_Pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW642 ST10+20 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qyf) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 900 psf
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.717150
Center: 6.615, 394.121
Radius: 126.592
Left Slip Surface Endpoint: -95.150, 318.827
Right Slip Surface Endpoint: 94.801, 303.298
Resisting Moment=6.99226e+007 lb-ft
Driving Moment=2.57338e+007 lb-ft

Method: spencer
FS: 2.729880
Center: 6.615, 394.121
Radius: 126.592
Left Slip Surface Endpoint: -95.150, 318.827
Right Slip Surface Endpoint: 94.801, 303.298
Resisting Moment=7.02501e+007 lb-ft
Driving Moment=2.57338e+007 lb-ft
Resisting Horizontal Force=502307 lb
Driving Horizontal Force=184003 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 8238
Number of Invalid Surfaces: 20373
Error Codes:
Error Code -99 reported for 7130 surfaces
Error Code -103 reported for 104 surfaces
Error Code -106 reported for 56 surfaces
Error Code -107 reported for 6 surfaces
Error Code -109 reported for 13077 surfaces

Method: spencer
Number of Valid Surfaces: 8238
Number of Invalid Surfaces: 20373
Error Codes:
Error Code -99 reported for 7130 surfaces
Error Code -103 reported for 104 surfaces
Error Code -106 reported for 56 surfaces
Error Code -107 reported for 6 surfaces
Error Code -109 reported for 13077 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite
strength material. If infinite strength regions
are defined for a model, a large number of
potential slip surfaces may show this error code.
This is Normal.

-103 = Two surface / slope intersections,
but one or more surface / nonslope external polygon
intersections lie between them. This usually occurs
when the slip surface extends past the bottom of the
soil region, but may also occur on a benched
slope model with two sets of Slope Limits.

-106 = Average slice width is less than
0.0001 * (maximum horizontal extent of soil region).
This limitation is imposed to avoid numerical errors
which may result from too many slices, or too
small a slip region.

-107 = Total driving moment or
total driving force is negative. This will occur
if the wrong failure direction is specified,
or if high external or anchor loads are applied
against the failure direction.

-109 = Soiltype for slice base not
located. This error should occur very rarely,
if at all. It may occur if a very low number of
slices is combined with certain soil geometries,
such that the midpoint of a slice base is
actually outside the soil region,even though
the slip surface is wholly within the soil region.

List of All Coordinates

Search Grid

-4.544	340.127
57.454	340.127
57.454	401.483
-4.544	401.483

Material Boundary

-16.000	321.692
-16.000	300.500
0.000	300.500
0.000	304.170

Material Boundary

-33.185	320.840
-16.000	300.500

Material Boundary

-100.000	291.970
100.000	291.970

Material Boundary

-100.000	261.970
100.000	261.970

External Boundary

-100.000	318.610
-100.000	291.970
-100.000	261.970
-100.000	250.000
100.000	250.000
100.000	261.970
100.000	291.970
100.000	303.250
0.000	304.170
0.000	338.380
-1.130	338.380
-1.130	324.390
-1.500	322.410
-16.000	321.692
-33.185	320.840
-35.500	320.760
-42.958	321.157

Water Table

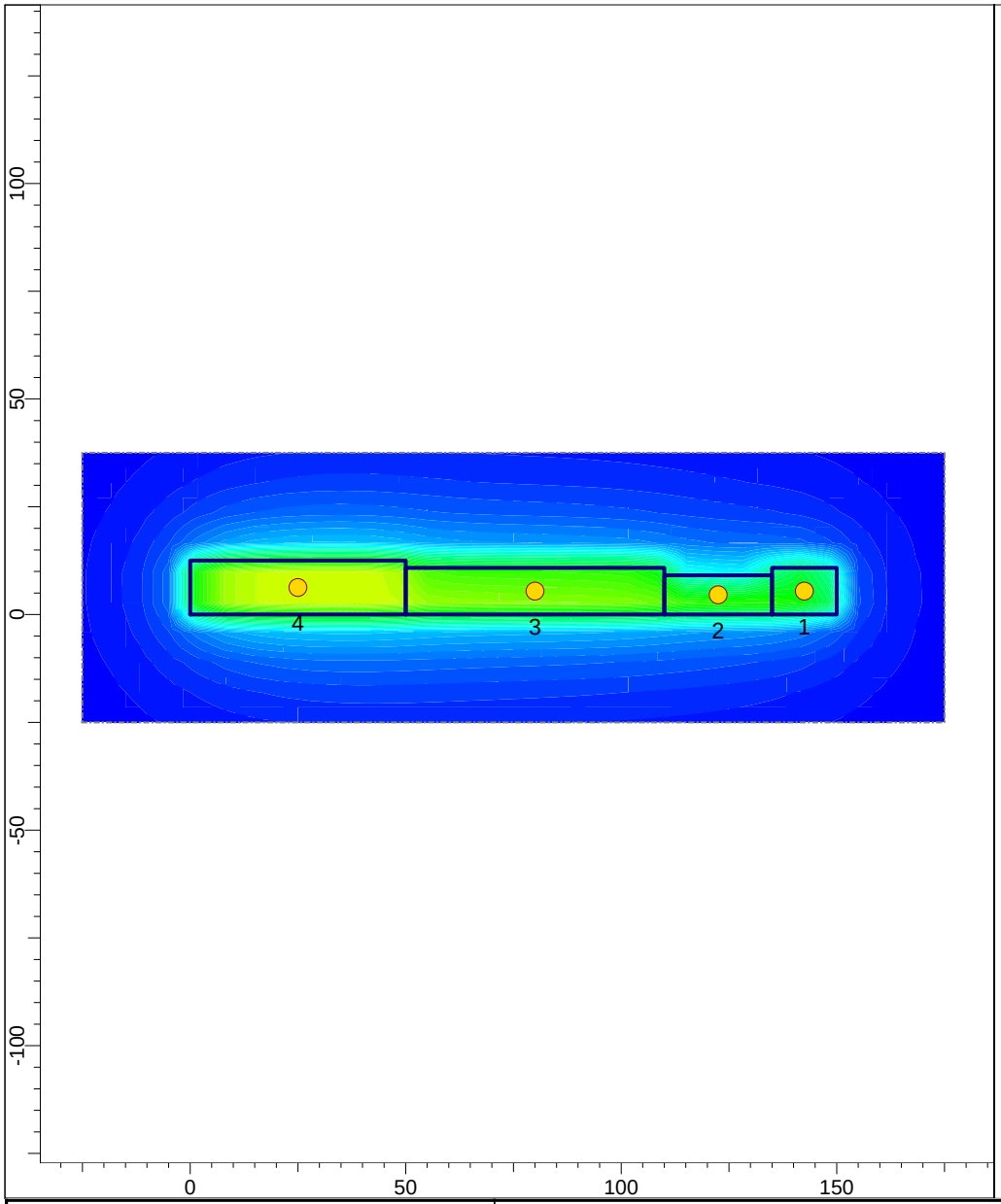
-100.000	284.000
100.000	284.000

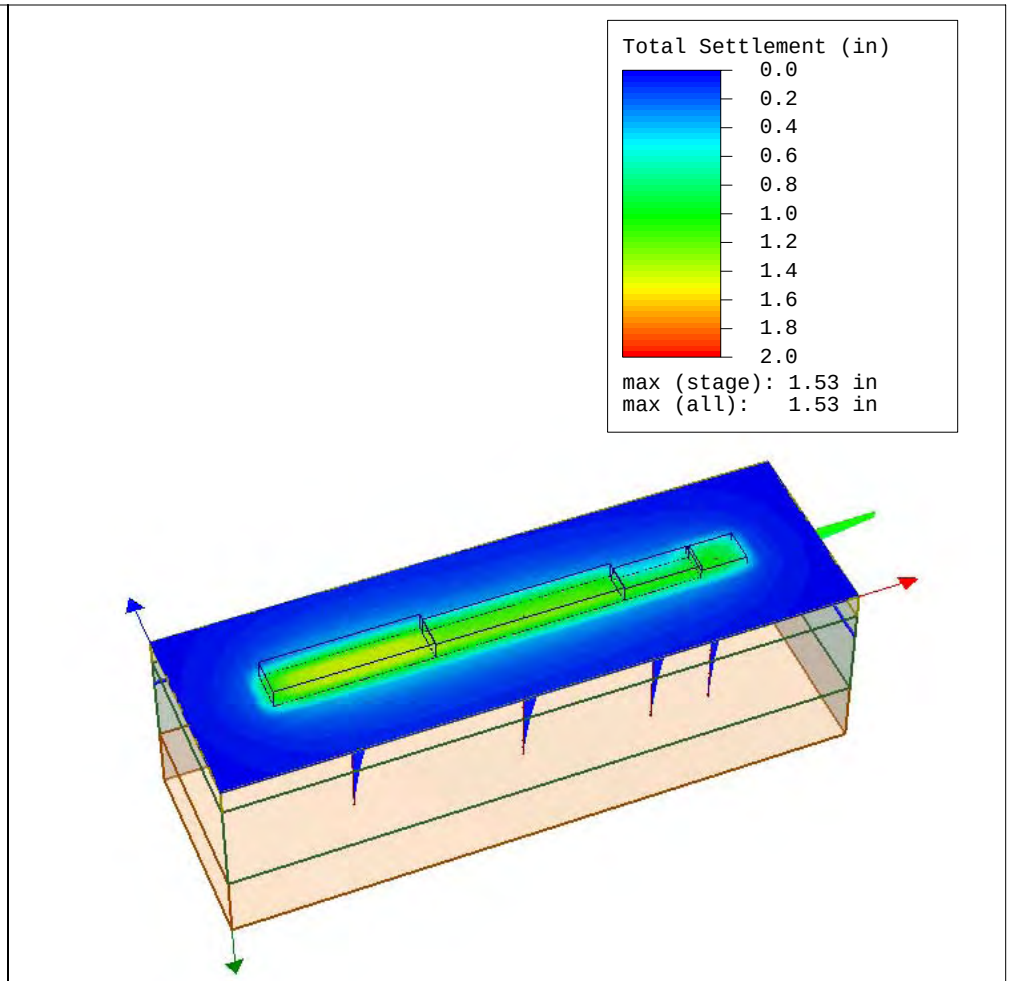
Distributed Load

-1.130	338.380
-1.130	324.390
-1.500	322.410

Distributed Load

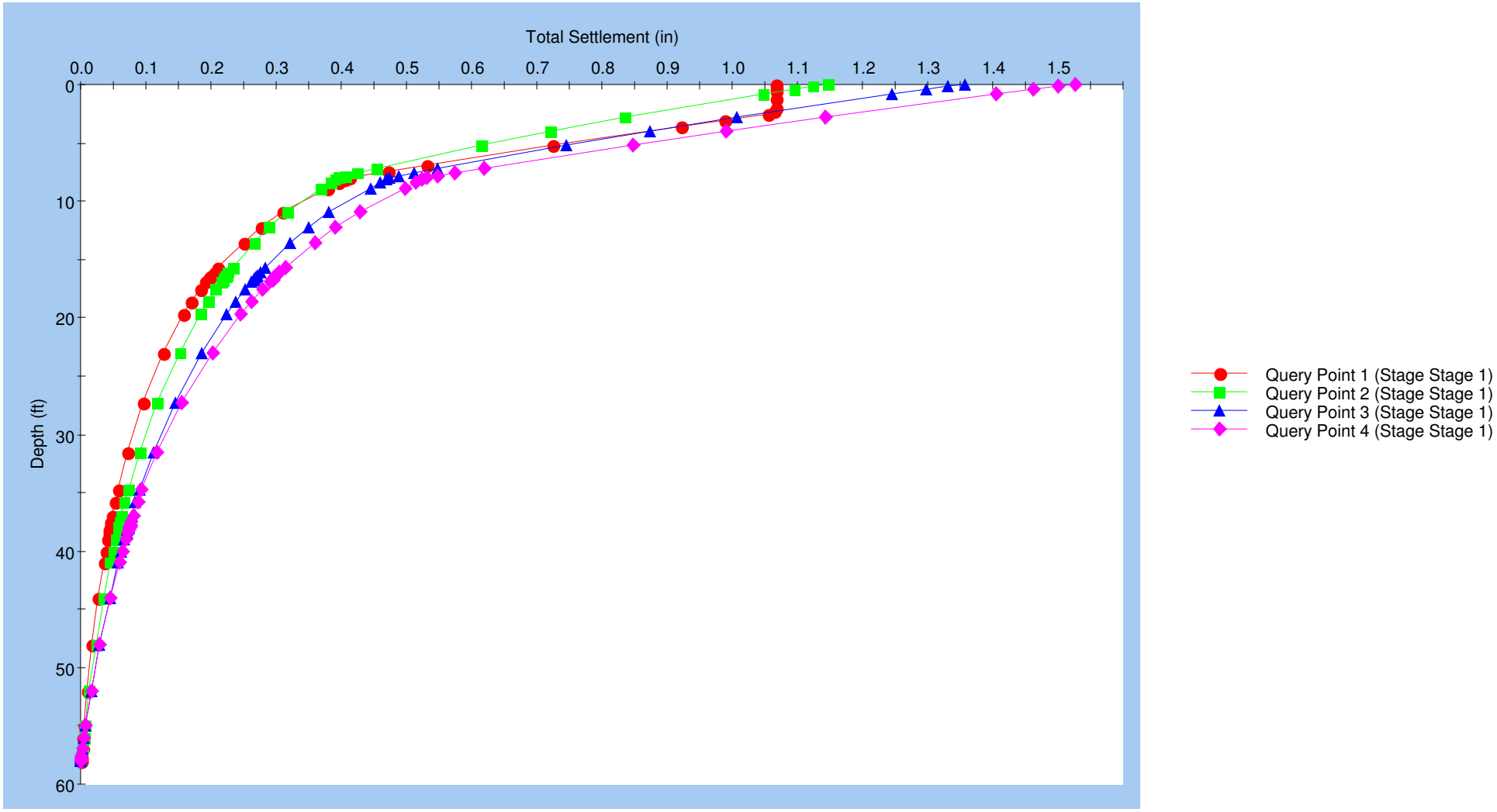
-1.500	322.410
-16.000	321.692
-33.185	320.840
-35.500	320.760
-42.958	321.157
-100.000	318.610





rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW642 ST10+20 to ST11+70	
	Drawn By RB	*Company*	CH2M HILL
	Date 2/24/2009, 9:44:35 AM	*File Name*	RW642_ST10+20toST11+70.s3z

Total Settlement vs. Depth



Reference Stage: None

rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW642 ST10+20 to ST11+70	
	Drawn By	RB	*Company* CH2M HILL
	Date	2/24/2009, 9:44:35 AM	*File Name* RW642_ST10+20toST11+70.s3z

Settle3D Analysis Information

Project Settings

Project Title: SR-57 Settlement Analysis
Analysis: RW642 ST10+20 to ST11+70
Author: RB
Company: CH2M HILL
Date Created: 2/24/2009, 9:44:35 AM
Stress Computation Method: Boussinesq
Groundwater method: Water Table
Water Unit Weight: 0.0624 kips/ft^3
Depth to water table: 16.5 [ft]

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	1.52548
Consolidation Settlement [in]	0	1.52548
Immediate Settlement [in]	0	0
Loading Stress [ksf]	0	3.75421
Effective Stress [ksf]	0	5.05622
Total Stress [ksf]	0	7.64582
Total Strain	1.26839e-010	0.0138818
Pore Water Pressure [ksf]	0	2.5896
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 50 ft
Width: 12.54 ft
Rotation angle: 0 degrees
Load: 3.754 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-1.77636e-014	0
50	0
50	12.54
-1.77636e-014	12.54

Rectangular Load

Length: 60 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.4166 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
50	4.44089e-016
110	4.44089e-016
110	10.82
50	10.82

Rectangular Load

Length: 25 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.085 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
110	8.88178e-016
135	8.88178e-016
135	9.1
110	9.1

Rectangular Load

Length: 15 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.4166 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
135	0
150	0
150	10.82
135	10.82

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	FILL (Af)	8	0
2	CLAY (Qyf)	30	8
3	CLAY (Qvof)	20	38

Soil Properties

FILL (Af)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.025
Cre	0.0025
Pc [ksf]	1.75

CLAY (Qyf)	
Unit Weight [kips/ft^3]	0.12
Saturated Unit Weight [kips/ft^3]	0.12
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.06
Cre	0.006
Pc [ksf]	8.17

CLAY (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.06
Cre	0.006
Pc [ksf]	12.8

Query Points

String #	(X,Y) Location	Number of Divisions
1	142.5, 5.41	59
2	122.5, 4.55	57

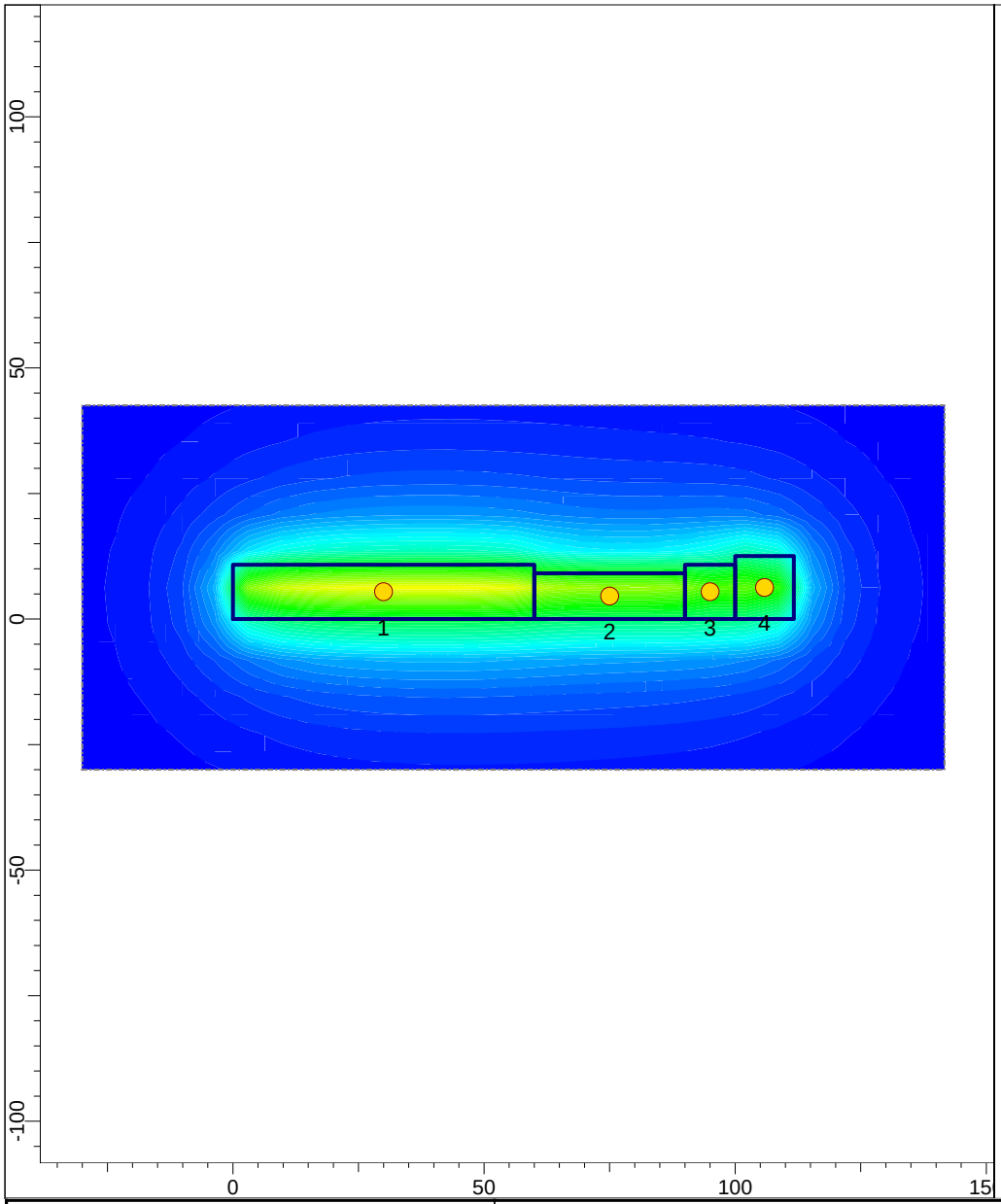
3	80, 5.41	57
4	25, 6.27	57

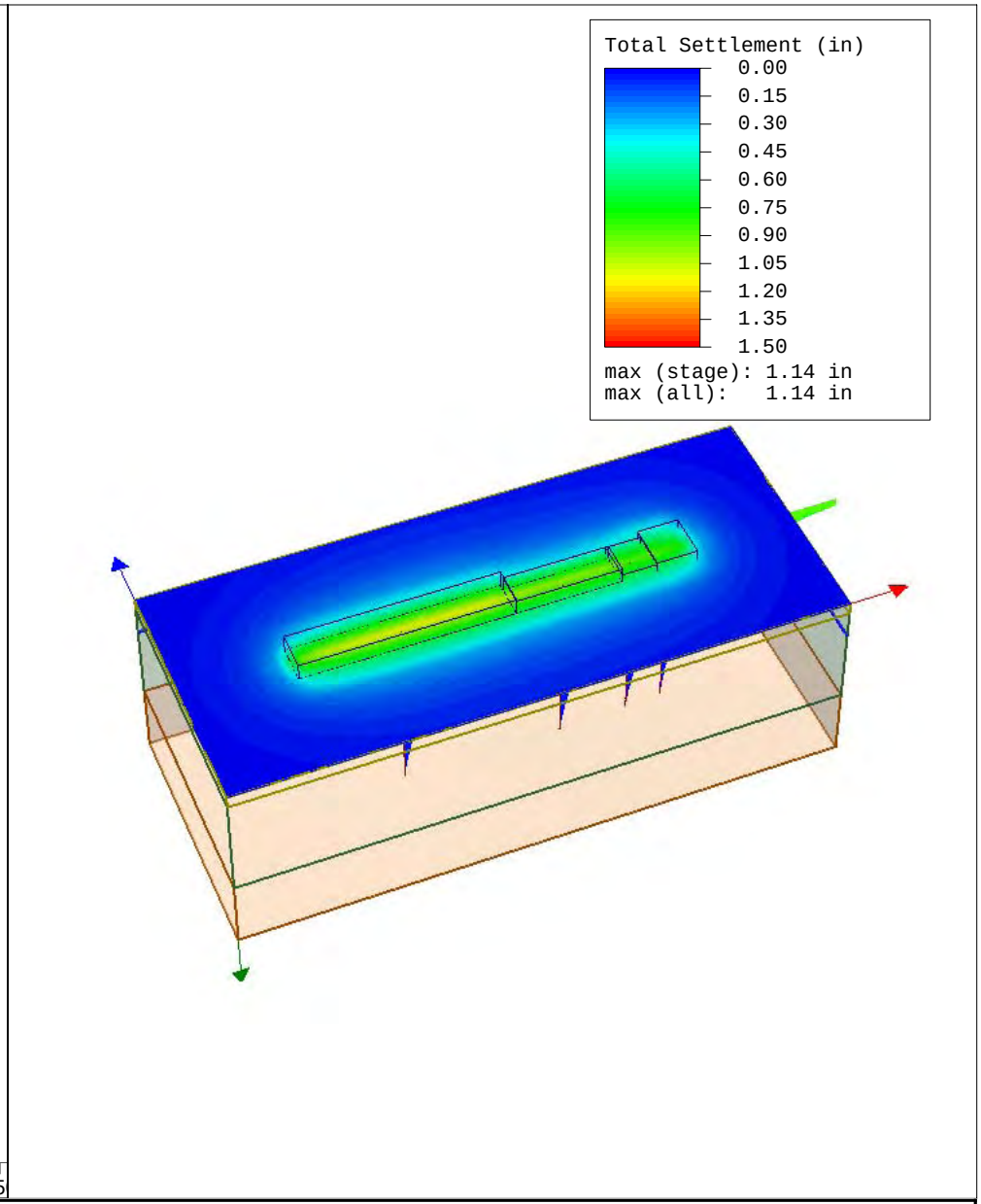
Grid

Number of points: 310
Expansion Factor: 2

Grid Coordinates

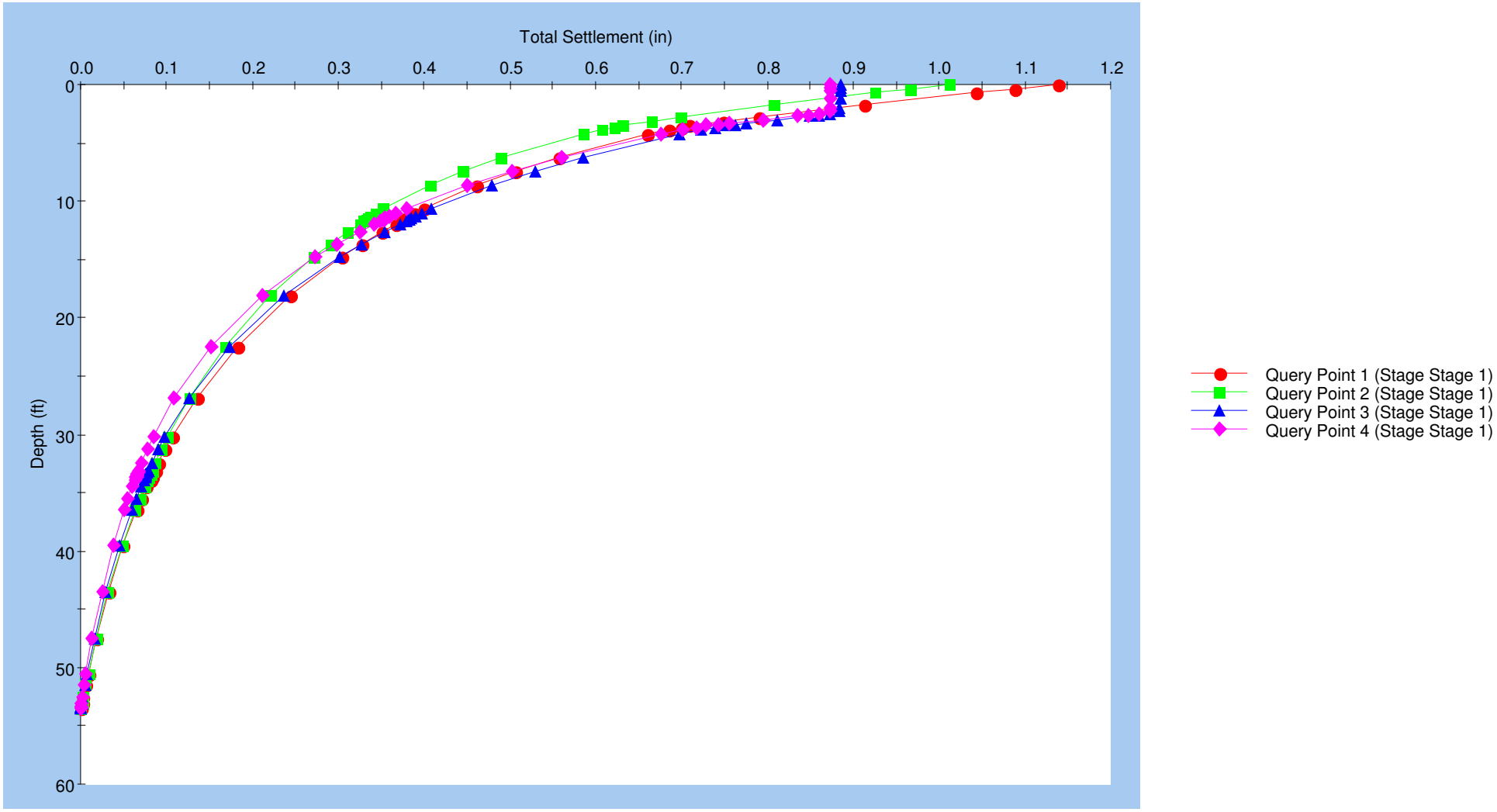
X [ft]	Y [ft]
175	37.54
175	-25
-25	-25
-25	37.54





rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW642 ST10+20 to ST11+70	
	Drawn By RB	*Company*	CH2M HILL
	Date 2/24/2009, 9:44:35 AM	*File Name*	RW642_ST11+90toST13+02.s3z

Total Settlement vs. Depth



Reference Stage: None

rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW642 ST10+20 to ST11+70	
	Drawn By RB	*Company*	CH2M HILL
	Date 2/24/2009, 9:44:35 AM	*File Name*	RW642_ST11+90toST13+02.s3z

Settle3D Analysis Information

Project Settings

Project Title: SR-57 Settlement Analysis
Analysis: RW642 ST10+20 to ST11+70
Author: RB
Company: CH2M HILL
Date Created: 2/24/2009, 9:44:35 AM
Stress Computation Method: Boussinesq
Groundwater method: Water Table
Water Unit Weight: 0.0624 kips/ft^3
Depth to water table: 11.5 [ft]

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	1.13897
Consolidation Settlement [in]	0	1.13897
Immediate Settlement [in]	0	0
Loading Stress [ksf]	0	3.75649
Effective Stress [ksf]	0	4.39874
Total Stress [ksf]	0	7.01954
Total Strain	0	0.0120505
Pore Water Pressure [ksf]	0	2.6208
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 11.68 ft
Width: 12.54 ft
Rotation angle: 0 degrees
Load: 3.754 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
100	0
111.68	0
111.68	12.54
100	12.54

Rectangular Load

Length: 60 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.4166 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-1.77636e-014	0
60	0
60	10.82
-1.77636e-014	10.82

Rectangular Load

Length: 30 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.085 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
60	0
90	0
90	9.1
60	9.1

Rectangular Load

Length: 10 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.4166 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
90	0
100	0
100	10.82
90	10.82

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	FILL (Af)	3.5	0
2	CLAY (Qyf)	30	3.5
3	CLAY (Qvof)	20	33.5

Soil Properties

FILL (Af)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.025
Cre	0.0025
Pc [ksf]	1.75

CLAY (Qyf)	
Unit Weight [kips/ft^3]	0.12
Saturated Unit Weight [kips/ft^3]	0.12
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.06
Cre	0.006
Pc [ksf]	8.17

CLAY (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.06
Cre	0.006
Pc [ksf]	12.8

Query Points

String #	(X,Y) Location	Number of Divisions
1	30, 5.41	53
2	75, 4.55	53
3	95, 5.41	59
4	105.84, 6.27	59

Grid

Number of points: 297
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
141.68	42.54
141.68	-30
-30	-30
-30	42.54

Retaining Wall RW 646

AASHTO DESIGN METHOD
SR57 MSE ANALYSES

PROJECT IDENTIFICATION

Title: SR57 MSE ANALYSES
Project Number: RW646
Client: OCTA
Designer: RB
Station Number: ST11+50

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive, #800

Santa Ana, CA 92707
Telephone #: 714-424-2900
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....is\RW646_ST11+50.BEN
Original date and time of creating this file: Wed Dec 17 16:36:11 2008

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	30.0 °
Equivalent cohesion, $c_{equiv.}$	950.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (eq. 17 is utilized to calculate Ka for all batters)
(For internal stability user specified $\delta = 0.00°$)
Ka (external stability) = 0.2871 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 30.14 N γ= 22.40

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4913 Kae (Kh = 0) = 0.2871 Δ Kae = 0.2042 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

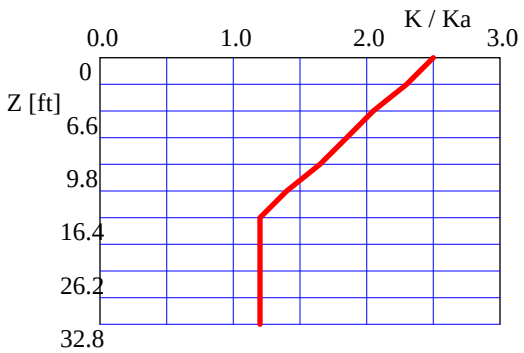
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	12.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

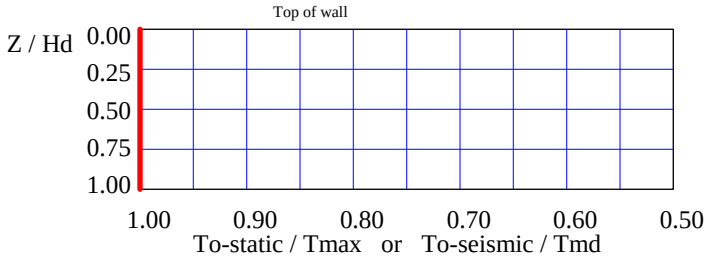


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	CALTRANS	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

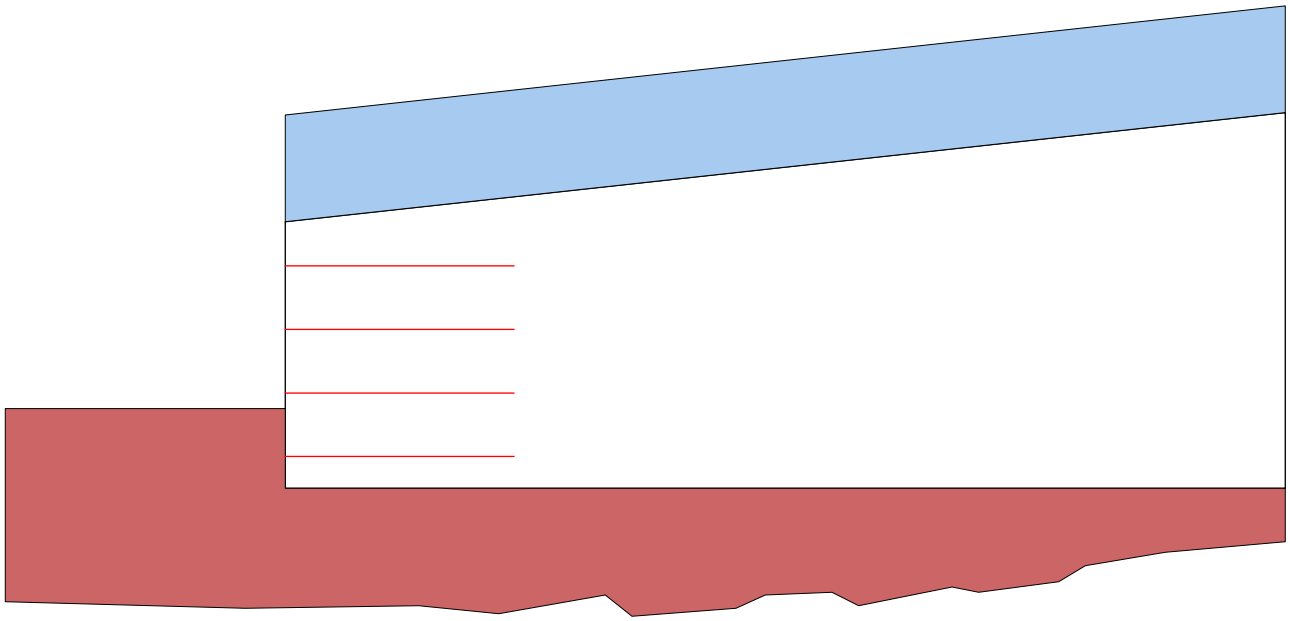
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	10.49	[ft]	{ Embedded depth is E = 3.13 ft, and height above top of finished bottom grade is H = 7.36 ft }
Batter, ω	0.0	[deg]	
Backslope, β	6.2	[deg]	
Backslope rise	5.6	[ft]	Broken back equivalent angle, I = 6.22° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 20.64, Meyerhof stress = 1916 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.185, Eccentricity, e/L = 0.0839, Fs-overturning = 5.10

	METAL MATS			CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	9.00	1	N/A	8.84	9.83	9.827	23.961	3.507	0.0657	CALTRANS
2	3.75	9.00	1	N/A	10.39	11.55	11.548	19.829	4.413	0.0341	CALTRANS
3	6.25	9.00	1	N/A	13.20	14.66	14.661	17.042	6.021	0.0083	CALTRANS
4	8.75	9.00	1	N/A	17.49	19.43	19.430	15.437	9.915	-0.0140	CALTRANS

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

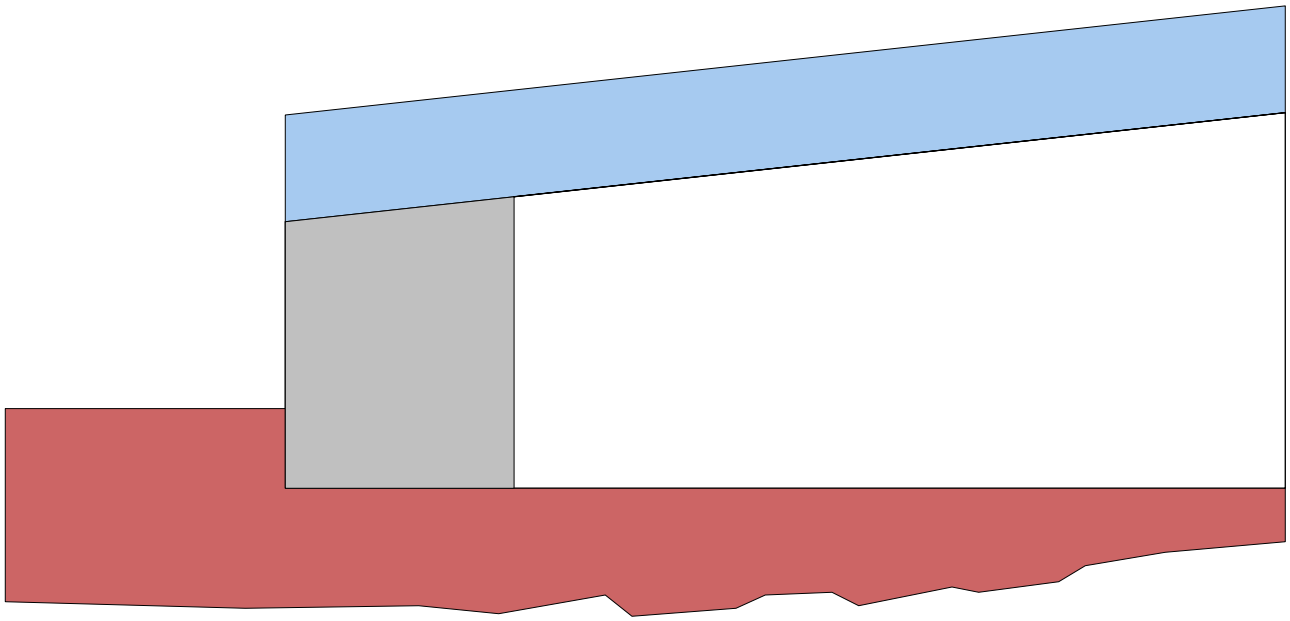
Bearing capacity, Fs = 13.82, Meyerhof stress = 2646 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.743, Eccentricity, e/L = 0.1958, Fs-overturning = 2.42

	METAL MATS			CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	9.00	1	N/A	7.80	8.67	8.671	16.914	1.965	0.1510	CALTRANS
2	3.75	9.00	1	N/A	9.21	10.24	10.236	14.061	2.638	0.0769	CALTRANS
3	6.25	9.00	1	N/A	11.59	12.88	12.878	11.975	4.009	0.0233	CALTRANS
4	8.75	9.00	1	N/A	14.77	16.42	16.416	10.434	8.107	-0.0122	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	39539	36574	[lb/ft ²]
Meyerhof stress, σ_V	1916.0	2646	[lb/ft ²]
Eccentricity, e	0.76	1.77	[ft]
Eccentricity, e/L	0.084	0.197	
Fs calculated	20.64	13.82	
Base length	9.00	9.00	[ft]



SCALE:

0 2 4 6 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.185 and Fs-seismic = 1.743

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	9.00	3.507	1.965	1	CALTRANS
2	3.75	9.00	4.413	2.638	1	CALTRANS
3	6.25	9.00	6.021	4.009	1	CALTRANS
4	8.75	9.00	9.915	8.107	1	CALTRANS

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.0839, e/L seismic = 0.1958; Overturning: Fs-static = 5.10, Fs-seismic = 2.42

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	9.00	0.0657	0.1510	1	CALTRANS
2	3.75	9.00	0.0341	0.0769	1	CALTRANS
3	6.25	9.00	0.0083	0.0233	1	CALTRANS
4	8.75	9.00	-0.0140	-0.0122	1	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	2.000	0.500	18225	1854.60	247.20	N/A	9.827	N/A	8.671
2	3.75	2.000	0.500	18225	1578.15	202.25	N/A	11.548	N/A	10.236
3	6.25	2.000	0.500	18225	1243.04	172.19	N/A	14.661	N/A	12.878
4	8.75	2.000	0.500	18225	937.96	172.19	N/A	19.430	N/A	16.416

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	2.000	1854.6	247.2	8.25	0.75	44437.6	N/A	23.961	35550.1	N/A	16.914
2	3.75	2.000	1578.2	202.3	6.75	2.25	31292.9	N/A	19.829	25034.4	N/A	14.061
3	6.25	2.000	1243.0	172.2	5.75	3.25	21184.4	N/A	17.042	16947.5	N/A	11.975
4	8.75	2.000	938.0	172.2	5.75	3.25	14479.4	N/A	15.437	11583.5	N/A	10.434

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.000	0.500	1855	0.90	16402	18225	N/A	8.84	N/A	9.83	CALTRANS
2	3.75	2.000	0.500	1578	0.90	16402	18225	N/A	10.39	N/A	11.55	CALTRANS
3	6.25	2.000	0.500	1243	0.90	16402	18225	N/A	13.20	N/A	14.66	CALTRANS
4	8.75	2.000	0.500	938	0.90	16402	18225	N/A	17.49	N/A	19.43	CALTRANS

RESULTS for CONNECTION (seismic conditions)

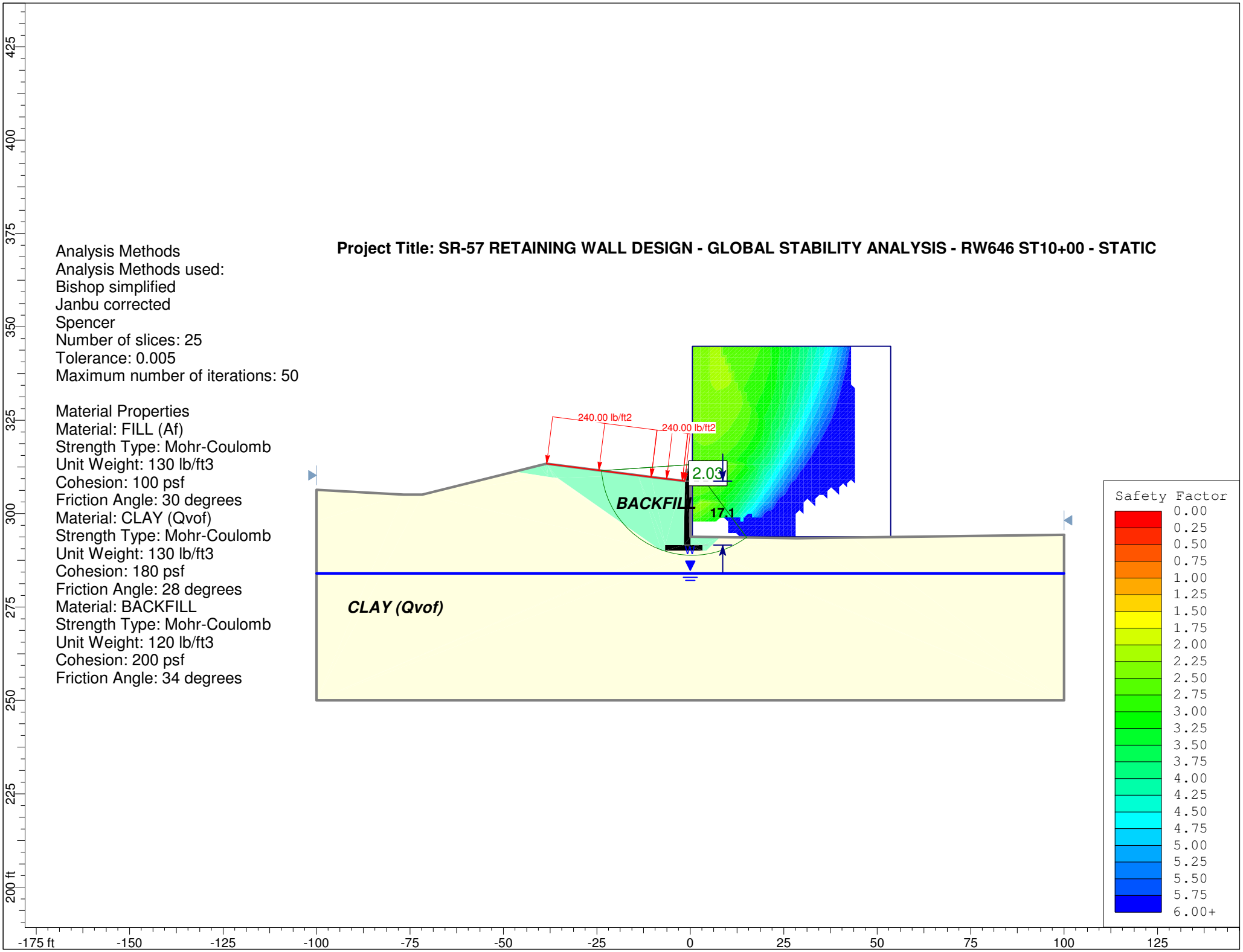
#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.000	0.500	2102	0.90	16402	18225	N/A	7.80	N/A	8.67	CALTRANS
2	3.75	2.000	0.500	1780	0.90	16402	18225	N/A	9.21	N/A	10.24	CALTRANS
3	6.25	2.000	0.500	1415	0.90	16402	18225	N/A	11.59	N/A	12.88	CALTRANS
4	8.75	2.000	0.500	1110	0.90	16402	18225	N/A	14.77	N/A	16.42	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW646 ST10+00 - STATIC



Slide Analysis Information

Document Name

File Name: RW646_ST10+00_STATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW646 ST10+00 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.027010
Center: 0.542, 313.165
Radius: 24.363
Left Slip Surface Endpoint: -23.764, 311.493
Right Slip Surface Endpoint: 15.054, 293.595
Resisting Moment=1.04511e+006 lb-ft
Driving Moment=515593 lb-ft

Method: spencer
FS: 2.014320
Center: 1.603, 313.165
Radius: 24.699
Left Slip Surface Endpoint: -23.032, 311.400
Right Slip Surface Endpoint: 16.645, 293.575
Resisting Moment=1.0637e+006 lb-ft
Driving Moment=528066 lb-ft
Resisting Horizontal Force=35700.1 lb
Driving Horizontal Force=17723.1 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 8392
Number of Invalid Surfaces: 20219
Error Codes:
Error Code -99 reported for 8184 surfaces
Error Code -100 reported for 4 surfaces
Error Code -103 reported for 4800 surfaces
Error Code -105 reported for 2 surfaces
Error Code -107 reported for 6184 surfaces
Error Code -112 reported for 1045 surfaces

Method: spencer
Number of Valid Surfaces: 7259
Number of Invalid Surfaces: 21352
Error Codes:
Error Code -99 reported for 8184 surfaces
Error Code -100 reported for 4 surfaces
Error Code -103 reported for 4800 surfaces
Error Code -105 reported for 2 surfaces
Error Code -107 reported for 6184 surfaces
Error Code -108 reported for 488 surfaces
Error Code -111 reported for 589 surfaces
Error Code -112 reported for 1101 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

0.542	293.790
53.609	293.790
53.609	344.777
0.542	344.777

Material Boundary

-40.480	312.890
-39.167	313.200
-38.490	313.360
-38.489	313.361

Material Boundary

28.590	293.420
42.940	293.600

Material Boundary

-2.164	308.797
-1.690	308.740
-1.470	308.720
-1.000	311.640
-0.990	311.720

Material Boundary

99.637	294.315
100.000	294.310

Material Boundary

-47.032	311.256
-38.030	309.860
-36.560	309.640
-36.352	309.620
-36.090	309.600
-35.518	309.556
-7.750	290.100
-6.750	290.100

Material Boundary

0.022	293.790
0.022	293.790

Material Boundary

-1.470	308.720
-1.710	291.600
-6.750	291.600
-6.750	290.100
3.250	290.100
3.250	291.600
0.022	291.600
0.022	293.790

Material Boundary

3.250	290.100
4.250	290.100
7.929	293.688

External Boundary

100.000	294.320
99.637	294.315
43.044	293.602
28.590	293.420
7.929	293.688
0.022	293.790
0.010	311.720
0.000	311.720
-0.020	311.720
-0.990	311.720
-1.470	308.720
-2.164	308.797
-10.487	309.796
-13.978	310.243
-38.450	313.370
-38.489	313.361
-39.167	313.200
-40.480	312.890
-47.032	311.256
-71.720	305.100
-76.720	305.100
-100.000	306.360
-100.000	298.000
-100.000	250.000
100.000	250.000
100.000	294.310

Water Table

-100.000	284.000
100.000	284.000

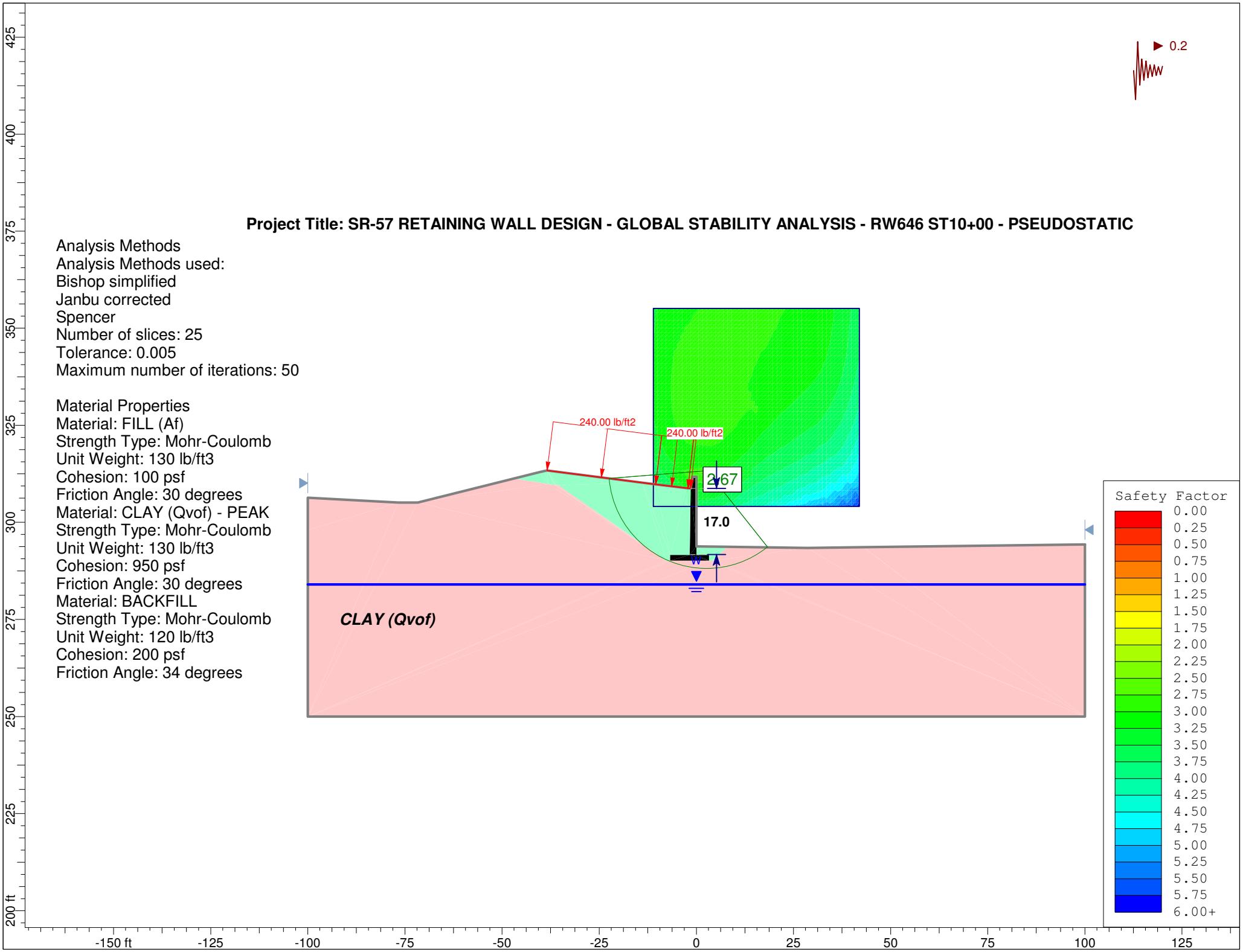
Distributed Load

-1.470	308.720
-2.164	308.797
-10.487	309.796
-38.450	313.370

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW646 ST10+00 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW646_ST10+00_PSEUDOSTATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW646 ST10+00 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 150 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.448200
Center: 6.949, 345.921
Radius: 57.778
Left Slip Surface Endpoint: -40.460, 312.895
Right Slip Surface Endpoint: 31.145, 293.452
Resisting Moment=3.68702e+006 lb-ft
Driving Moment=2.54594e+006 lb-ft

Method: spencer
FS: 1.457780
Center: 6.949, 345.921
Radius: 57.778
Left Slip Surface Endpoint: -40.460, 312.895
Right Slip Surface Endpoint: 31.145, 293.452
Resisting Moment=3.71141e+006 lb-ft
Driving Moment=2.54594e+006 lb-ft
Resisting Horizontal Force=58678.4 lb
Driving Horizontal Force=40252 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 13958
Number of Invalid Surfaces: 14653
Error Codes:
Error Code -99 reported for 9632 surfaces
Error Code -100 reported for 3 surfaces
Error Code -103 reported for 4453 surfaces
Error Code -112 reported for 565 surfaces

Method: spencer
Number of Valid Surfaces: 12821
Number of Invalid Surfaces: 15790
Error Codes:
Error Code -99 reported for 9632 surfaces
Error Code -100 reported for 3 surfaces
Error Code -103 reported for 4453 surfaces
Error Code -108 reported for 8 surfaces
Error Code -111 reported for 190 surfaces
Error Code -112 reported for 1504 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

-11.093	304.111
41.974	304.111
41.974	355.098
-11.093	355.098

Material Boundary

-40.480	312.890
-39.167	313.200
-38.490	313.360
-38.489	313.361

Material Boundary

28.590	293.420
42.940	293.600

Material Boundary

-2.164	308.797
-1.690	308.740
-1.470	308.720
-1.000	311.640
-0.990	311.720

Material Boundary

99.637	294.315
100.000	294.310

Material Boundary

-47.032	311.256
-38.030	309.860
-36.560	309.640
-36.352	309.620
-36.090	309.600
-35.518	309.556
-7.750	290.100
-6.750	290.100

Material Boundary

0.022	293.790
0.022	293.790

Material Boundary

-1.470	308.720
-1.710	291.600
-6.750	291.600
-6.750	290.100
3.250	290.100
3.250	291.600
0.022	291.600
0.022	293.790

Material Boundary

3.250	290.100
4.250	290.100
7.929	293.688

External Boundary

100.000	294.320
99.637	294.315
43.044	293.602
28.590	293.420
7.929	293.688

0.022	293.790
0.010	311.720
0.000	311.720
-0.020	311.720
-0.990	311.720
-1.470	308.720
-2.164	308.797
-10.487	309.796
-13.978	310.243
-38.450	313.370
-38.489	313.361
-39.167	313.200
-40.480	312.890
-47.032	311.256
-71.720	305.100
-76.720	305.100
-100.000	306.360
-100.000	298.000
-100.000	250.000
100.000	250.000
100.000	294.310

Water Table

-100.000	284.000
100.000	284.000

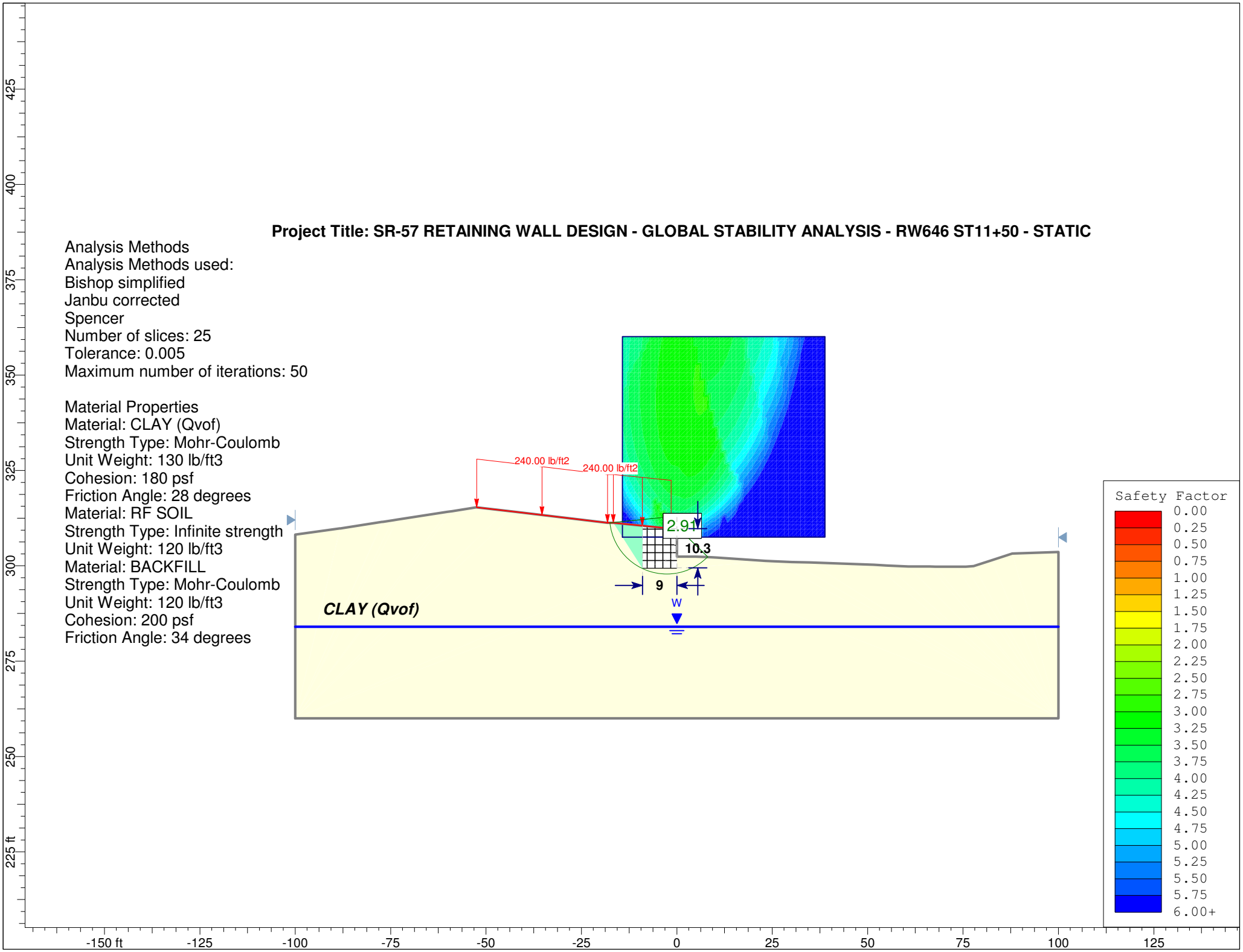
Distributed Load

-1.470	308.720
-2.164	308.797
-10.487	309.796
-38.450	313.370

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW646 ST11+50 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW646_ST11+50_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW646 ST11+50 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.911410
Center: -2.596, 312.789
Radius: 15.013
Left Slip Surface Endpoint: -17.532, 311.269
Right Slip Surface Endpoint: 8.120, 302.274
Resisting Moment=337788 lb-ft
Driving Moment=116022 lb-ft

Method: spencer
FS: 2.898250
Center: -2.596, 312.789
Radius: 15.013
Left Slip Surface Endpoint: -17.532, 311.269
Right Slip Surface Endpoint: 8.120, 302.274
Resisting Moment=336261 lb-ft
Driving Moment=116022 lb-ft
Resisting Horizontal Force=18852.7 lb
Driving Horizontal Force=6504.84 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 14723
Number of Invalid Surfaces: 13888
Error Codes:
Error Code -99 reported for 4916 surfaces
Error Code -100 reported for 4 surfaces
Error Code -103 reported for 6557 surfaces
Error Code -106 reported for 61 surfaces
Error Code -109 reported for 2246 surfaces
Error Code -112 reported for 104 surfaces

Method: spencer
Number of Valid Surfaces: 14216
Number of Invalid Surfaces: 14395
Error Codes:
Error Code -99 reported for 4916 surfaces
Error Code -100 reported for 4 surfaces
Error Code -103 reported for 6557 surfaces
Error Code -106 reported for 61 surfaces
Error Code -108 reported for 47 surfaces
Error Code -109 reported for 2246 surfaces
Error Code -111 reported for 450 surfaces
Error Code -112 reported for 114 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

-14.277	307.533
38.819	307.533
38.819	360.091
-14.277	360.091

Material Boundary

-52.640	315.318
-44.890	314.430
-41.915	314.084

Material Boundary

4.997	302.380
8.810	302.250

Material Boundary

-9.000	310.503
-9.000	299.250
0.000	299.250
0.000	302.380

Material Boundary

-16.664	311.280
-9.000	299.250

External Boundary

-100.000	260.000
100.000	260.000
100.000	303.600
87.870	303.210
82.470	301.460
77.750	299.940
75.740	299.770
73.140	299.750
67.790	299.760
66.280	299.800
60.650	299.840
54.960	300.060
51.650	300.270
34.880	300.870
30.100	300.970
25.450	301.170
23.200	301.290
10.540	302.150
8.810	302.250

5.000	302.380
4.997	302.380
0.000	302.380
0.000	312.740
-1.000	312.740
-1.480	309.740
-9.000	310.503
-16.664	311.280
-18.170	311.260
-41.915	314.084
-52.470	315.340
-52.630	315.320
-52.640	315.318
-58.920	314.320
-60.170	314.140
-73.240	312.100
-74.420	311.940
-77.097	311.533
-77.250	311.510
-88.160	309.811
-88.360	309.780
-100.000	308.190

Water Table

-100.000	284.000
100.000	284.000

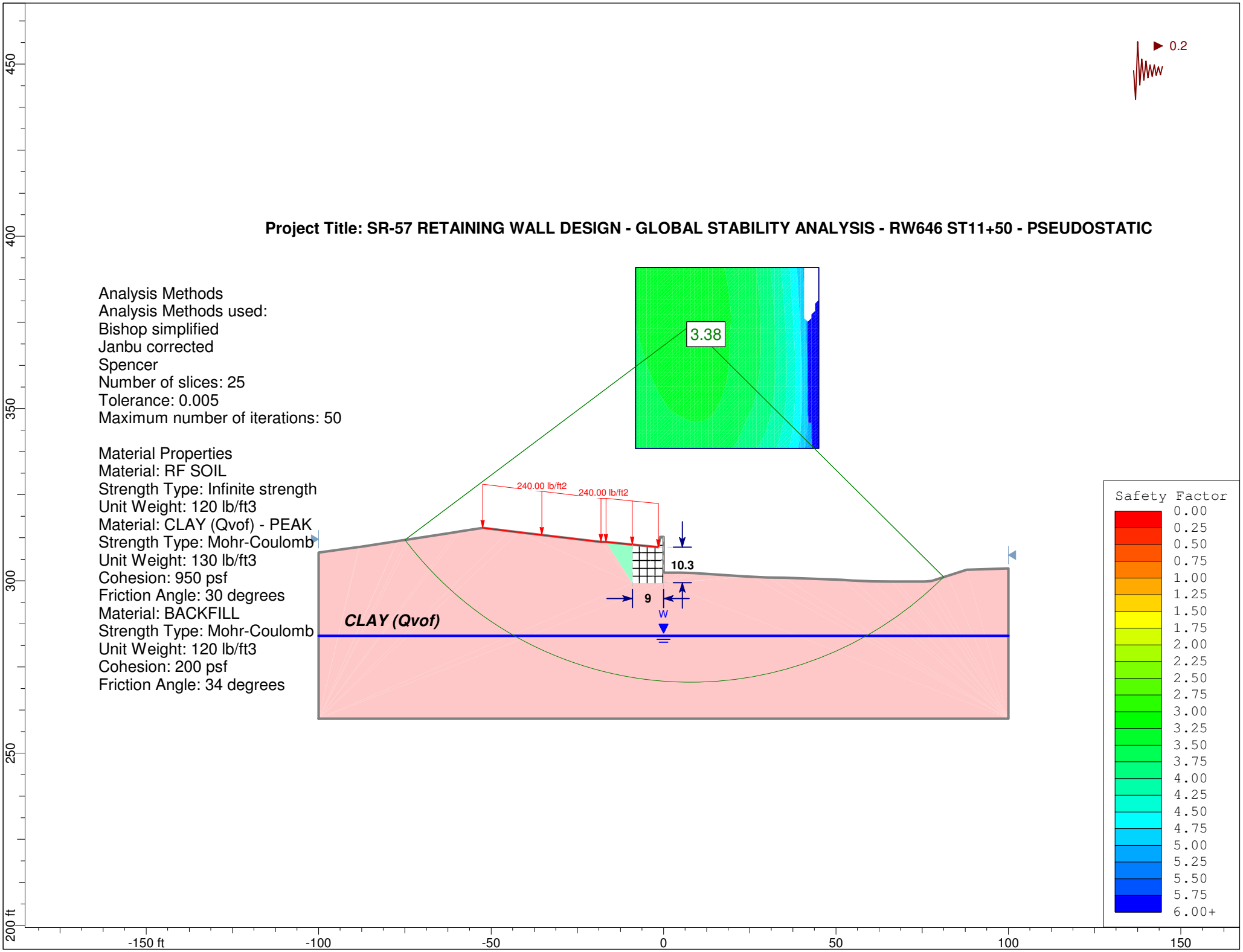
Distributed Load

-52.470	315.340
-41.915	314.084
-18.170	311.260
-16.664	311.280
-9.000	310.503
-1.480	309.740

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW646 ST11+50 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: RW646_ST11+50_Pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW646 ST11+50 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 3.378280
Center: 7.828, 374.113
Radius: 103.589
Left Slip Surface Endpoint: -74.966, 311.857
Right Slip Surface Endpoint: 81.292, 301.081
Resisting Moment=4.66878e+007 lb-ft
Driving Moment=1.382e+007 lb-ft

Method: spencer
FS: 3.391300
Center: 7.828, 379.369
Radius: 107.304
Left Slip Surface Endpoint: -75.509, 311.774
Right Slip Surface Endpoint: 81.170, 301.041
Resisting Moment=4.72834e+007 lb-ft
Driving Moment=1.39426e+007 lb-ft
Resisting Horizontal Force=402692 lb
Driving Horizontal Force=118743 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 15461
Number of Invalid Surfaces: 13150
Error Codes:
Error Code -99 reported for 7344 surfaces
Error Code -103 reported for 1557 surfaces
Error Code -106 reported for 65 surfaces
Error Code -109 reported for 4184 surfaces

Method: spencer
Number of Valid Surfaces: 15461
Number of Invalid Surfaces: 13150
Error Codes:
Error Code -99 reported for 7344 surfaces
Error Code -103 reported for 1557 surfaces
Error Code -106 reported for 65 surfaces
Error Code -109 reported for 4184 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

List of All Coordinates

Search Grid

-8.100	338.374
44.996	338.374
44.996	390.932
-8.100	390.932

Material Boundary

-52.640	315.318
-44.890	314.430
-41.915	314.084

Material Boundary

4.997	302.380
8.810	302.250

Material Boundary

-9.000	310.503
-9.000	299.250
0.000	299.250
0.000	302.380

Material Boundary

-16.664	311.280
-9.000	299.250

External Boundary

-100.000	260.000
100.000	260.000
100.000	303.600
87.870	303.210
82.470	301.460
77.750	299.940
75.740	299.770
73.140	299.750
67.790	299.760
66.280	299.800
60.650	299.840
54.960	300.060
51.650	300.270
34.880	300.870
30.100	300.970
25.450	301.170
23.200	301.290
10.540	302.150
8.810	302.250
5.000	302.380
4.997	302.380
0.000	302.380
0.000	312.740
-1.000	312.740
-1.480	309.740
-9.000	310.503
-16.664	311.280
-18.170	311.260
-41.915	314.084
-52.470	315.340
-52.630	315.320
-52.640	315.318
-58.920	314.320
-60.170	314.140
-73.240	312.100
-74.420	311.940
-77.097	311.533
-77.250	311.510
-88.160	309.811
-88.360	309.780
-100.000	308.190

Water Table

-100.000	284.000
100.000	284.000

Distributed Load

-52.470	315.340
-41.915	314.084
-18.170	311.260
-16.664	311.280
-9.000	310.503
-1.480	309.740

Retaining Wall RW 670

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW670
Client: OCTA
Designer: RB
Station Number: 17+60

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....is\RW670_ST17+60.BEN
Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	34.0 °
Equivalent cohesion, $c_{equiv.}$	250.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 4.04 N γ= 11.49

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

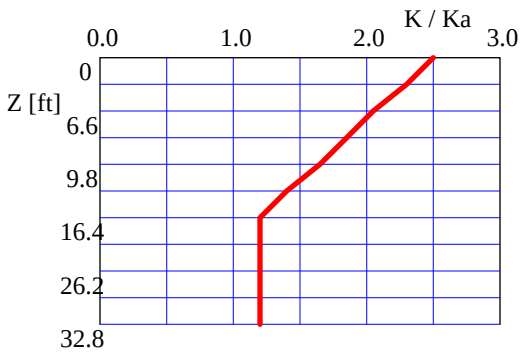
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

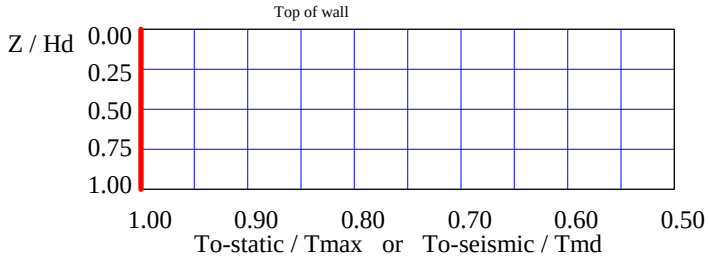


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

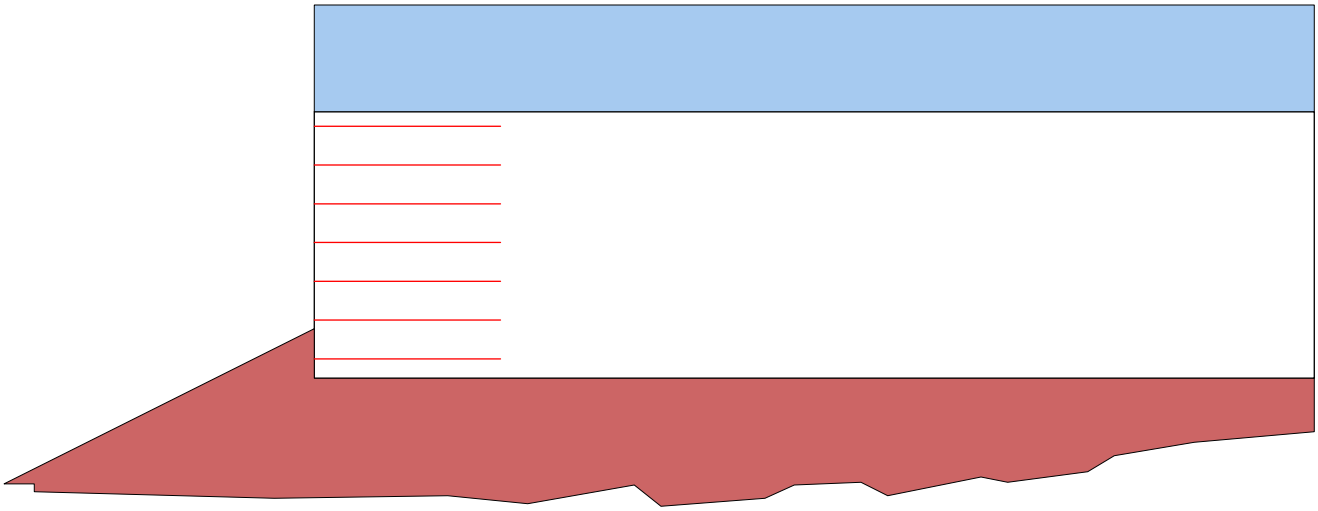
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	17.19	[ft]	{ Embedded depth is E = 3.19 ft, and height above top of finished bottom grade is H = 14.00 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 2.62, Meyerhof stress = 3005 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.017, Eccentricity, e/L = 0.1168, Fs-overturning = 4.28

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	12.00	1	N/A	7.51	8.34	8.341	16.447	3.232	0.1017	Caltrans W20
2	3.75	12.00	1	N/A	7.77	8.63	8.630	14.049	3.772	0.0744	Caltrans W20
3	6.25	12.00	1	N/A	8.41	9.35	9.345	11.823	4.533	0.0513	Caltrans W20
4	8.75	12.00	1	N/A	9.61	10.68	10.678	9.833	5.694	0.0322	Caltrans W20
5	11.25	12.00	1	N/A	11.66	12.95	12.953	9.806	7.700	0.0174	Caltrans W20
6	13.75	12.00	1	N/A	15.72	17.47	17.470	9.738	12.171	0.0067	Caltrans W20
7	16.25	12.00	1	N/A	29.58	32.87	32.870	10.591	36.253	0.0007	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

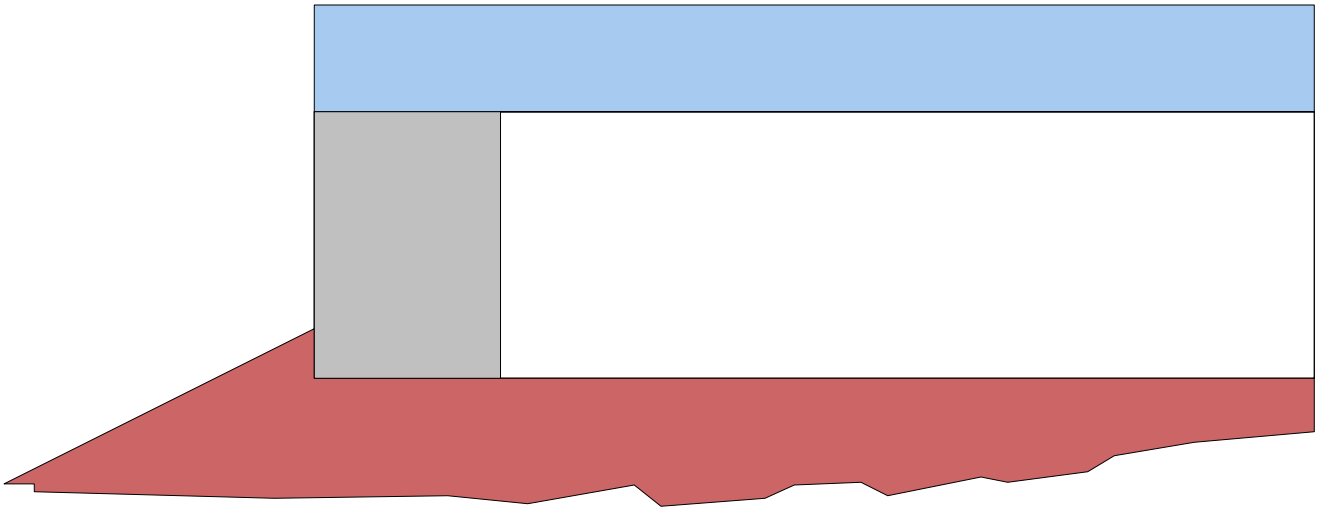
Bearing capacity, Fs = 0.96, Meyerhof stress = 5186 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.541, Eccentricity, e/L = 0.2780, Fs-overturning = 1.80

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	12.00	1	N/A	6.35	7.06	7.059	11.136	1.663	0.2391	Caltrans W20
2	3.75	12.00	1	N/A	6.68	7.42	7.422	9.666	1.975	0.1701	Caltrans W20
3	6.25	12.00	1	N/A	7.32	8.13	8.133	8.231	2.431	0.1129	Caltrans W20
4	8.75	12.00	1	N/A	8.42	9.36	9.355	6.892	3.161	0.0673	Caltrans W20
5	11.25	12.00	1	N/A	9.95	11.06	11.058	6.696	4.514	0.0334	Caltrans W20
6	13.75	12.00	1	N/A	12.77	14.19	14.189	6.328	7.873	0.0113	Caltrans W20
7	16.25	12.00	1	N/A	20.61	22.91	22.905	5.904	29.602	0.0009	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	7874	4987	[lb/ft ²]
Meyerhof stress, σ_V	3005.1	5186	[lb/ft ²]
Eccentricity, e	1.40	3.34	[ft]
Eccentricity, e/L	0.117	0.278	
Fs calculated	2.62	0.96	
Base length	12.00	12.00	[ft]



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT
(for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.017 and Fs-seismic = 1.541

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	12.00	3.232	1.663	1	Caltrans W20
2	3.75	12.00	3.772	1.975	1	Caltrans W20
3	6.25	12.00	4.533	2.431	1	Caltrans W20
4	8.75	12.00	5.694	3.161	1	Caltrans W20
5	11.25	12.00	7.700	4.514	1	Caltrans W20
6	13.75	12.00	12.171	7.873	1	Caltrans W20
7	16.25	12.00	36.253	29.602	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1168, e/L seismic = 0.2780; Overturning: Fs-static = 4.28, Fs-seismic = 1.80

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	12.00	0.1017	0.2391	1	Caltrans W20
2	3.75	12.00	0.0744	0.1701	1	Caltrans W20
3	6.25	12.00	0.0513	0.1129	1	Caltrans W20
4	8.75	12.00	0.0322	0.0673	1	Caltrans W20
5	11.25	12.00	0.0174	0.0334	1	Caltrans W20
6	13.75	12.00	0.0067	0.0113	1	Caltrans W20
7	16.25	12.00	0.0007	0.0009	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2183.67	396.30	N/A	8.341	N/A	7.059
2	3.75	1.000	0.500	18213	2110.48	343.46	N/A	8.630	N/A	7.422
3	6.25	1.000	0.500	18213	1948.87	290.62	N/A	9.345	N/A	8.133
4	8.75	1.000	0.500	18213	1705.73	241.05	N/A	10.678	N/A	9.355
5	11.25	1.000	0.500	18213	1406.06	241.05	N/A	12.953	N/A	11.058
6	13.75	1.000	0.500	18213	1042.55	241.05	N/A	17.470	N/A	14.189
7	16.25	1.000	0.500	18213	554.10	241.05	N/A	32.870	N/A	22.905

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2183.7	396.3	11.25	0.75	35913.9	N/A	16.447	28731.1	N/A	11.136
2	3.75	1.000	2110.5	343.5	9.75	2.25	29649.5	N/A	14.049	23719.6	N/A	9.666
3	6.25	1.000	1948.9	290.6	8.25	3.75	23041.5	N/A	11.823	18433.2	N/A	8.231
4	8.75	1.000	1705.7	241.1	6.84	5.16	16772.6	N/A	9.833	13418.1	N/A	6.892
5	11.25	1.000	1406.1	241.1	6.84	5.16	13787.2	N/A	9.806	11029.8	N/A	6.696
6	13.75	1.000	1042.6	241.1	6.84	5.16	10152.5	N/A	9.738	8122.0	N/A	6.328
7	16.25	1.000	554.1	241.1	6.84	5.16	5868.6	N/A	10.591	4694.9	N/A	5.904

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2184	0.90	16392	18213	N/A	7.51	N/A	8.34	Caltrans W20
2	3.75	1.000	0.500	2110	0.90	16392	18213	N/A	7.77	N/A	8.63	Caltrans W20
3	6.25	1.000	0.500	1949	0.90	16392	18213	N/A	8.41	N/A	9.35	Caltrans W20
4	8.75	1.000	0.500	1706	0.90	16392	18213	N/A	9.61	N/A	10.68	Caltrans W20
5	11.25	1.000	0.500	1406	0.90	16392	18213	N/A	11.66	N/A	12.95	Caltrans W20
6	13.75	1.000	0.500	1043	0.90	16392	18213	N/A	15.72	N/A	17.47	Caltrans W20
7	16.25	1.000	0.500	554	0.90	16392	18213	N/A	29.58	N/A	32.87	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2580	0.90	16392	18213	N/A	6.35	N/A	7.06	Caltrans W20
2	3.75	1.000	0.500	2454	0.90	16392	18213	N/A	6.68	N/A	7.42	Caltrans W20
3	6.25	1.000	0.500	2239	0.90	16392	18213	N/A	7.32	N/A	8.13	Caltrans W20
4	8.75	1.000	0.500	1947	0.90	16392	18213	N/A	8.42	N/A	9.36	Caltrans W20
5	11.25	1.000	0.500	1647	0.90	16392	18213	N/A	9.95	N/A	11.06	Caltrans W20
6	13.75	1.000	0.500	1284	0.90	16392	18213	N/A	12.77	N/A	14.19	Caltrans W20
7	16.25	1.000	0.500	795	0.90	16392	18213	N/A	20.61	N/A	22.91	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW670
Client: OCTA
Designer: RB
Station Number: 19+30

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92707
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....is\RW670_ST19+30.BEN

Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	34.0 °
Equivalent cohesion, $c_{equiv.}$	250.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 4.04 N γ= 11.49

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

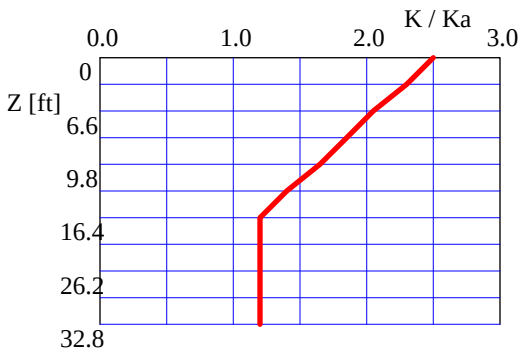
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

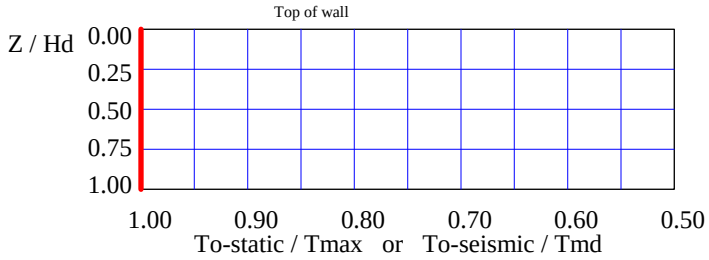


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

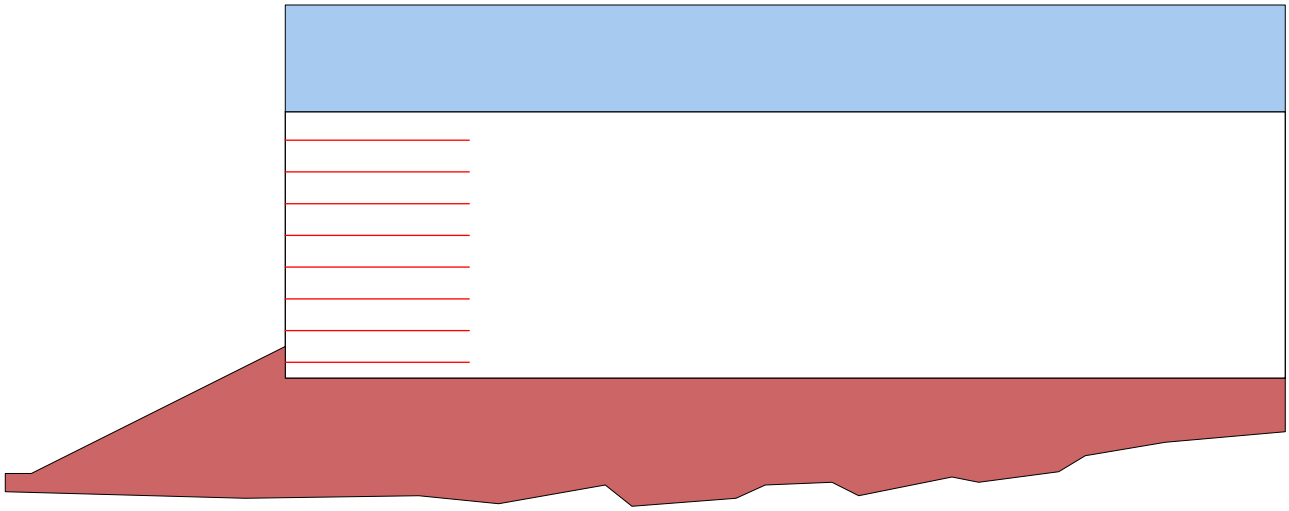
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	21.00	[ft]	{ Embedded depth is E = 2.50 ft, and height above top of finished bottom grade is H = 18.50 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 2.59, Meyerhof stress = 3594 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.031, Eccentricity, e/L = 0.1160, Fs-overturning = 4.31

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	14.50	1	N/A	7.20	8.00	8.001	19.641	3.208	0.1035	Caltrans W20
2	3.75	14.50	1	N/A	7.46	8.29	8.285	18.018	3.633	0.0805	Caltrans W20
3	6.25	14.50	1	N/A	7.60	8.44	8.440	15.604	4.190	0.0604	Caltrans W20
4	8.75	14.50	1	N/A	8.01	8.90	8.899	13.262	4.953	0.0431	Caltrans W20
5	11.25	14.50	1	N/A	8.90	9.89	9.892	11.768	6.064	0.0286	Caltrans W20
6	13.75	14.50	1	N/A	10.44	11.60	11.599	11.780	7.847	0.0169	Caltrans W20
7	16.25	14.50	1	N/A	13.19	14.66	14.658	11.709	11.237	0.0081	Caltrans W20
8	18.75	14.50	1	N/A	15.72	17.47	17.472	9.422	20.910	0.0022	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

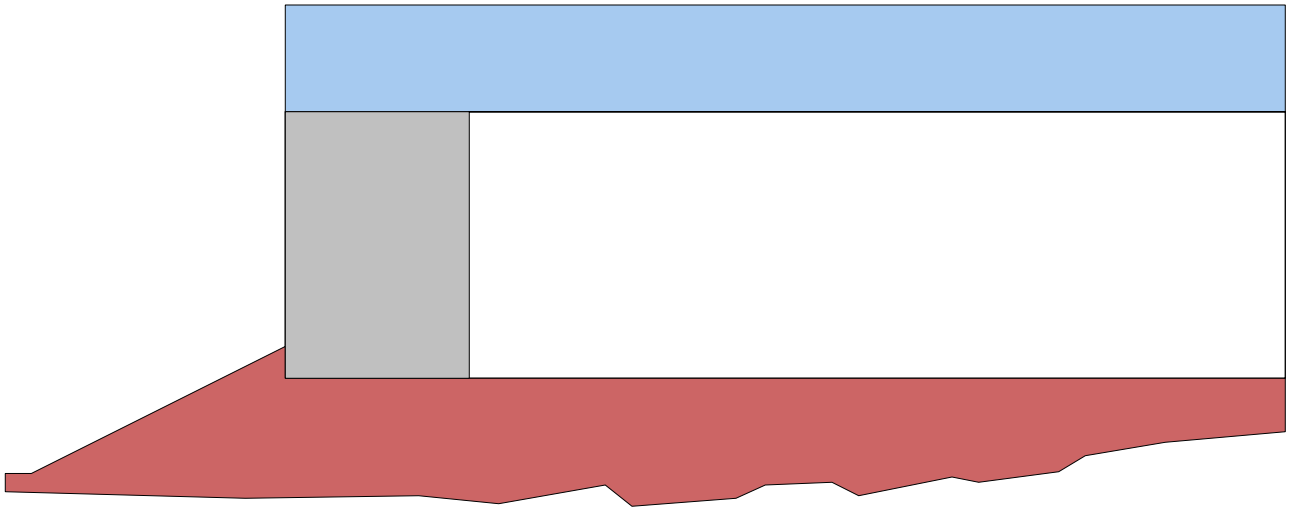
Bearing capacity, Fs = 0.89, Meyerhof stress = 6385 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.522, Eccentricity, e/L = 0.2839, Fs-overturning = 1.76

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	14.50	1	N/A	5.86	6.51	6.514	12.793	1.619	0.2512	Caltrans W20
2	3.75	14.50	1	N/A	6.16	6.84	6.845	11.907	1.855	0.1917	Caltrans W20
3	6.25	14.50	1	N/A	6.39	7.10	7.103	10.506	2.172	0.1403	Caltrans W20
4	8.75	14.50	1	N/A	6.84	7.60	7.601	9.062	2.620	0.0969	Caltrans W20
5	11.25	14.50	1	N/A	7.62	8.47	8.467	8.059	3.301	0.0614	Caltrans W20
6	13.75	14.50	1	N/A	8.72	9.69	9.688	7.871	4.456	0.0340	Caltrans W20
7	16.25	14.50	1	N/A	10.56	11.73	11.733	7.498	6.847	0.0147	Caltrans W20
8	18.75	14.50	1	N/A	12.12	13.47	13.469	5.811	14.673	0.0033	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	9322	5688	[lb/ft ²]
Meyerhof stress, σ_V	3593.9	6385	[lb/ft ²]
Eccentricity, e	1.68	4.12	[ft]
Eccentricity, e/L	0.116	0.284	
Fs calculated	2.59	0.89	
Base length	14.50	14.50	[ft]



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.031 and Fs-seismic = 1.522

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	14.50	3.208	1.619	1	Caltrans W20
2	3.75	14.50	3.633	1.855	1	Caltrans W20
3	6.25	14.50	4.190	2.172	1	Caltrans W20
4	8.75	14.50	4.953	2.620	1	Caltrans W20
5	11.25	14.50	6.064	3.301	1	Caltrans W20
6	13.75	14.50	7.847	4.456	1	Caltrans W20
7	16.25	14.50	11.237	6.847	1	Caltrans W20
8	18.75	14.50	20.910	14.673	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1160, e/L seismic = 0.2839; Overturning: Fs-static = 4.31, Fs-seismic = 1.76

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	14.50	0.1035	0.2512	1	Caltrans W20
2	3.75	14.50	0.0805	0.1917	1	Caltrans W20
3	6.25	14.50	0.0604	0.1403	1	Caltrans W20
4	8.75	14.50	0.0431	0.0969	1	Caltrans W20
5	11.25	14.50	0.0286	0.0614	1	Caltrans W20
6	13.75	14.50	0.0169	0.0340	1	Caltrans W20
7	16.25	14.50	0.0081	0.0147	1	Caltrans W20
8	18.75	14.50	0.0022	0.0033	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2276.46	519.42	N/A	8.001	N/A	6.514
2	3.75	1.000	0.500	18213	2198.19	462.75	N/A	8.285	N/A	6.845
3	6.25	1.000	0.500	18213	2157.87	406.09	N/A	8.440	N/A	7.103
4	8.75	1.000	0.500	18213	2046.69	349.43	N/A	8.899	N/A	7.601
5	11.25	1.000	0.500	18213	1841.20	309.76	N/A	9.892	N/A	8.467
6	13.75	1.000	0.500	18213	1570.20	309.76	N/A	11.599	N/A	9.688
7	16.25	1.000	0.500	18213	1242.56	309.76	N/A	14.658	N/A	11.733
8	18.75	1.000	0.500	18213	1042.43	309.76	N/A	17.472	N/A	13.469

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2276.5	519.4	13.75	0.75	44710.8	N/A	19.641	35768.6	N/A	12.793
2	3.75	1.000	2198.2	462.8	12.25	2.25	39606.1	N/A	18.018	31684.9	N/A	11.907
3	6.25	1.000	2157.9	406.1	10.75	3.75	33670.6	N/A	15.604	26936.5	N/A	10.506
4	8.75	1.000	2046.7	349.4	9.25	5.25	27142.5	N/A	13.262	21714.0	N/A	9.062
5	11.25	1.000	1841.2	309.8	8.20	6.30	21668.0	N/A	11.768	17334.4	N/A	8.059
6	13.75	1.000	1570.2	309.8	8.20	6.30	18497.5	N/A	11.780	14798.0	N/A	7.871
7	16.25	1.000	1242.6	309.8	8.20	6.30	14548.8	N/A	11.709	11639.0	N/A	7.498
8	18.75	1.000	1042.4	309.8	8.20	6.30	9821.8	N/A	9.422	7857.5	N/A	5.811

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2276	0.90	16392	18213	N/A	7.20	N/A	8.00	Caltrans W20
2	3.75	1.000	0.500	2198	0.90	16392	18213	N/A	7.46	N/A	8.29	Caltrans W20
3	6.25	1.000	0.500	2158	0.90	16392	18213	N/A	7.60	N/A	8.44	Caltrans W20
4	8.75	1.000	0.500	2047	0.90	16392	18213	N/A	8.01	N/A	8.90	Caltrans W20
5	11.25	1.000	0.500	1841	0.90	16392	18213	N/A	8.90	N/A	9.89	Caltrans W20
6	13.75	1.000	0.500	1570	0.90	16392	18213	N/A	10.44	N/A	11.60	Caltrans W20
7	16.25	1.000	0.500	1243	0.90	16392	18213	N/A	13.19	N/A	14.66	Caltrans W20
8	18.75	1.000	0.500	1042	0.90	16392	18213	N/A	15.72	N/A	17.47	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

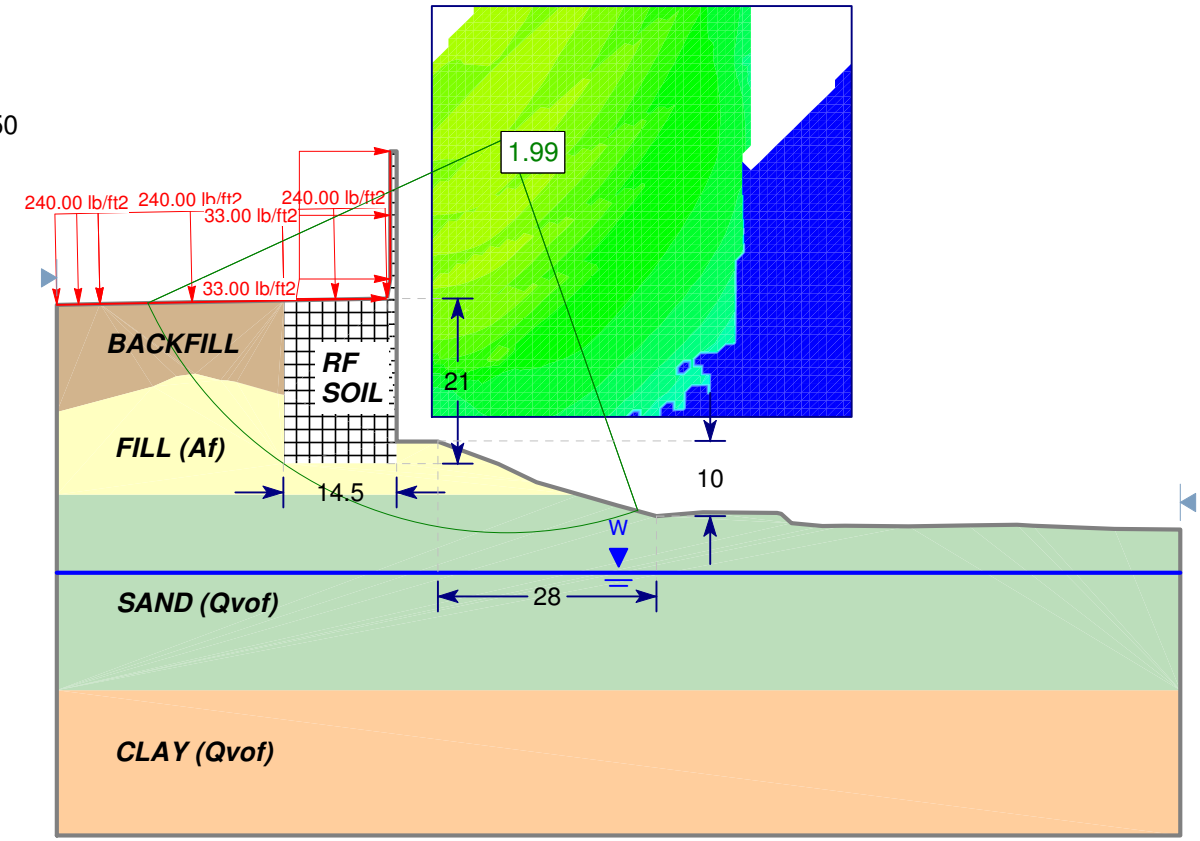
#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2796	0.90	16392	18213	N/A	5.86	N/A	6.51	Caltrans W20
2	3.75	1.000	0.500	2661	0.90	16392	18213	N/A	6.16	N/A	6.84	Caltrans W20
3	6.25	1.000	0.500	2564	0.90	16392	18213	N/A	6.39	N/A	7.10	Caltrans W20
4	8.75	1.000	0.500	2396	0.90	16392	18213	N/A	6.84	N/A	7.60	Caltrans W20
5	11.25	1.000	0.500	2151	0.90	16392	18213	N/A	7.62	N/A	8.47	Caltrans W20
6	13.75	1.000	0.500	1880	0.90	16392	18213	N/A	8.72	N/A	9.69	Caltrans W20
7	16.25	1.000	0.500	1552	0.90	16392	18213	N/A	10.56	N/A	11.73	Caltrans W20
8	18.75	1.000	0.500	1352	0.90	16392	18213	N/A	12.12	N/A	13.47	Caltrans W20

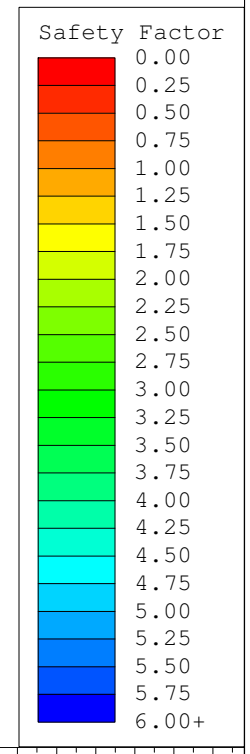
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW670 ST19+30 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 34 degrees
Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 250 psf
Friction Angle: 35 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees





Slide Analysis Information

Document Name

File Name: RW670_ST19+30_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW670 ST19+30 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 34 degrees
Water Surface: None

Material: SAND (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 250 psf
Friction Angle: 35 degrees
Water Surface: None

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.985890
Center: 13.876, 405.711
Radius: 50.642
Left Slip Surface Endpoint: -32.113, 384.507
Right Slip Surface Endpoint: 30.587, 357.905
Resisting Moment=4.33031e+006 lb-ft
Driving Moment=2.18054e+006 lb-ft

Method: spencer
FS: 1.991260
Center: 13.876, 405.711
Radius: 50.642
Left Slip Surface Endpoint: -32.113, 384.507
Right Slip Surface Endpoint: 30.587, 357.905
Resisting Moment=4.34203e+006 lb-ft
Driving Moment=2.18054e+006 lb-ft
Resisting Horizontal Force=75583 lb
Driving Horizontal Force=37957.4 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 11209

Number of Invalid Surfaces: 17402
Error Codes:
Error Code -99 reported for 11961 surfaces
Error Code -100 reported for 29 surfaces
Error Code -103 reported for 544 surfaces
Error Code -105 reported for 87 surfaces
Error Code -107 reported for 38 surfaces
Error Code -108 reported for 1 surface
Error Code -109 reported for 4673 surfaces
Error Code -112 reported for 51 surfaces
Error Code -113 reported for 18 surfaces

Method: spencer
Number of Valid Surfaces: 10377
Number of Invalid Surfaces: 18234
Error Codes:
Error Code -99 reported for 11961 surfaces
Error Code -100 reported for 29 surfaces
Error Code -103 reported for 544 surfaces
Error Code -105 reported for 87 surfaces
Error Code -107 reported for 38 surfaces
Error Code -108 reported for 114 surfaces
Error Code -109 reported for 4673 surfaces
Error Code -111 reported for 696 surfaces
Error Code -112 reported for 74 surfaces
Error Code -113 reported for 18 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

4.202	369.952
57.948	369.952
57.948	422.539
4.202	422.539

Material Boundary

-43.760	370.541
-43.760	384.280

Material Boundary

-14.700	384.839
-14.700	372.754
-14.700	364.000
-0.270	364.000
-0.270	366.780

Material Boundary

-43.760	370.541
-31.490	373.820
-28.490	375.130
-26.360	375.440
-26.060	375.490
-22.820	374.640
-21.940	374.610
-20.750	374.400
-15.530	372.930

-14.700	372.754

Material Boundary

-43.760	360.000
23.162	360.000

Material Boundary

-43.760	335.000
100.000	335.000

External Boundary

-43.760	316.373
100.000	316.373
100.000	335.000
100.000	355.550
91.560	355.600
81.130	356.040
79.110	356.140
72.822	356.058
65.230	355.960
57.080	356.010
54.190	355.980
50.250	356.360
48.940	357.550
48.380	357.660
38.900	357.750
32.970	357.260
28.020	358.600
23.162	360.000
17.610	361.600
12.720	363.920
5.000	366.780
-0.270	366.780
-0.280	403.920
-1.110	403.920
-1.110	387.590
-1.500	385.100
-14.700	384.839
-38.230	384.390
-43.760	384.280
-43.780	384.290
-43.760	370.541
-43.760	360.000
-43.760	335.000

Water Table

-43.760	350.000
100.000	350.000

Distributed Load

-1.500	385.100
-14.700	384.839
-38.230	384.390
-43.760	384.280

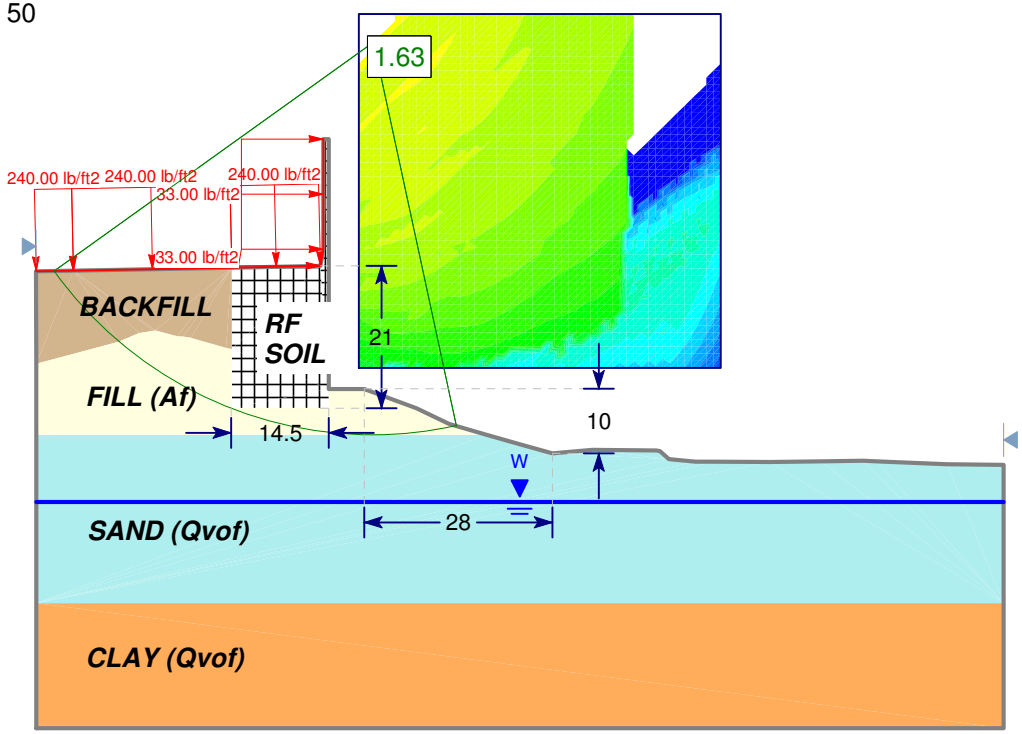
Distributed Load

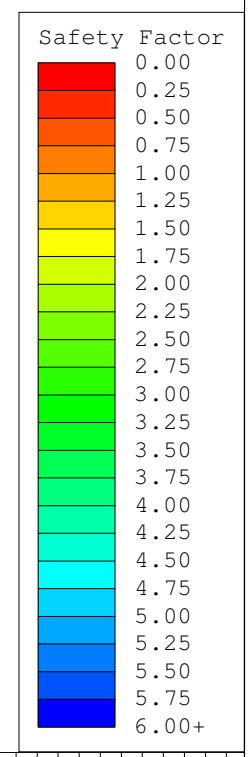
-1.110	403.920
-1.110	387.590
-1.500	385.100

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW670 ST19+30 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 34 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 250 psf
Friction Angle: 34 degrees
Material: SAND (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 450 psf
Friction Angle: 38 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees





0.2

Slide Analysis Information

Document Name

File Name: RW670_ST19+30_Pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW670 ST19+30 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 34 degrees
Water Surface: None

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 250 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: SAND (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 450 psf
Friction Angle: 38 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.630480
Center: 6.352, 418.332
Radius: 58.361
Left Slip Surface Endpoint: -41.083, 384.333
Right Slip Surface Endpoint: 18.687, 361.290
Resisting Moment=4.76877e+006 lb-ft
Driving Moment=2.92476e+006 lb-ft

Method: spencer
FS: 1.651440
Center: 6.352, 418.332
Radius: 58.361
Left Slip Surface Endpoint: -41.083, 384.333

Right Slip Surface Endpoint: 18.687, 361.290
Resisting Moment=4.83006e+006 lb-ft
Driving Moment=2.92476e+006 lb-ft
Resisting Horizontal Force=76281.7 lb
Driving Horizontal Force=46191 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 10998
Number of Invalid Surfaces: 17613
Error Codes:
Error Code -99 reported for 11961 surfaces
Error Code -100 reported for 29 surfaces
Error Code -103 reported for 544 surfaces
Error Code -105 reported for 87 surfaces
Error Code -109 reported for 4673 surfaces
Error Code -112 reported for 301 surfaces
Error Code -113 reported for 18 surfaces

Method: spencer
Number of Valid Surfaces: 9835
Number of Invalid Surfaces: 18776
Error Codes:
Error Code -99 reported for 11961 surfaces
Error Code -100 reported for 29 surfaces
Error Code -103 reported for 544 surfaces
Error Code -105 reported for 87 surfaces
Error Code -108 reported for 22 surfaces
Error Code -109 reported for 4673 surfaces
Error Code -111 reported for 365 surfaces
Error Code -112 reported for 1077 surfaces
Error Code -113 reported for 18 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

4.202	369.952
57.948	369.952
57.948	422.539
4.202	422.539

Material Boundary

-43.760	370.541
-43.760	384.280

Material Boundary

-14.700	384.839
-14.700	372.754
-14.700	364.000
-0.270	364.000
-0.270	366.780

Material Boundary

-43.760	370.541
-31.490	373.820
-28.490	375.130
-26.360	375.440
-26.060	375.490
-22.820	374.640

-21.940	374.610
-20.750	374.400
-15.530	372.930
-14.700	372.754

Material Boundary

-43.760	360.000
23.162	360.000

Material Boundary

-43.760	335.000
100.000	335.000

External Boundary

-43.760	316.373
100.000	316.373
100.000	335.000
100.000	355.550
91.560	355.600
81.130	356.040
79.110	356.140
72.822	356.058
65.230	355.960
57.080	356.010
54.190	355.980
50.250	356.360
48.940	357.550
48.380	357.660
38.900	357.750
32.970	357.260
28.020	358.600
23.162	360.000
17.610	361.600
12.720	363.920
5.000	366.780
-0.270	366.780
-0.280	403.920
-1.110	403.920
-1.110	387.590
-1.500	385.100
-14.700	384.839
-38.230	384.390
-43.760	384.280
-43.780	384.290
-43.760	370.541
-43.760	360.000
-43.760	335.000

Water Table

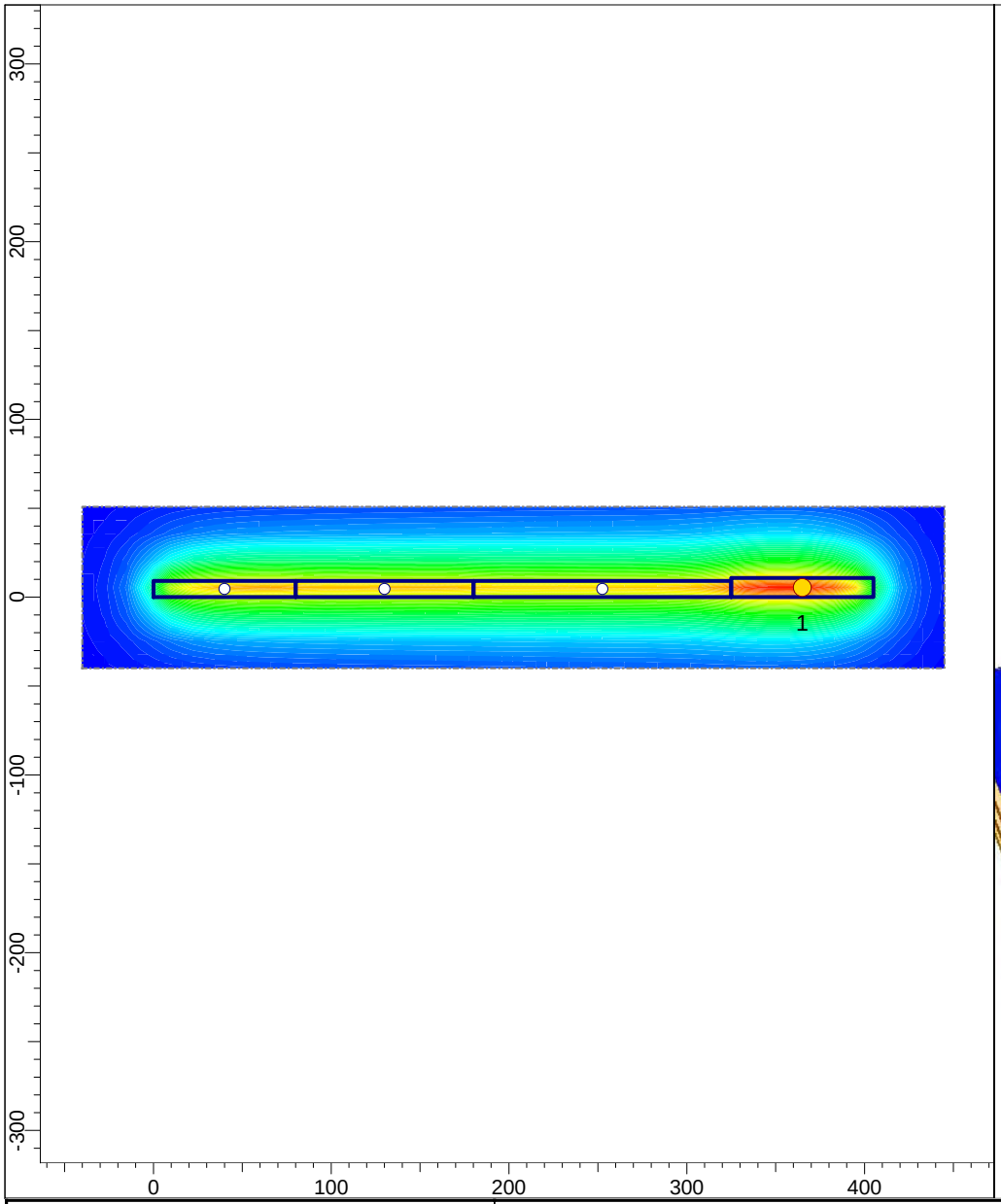
-43.760	350.000
100.000	350.000

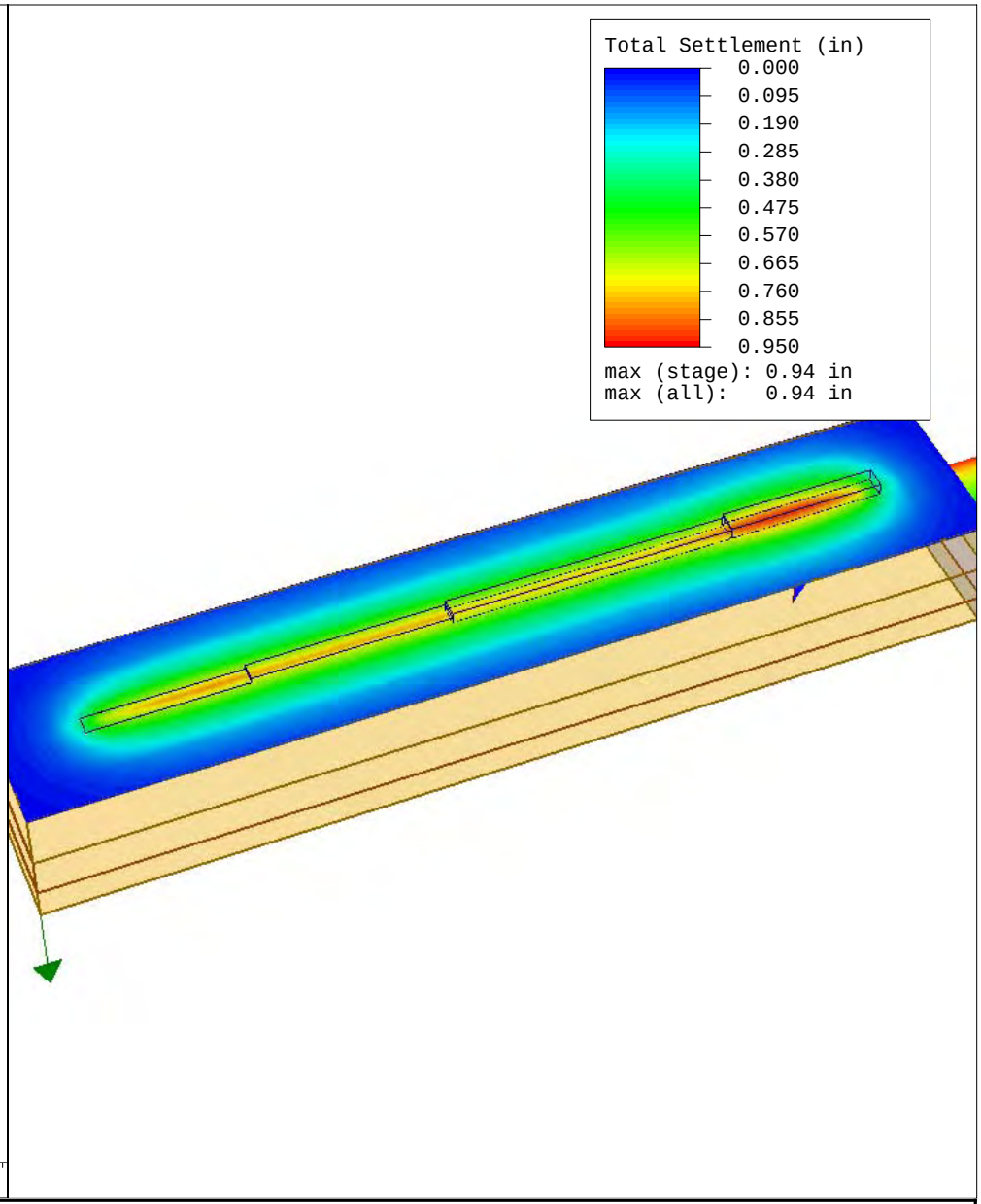
Distributed Load

-1.500	385.100
-14.700	384.839
-38.230	384.390
-43.760	384.280

Distributed Load

-1.110	403.920
-1.110	387.590
-1.500	385.100

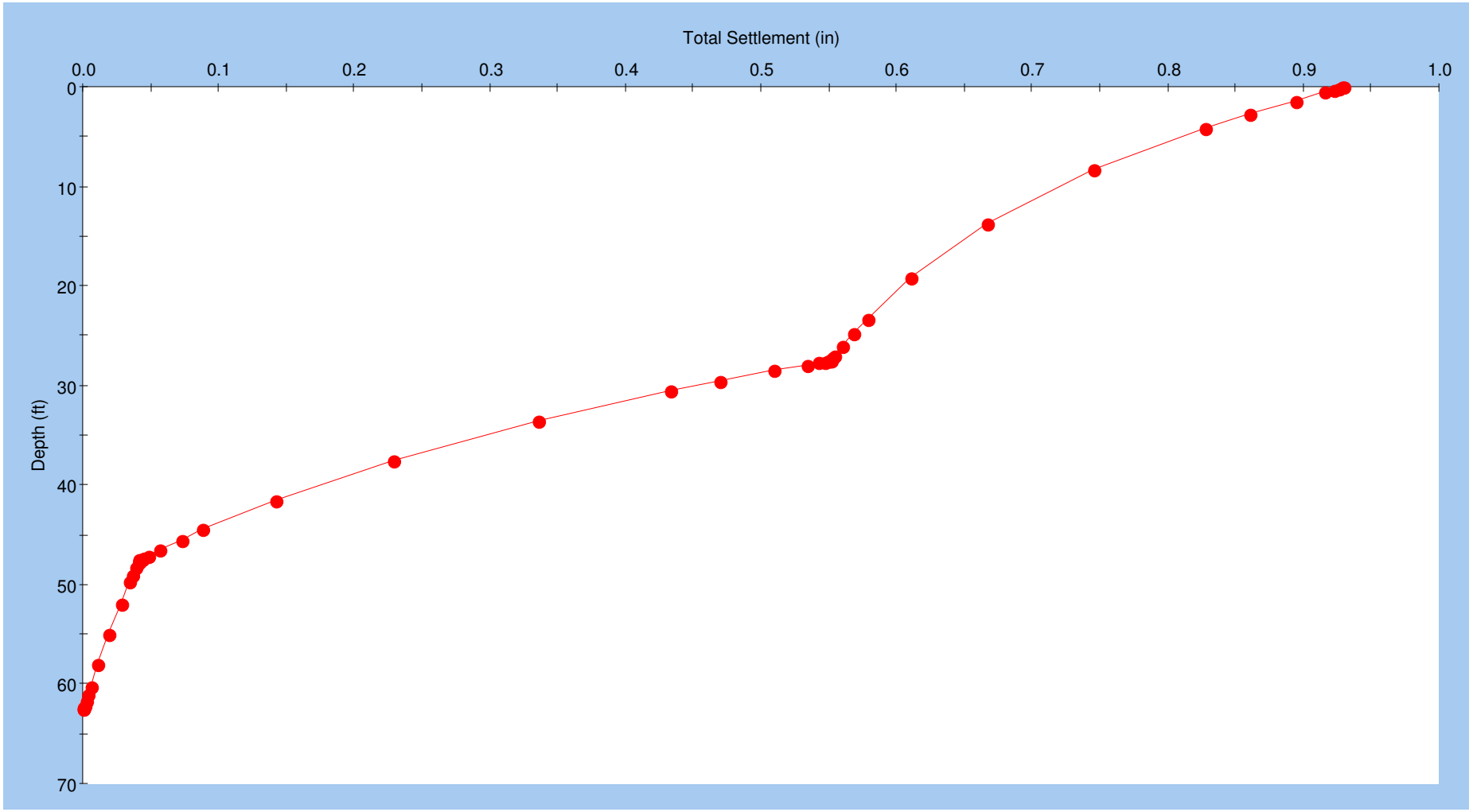




rocscience	Project	SR-57 Settlement Analysis	
	Analysis Description	RW670 ST15+35 to ST19+30	
	Drawn By	RB	Company: CH2M HILL
	Date	2/11/2009, 1:54:44 PM	File Name: RW670_ST15+35toST19+30_profile 1.s3z

SETTLE3D 1.011

Total Settlement vs. Depth



Query Point 1 (Stage Stage 1)
Reference Stage: None

rocscience	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW670 ST15+35 to ST19+30	
	Drawn By RB	*Company*	CH2M HILL
SETTLE3D 1.011	*Date* 2/11/2009, 1:54:44 PM	*File Name*	RW670_ST15+35toST19+30_profile 1.s3z

Settle3D Analysis Information

Project Settings

Project Title: SR-57 Settlement Analysis
Analysis: RW670 ST15+35 to ST19+30
Author: RB
Company: CH2M HILL
Date Created: 2/11/2009, 1:54:44 PM
Stress Computation Method: Boussinesq
Groundwater method: Water Table
Water Unit Weight: 0.0624 kips/ft^3
Depth to water table: 0 [ft]

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.935431
Consolidation Settlement [in]	0	0.513781
Immediate Settlement [in]	0	0.42165
Loading Stress [ksf]	0	3.42001
Effective Stress [ksf]	0	4.12579
Total Stress [ksf]	0	8.02579
Total Strain	0	0.00359955
Pore Water Pressure [ksf]	0	3.9
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 80 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.42 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
325	0
405	0
405	10.82
325	10.82

Rectangular Load

Length: 145 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.085 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
180	0
325	0
325	9.1
180	9.1

Rectangular Load

Length: 100 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.085 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
80	0
180	0
180	9.1
80	9.1

Rectangular Load

Length: 80 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.085 ksf
Depth: 5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-5.68434e-014	0
80	0
80	9.1
-5.68434e-014	9.1

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	SAND (Qvof)	27.5	0
2	CLAY 3 (Qvof)	20	27.5
3	SAND (Qvof)	15	47.5

Soil Properties

CLAY 3 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.02
Cre	0.002
OCR	1

SAND (Qvof)	
Unit Weight [kips/ft^3]	0.12
Saturated Unit Weight [kips/ft^3]	0.12
Immediate Settlement	Enabled
Es [ksf]	1600
Eur [ksf]	1600

Query Points

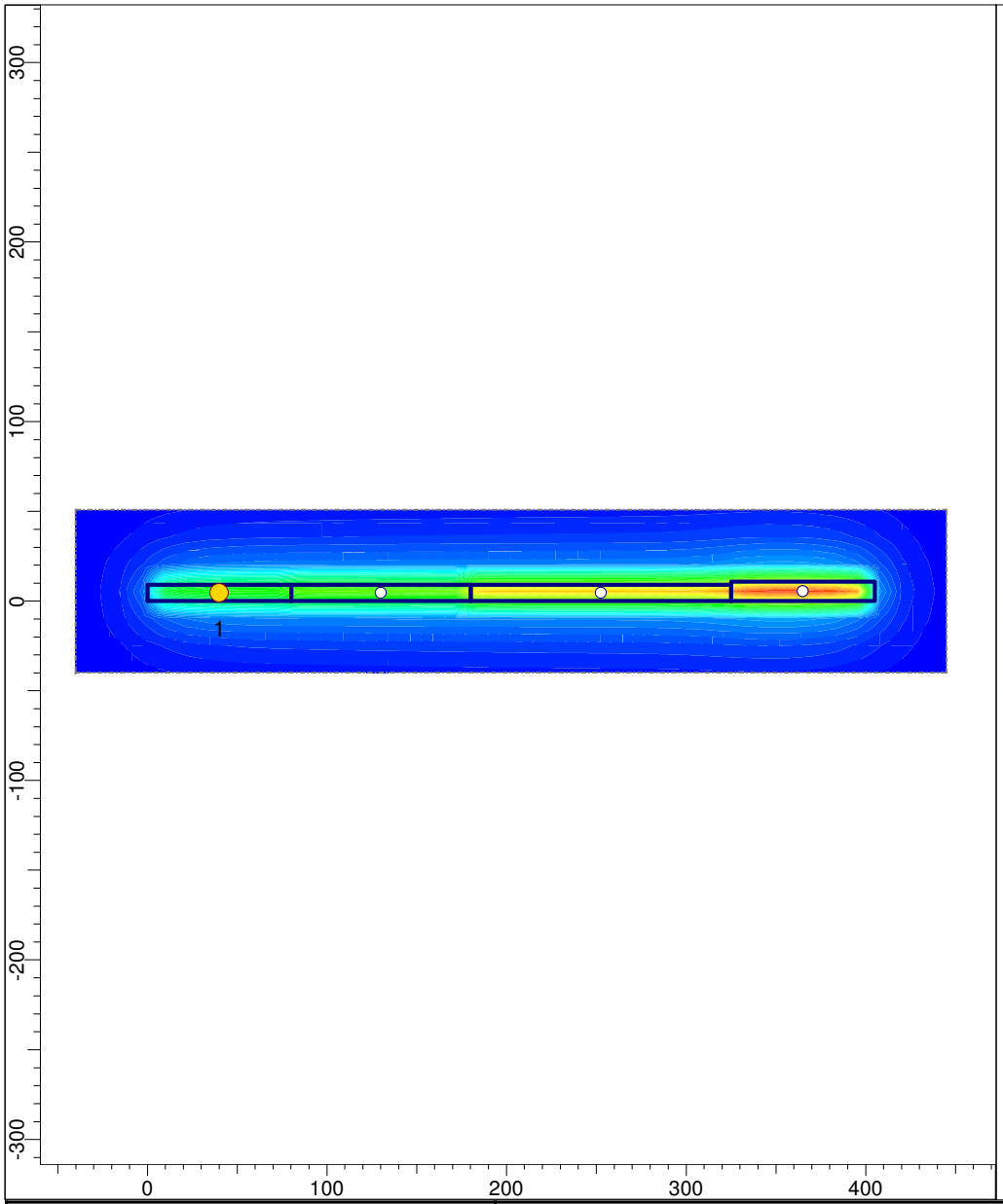
String #	(X,Y) Location	Number of Divisions
1	365, 5.41	55

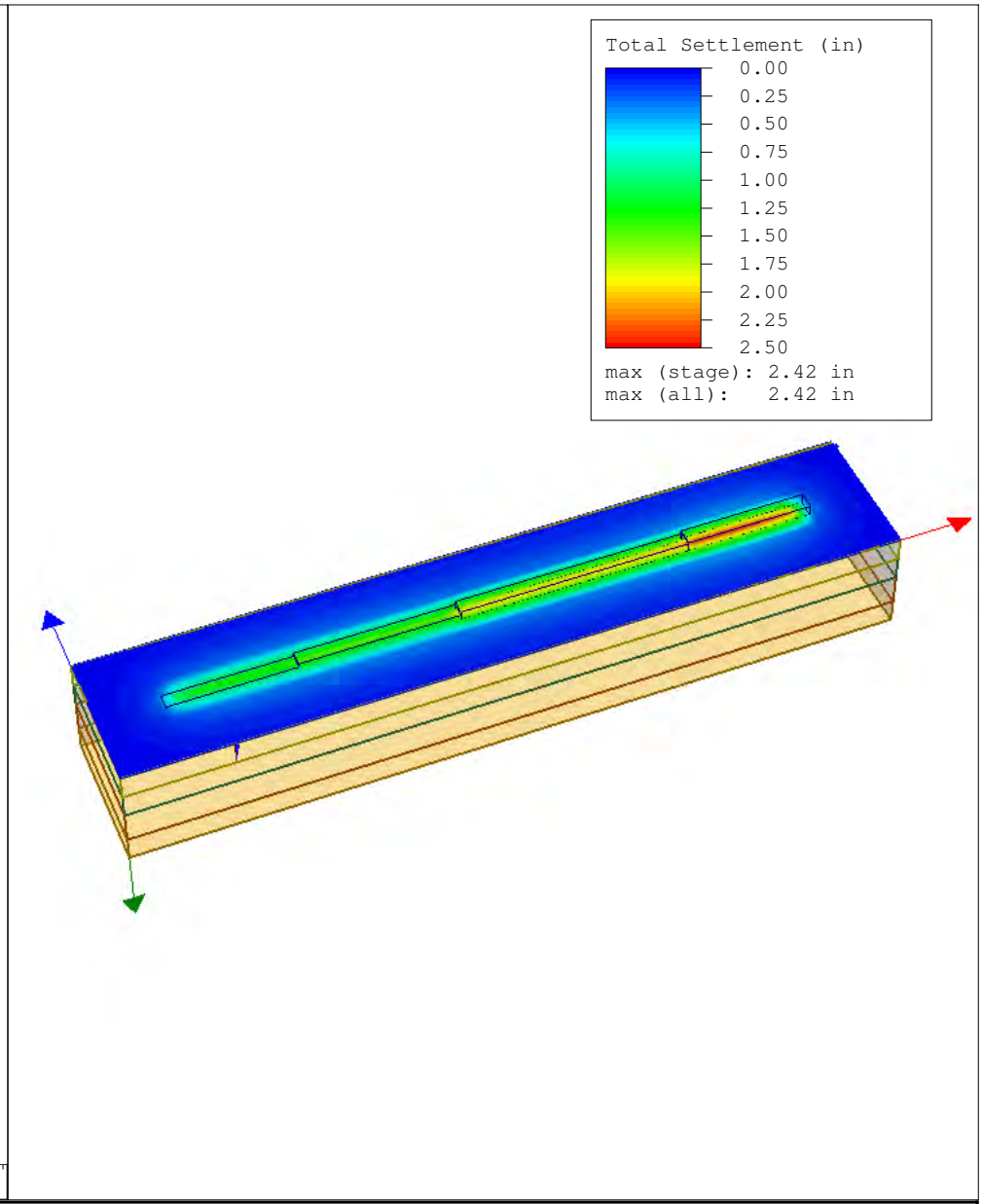
Grid

Number of points: 280
Expansion Factor: 2

Grid Coordinates

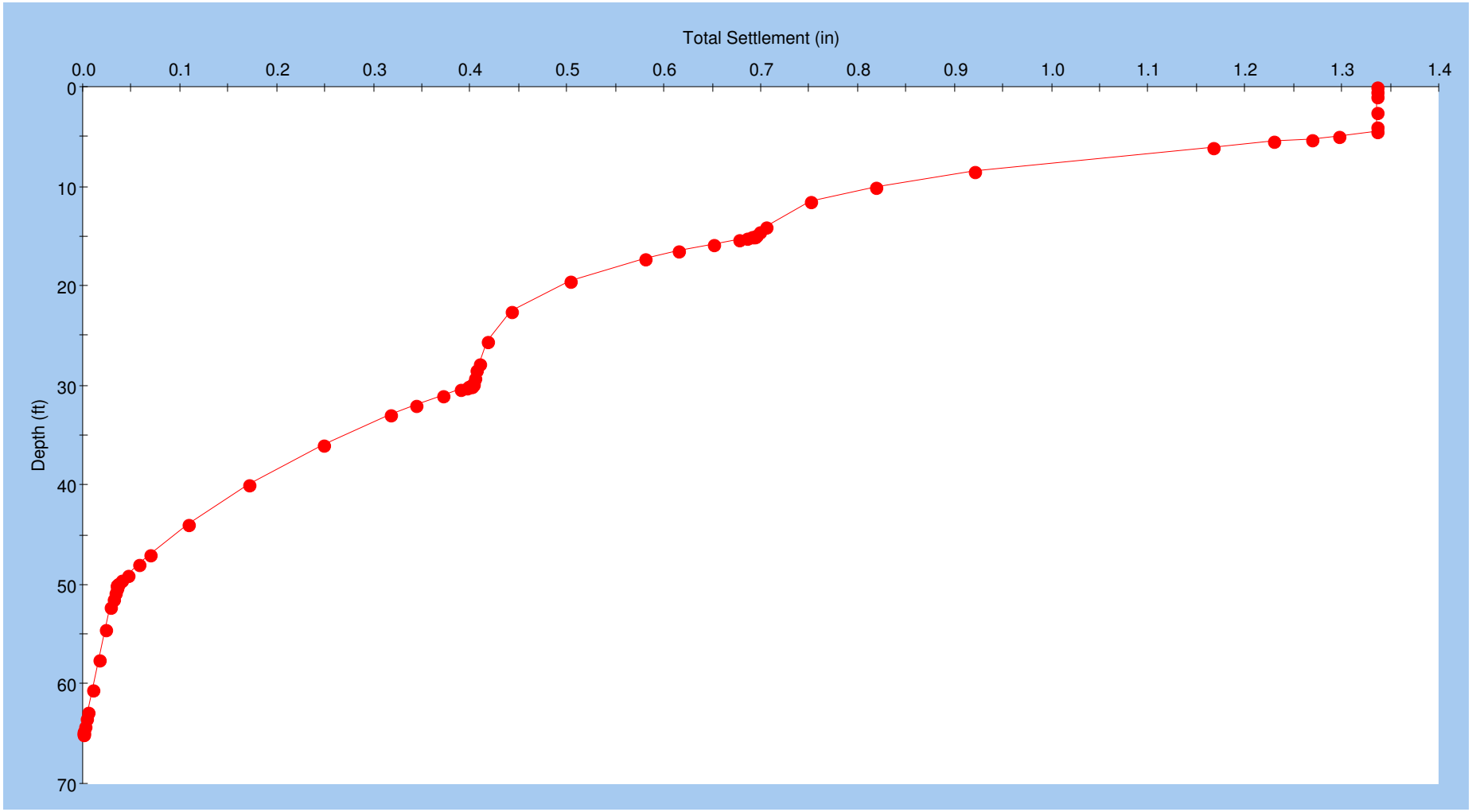
X [ft]	Y [ft]
445	50.82
445	-40
-40	-40
-40	50.82





rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW670 ST15+35 to ST19+30	
	Drawn By RB	*Company*	CH2M HILL
	Date 2/11/2009, 1:54:44 PM	*File Name*	RW670_ST15+35toST19+30_profile 2.s3z

Total Settlement vs. Depth



Query Point 1 (Stage Stage 1)
Reference Stage: None

rocscience	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW670 ST15+35 to ST19+30	
	Drawn By RB	*Company*	CH2M HILL
SETTLE3D 1.011	*Date* 2/11/2009, 1:54:44 PM	*File Name*	RW670_ST15+35toST19+30_profile 2.s3z

Settle3D Analysis Information

Project Settings

Project Title: SR-57 Settlement Analysis
Analysis: RW670 ST15+35 to ST19+30
Author: RB
Company: CH2M HILL
Date Created: 2/11/2009, 1:54:44 PM
Stress Computation Method: Boussinesq
Groundwater method: Water Table
Water Unit Weight: 0.0624 kips/ft^3
Depth to water table: 0 [ft]

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	2.42127
Consolidation Settlement [in]	0	2.38097
Immediate Settlement [in]	0	0.0407804
Loading Stress [ksf]	0	3.42002
Effective Stress [ksf]	0	4.55465
Total Stress [ksf]	0	8.61065
Total Strain	0	0.0619742
Pore Water Pressure [ksf]	0	4.056
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 80 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.42 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
325	0
405	0
405	10.82
325	10.82

Rectangular Load

Length: 145 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.085 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
180	0
325	0
325	9.1
180	9.1

Rectangular Load

Length: 100 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.085 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
80	0
180	0
180	9.1
80	9.1

Rectangular Load

Length: 80 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.085 ksf
Depth: 5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
-5.68434e-014	0
80	0
80	9.1
-5.68434e-014	9.1

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	CLAY 1 (Qvof)	15	0
2	CLAY 2 (Qvof)	15	15
3	CLAY 3 (Qvof)	20	30
4	SAND (Qvof)	15	50

Soil Properties

CLAY 1 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.02
Cre	0.002
OCR	3

CLAY 2 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.02
Cre	0.002
OCR	1.5

CLAY 3 (Qvof)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.02
Cre	0.002
OCR	1

SAND (Qvof)	
Unit Weight [kips/ft^3]	0.12
Saturated Unit Weight [kips/ft^3]	0.12

Immediate Settlement	Enabled
Es [ksf]	1600
Eur [ksf]	1600

Query Points

String #	(X,Y) Location	Number of Divisions
1	40, 4.55	71

Grid

Number of points: 280
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
445	50.82
445	-40
-40	-40
-40	50.82

Retaining Wall RW 684

AASHTO DESIGN METHOD
SR-57 MSE WALL DESIGN

PROJECT IDENTIFICATION

Title: SR-57 MSE WALL DESIGN
Project Number: RW684
Client: OCTA
Designer: RB
Station Number: ST10+10

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive, #800

Santa Ana, CA 92707
Telephone #: 714-424-2900
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....684_ST16+70_h=18.BEN
Original date and time of creating this file: Fri Jan 02 13:26:08 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	33.0 °
Equivalent cohesion, $c_{equiv.}$	800.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 12.01 N γ= 9.31

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

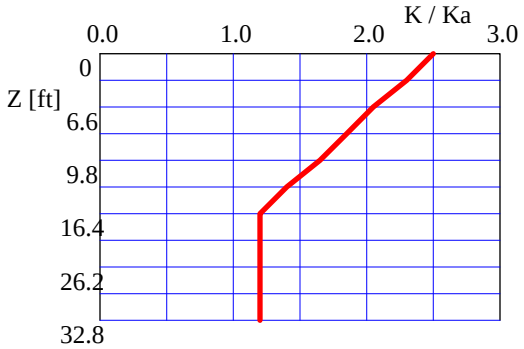
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	12.5	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

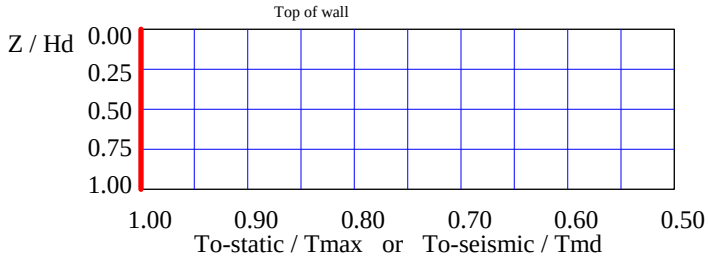


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	CALTRANS	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

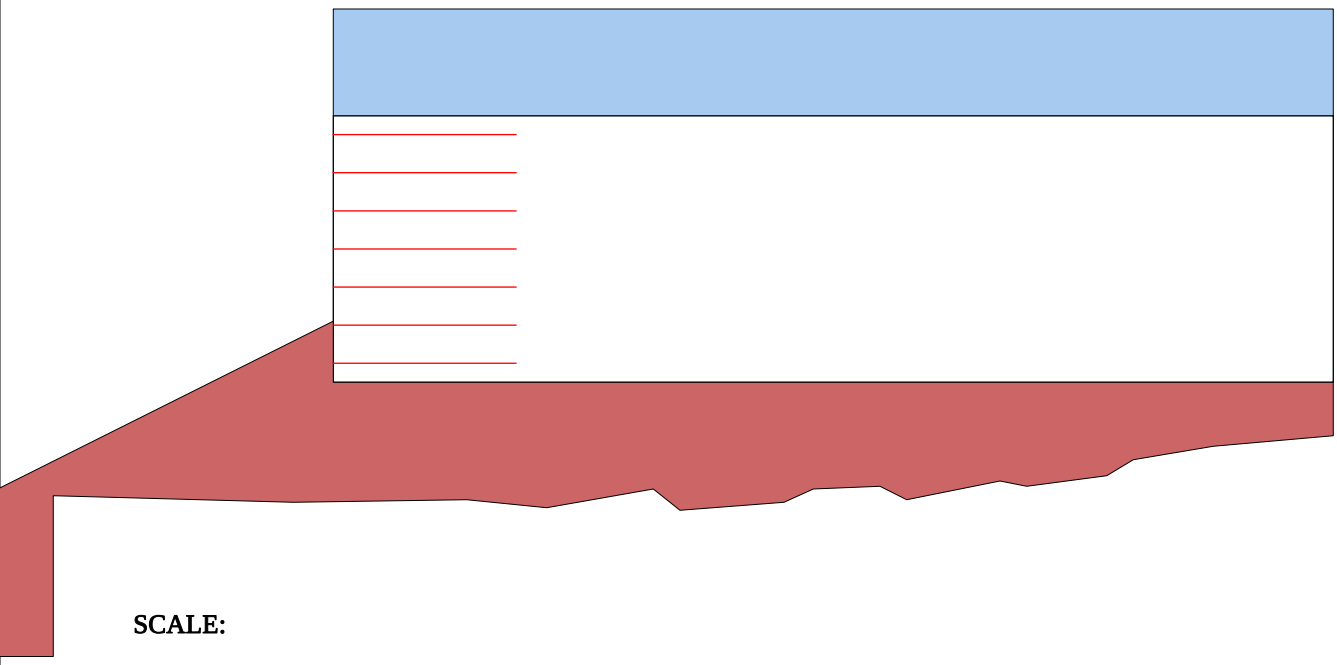
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	17.50	[ft]	{ Embedded depth is E = 4.00 ft, and height above top of finished bottom grade is H = 13.50 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 4.90, Meyerhof stress = 3085 lb/ft².
Foundation Interface: Direct sliding, Fs = 2.968, Eccentricity, e/L = 0.1208, Fs-overturning = 4.14

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	12.00	1	N/A	7.49	8.33	8.327	34.328	3.176	0.1053	CALTRANS
2	3.75	12.00	1	N/A	7.72	8.58	8.579	29.303	3.695	0.0776	CALTRANS
3	6.25	12.00	1	N/A	8.31	9.23	9.231	24.635	4.422	0.0539	CALTRANS
4	8.75	12.00	1	N/A	9.43	10.48	10.478	20.217	5.517	0.0344	CALTRANS
5	11.25	12.00	1	N/A	11.34	12.60	12.598	20.177	7.374	0.0190	CALTRANS
6	13.75	12.00	1	N/A	15.02	16.69	16.693	20.040	11.329	0.0078	CALTRANS
7	16.25	12.00	1	N/A	24.85	27.61	27.614	20.053	28.357	0.0011	CALTRANS

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

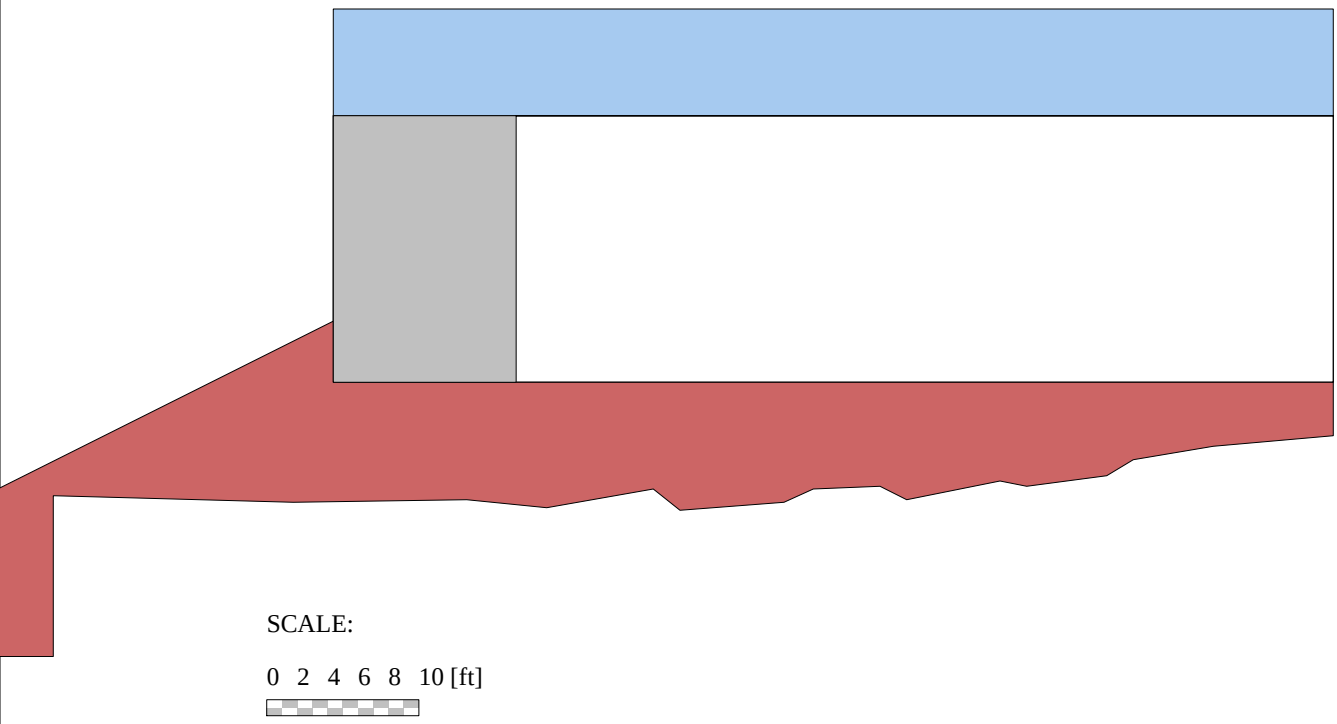
Bearing capacity, Fs = 2.30, Meyerhof stress = 5520 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.513, Eccentricity, e/L = 0.2881, Fs-overturning = 1.74

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	12.00	1	N/A	6.30	7.00	7.004	23.099	1.631	0.2485	CALTRANS
2	3.75	12.00	1	N/A	6.61	7.34	7.341	20.059	1.930	0.1780	CALTRANS
3	6.25	12.00	1	N/A	7.20	8.00	8.002	17.085	2.363	0.1193	CALTRANS
4	8.75	12.00	1	N/A	8.25	9.17	9.171	14.155	3.048	0.0723	CALTRANS
5	11.25	12.00	1	N/A	9.68	10.75	10.754	13.779	4.287	0.0370	CALTRANS
6	13.75	12.00	1	N/A	12.24	13.60	13.602	13.064	7.210	0.0134	CALTRANS
7	16.25	12.00	1	N/A	18.06	20.07	20.071	11.660	22.134	0.0015	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	15118	12687	[lb/ft ²]
Meyerhof stress, σ_V	3085.2	5520	[lb/ft ²]
Eccentricity, e	1.45	3.46	[ft]
Eccentricity, e/L	0.121	0.288	
Fs calculated	4.90	2.30	
Base length	12.00	12.00	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 2.968 and Fs-seismic = 1.513

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	12.00	3.176	1.631	1	CALTRANS
2	3.75	12.00	3.695	1.930	1	CALTRANS
3	6.25	12.00	4.422	2.363	1	CALTRANS
4	8.75	12.00	5.517	3.048	1	CALTRANS
5	11.25	12.00	7.374	4.287	1	CALTRANS
6	13.75	12.00	11.329	7.210	1	CALTRANS
7	16.25	12.00	28.357	22.134	1	CALTRANS

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1208, e/L seismic = 0.2881; Overturning: Fs-static = 4.14, Fs-seismic = 1.74

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	12.00	0.1053	0.2485	1	CALTRANS
2	3.75	12.00	0.0776	0.1780	1	CALTRANS
3	6.25	12.00	0.0539	0.1193	1	CALTRANS
4	8.75	12.00	0.0344	0.0723	1	CALTRANS
5	11.25	12.00	0.0190	0.0370	1	CALTRANS
6	13.75	12.00	0.0078	0.0134	1	CALTRANS
7	16.25	12.00	0.0011	0.0015	1	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	2.084	0.500	18226	2188.91	413.43	N/A	8.327	N/A	7.004
2	3.75	2.084	0.500	18226	2124.39	358.31	N/A	8.579	N/A	7.341
3	6.25	2.084	0.500	18226	1974.51	303.19	N/A	9.231	N/A	8.002
4	8.75	2.084	0.500	18226	1739.39	248.06	N/A	10.478	N/A	9.171
5	11.25	2.084	0.500	18226	1446.71	248.06	N/A	12.598	N/A	10.754
6	13.75	2.084	0.500	18226	1091.87	248.06	N/A	16.693	N/A	13.602
7	16.25	2.084	0.500	18226	660.03	248.06	N/A	27.614	N/A	20.071

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	2.084	2188.9	413.4	11.25	0.75	75139.9	N/A	34.328	60111.9	N/A	23.099
2	3.75	2.084	2124.4	358.3	9.75	2.25	62251.9	N/A	29.303	49801.5	N/A	20.059
3	6.25	2.084	1974.5	303.2	8.25	3.75	48642.7	N/A	24.635	38914.2	N/A	17.085
4	8.75	2.084	1739.4	248.1	6.75	5.25	35165.3	N/A	20.217	28132.2	N/A	14.155
5	11.25	2.084	1446.7	248.1	6.75	5.25	29190.7	N/A	20.177	23352.6	N/A	13.779
6	13.75	2.084	1091.9	248.1	6.75	5.25	21880.7	N/A	20.040	17504.6	N/A	13.064
7	16.25	2.084	660.0	248.1	6.75	5.25	13235.4	N/A	20.053	10588.3	N/A	11.660

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.084	0.500	2189	0.90	16403	18226	N/A	7.49	N/A	8.33	CALTRANS
2	3.75	2.084	0.500	2124	0.90	16403	18226	N/A	7.72	N/A	8.58	CALTRANS
3	6.25	2.084	0.500	1975	0.90	16403	18226	N/A	8.31	N/A	9.23	CALTRANS
4	8.75	2.084	0.500	1739	0.90	16403	18226	N/A	9.43	N/A	10.48	CALTRANS
5	11.25	2.084	0.500	1447	0.90	16403	18226	N/A	11.34	N/A	12.60	CALTRANS
6	13.75	2.084	0.500	1092	0.90	16403	18226	N/A	15.02	N/A	16.69	CALTRANS
7	16.25	2.084	0.500	660	0.90	16403	18226	N/A	24.85	N/A	27.61	CALTRANS

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.084	0.500	2602	0.90	16403	18226	N/A	6.30	N/A	7.00	CALTRANS
2	3.75	2.084	0.500	2483	0.90	16403	18226	N/A	6.61	N/A	7.34	CALTRANS
3	6.25	2.084	0.500	2278	0.90	16403	18226	N/A	7.20	N/A	8.00	CALTRANS
4	8.75	2.084	0.500	1987	0.90	16403	18226	N/A	8.25	N/A	9.17	CALTRANS
5	11.25	2.084	0.500	1695	0.90	16403	18226	N/A	9.68	N/A	10.75	CALTRANS
6	13.75	2.084	0.500	1340	0.90	16403	18226	N/A	12.24	N/A	13.60	CALTRANS
7	16.25	2.084	0.500	908	0.90	16403	18226	N/A	18.06	N/A	20.07	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 MSE WALL DESIGN

PROJECT IDENTIFICATION

Title: SR-57 MSE WALL DESIGN
Project Number: RW684
Client: OCTA
Designer: RB
Station Number: ST16+70

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive, #800

Santa Ana, CA 92707
Telephone #: 714-424-2900
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....684_ST16+70_h=18.BEN
Original date and time of creating this file: Fri Jan 02 13:26:08 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	33.0 °
Equivalent cohesion, $c_{equiv.}$	800.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 2.20 N γ= 9.31

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

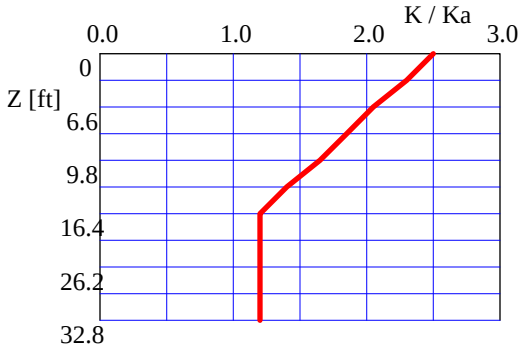
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	12.5	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

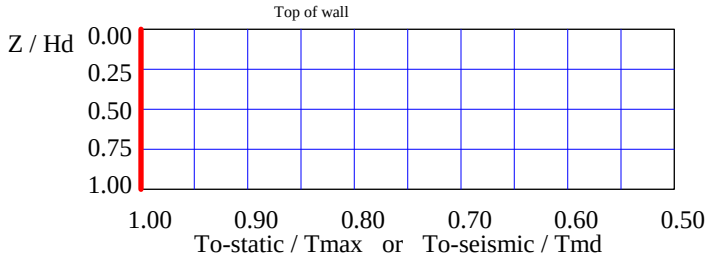


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	CALTRANS	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

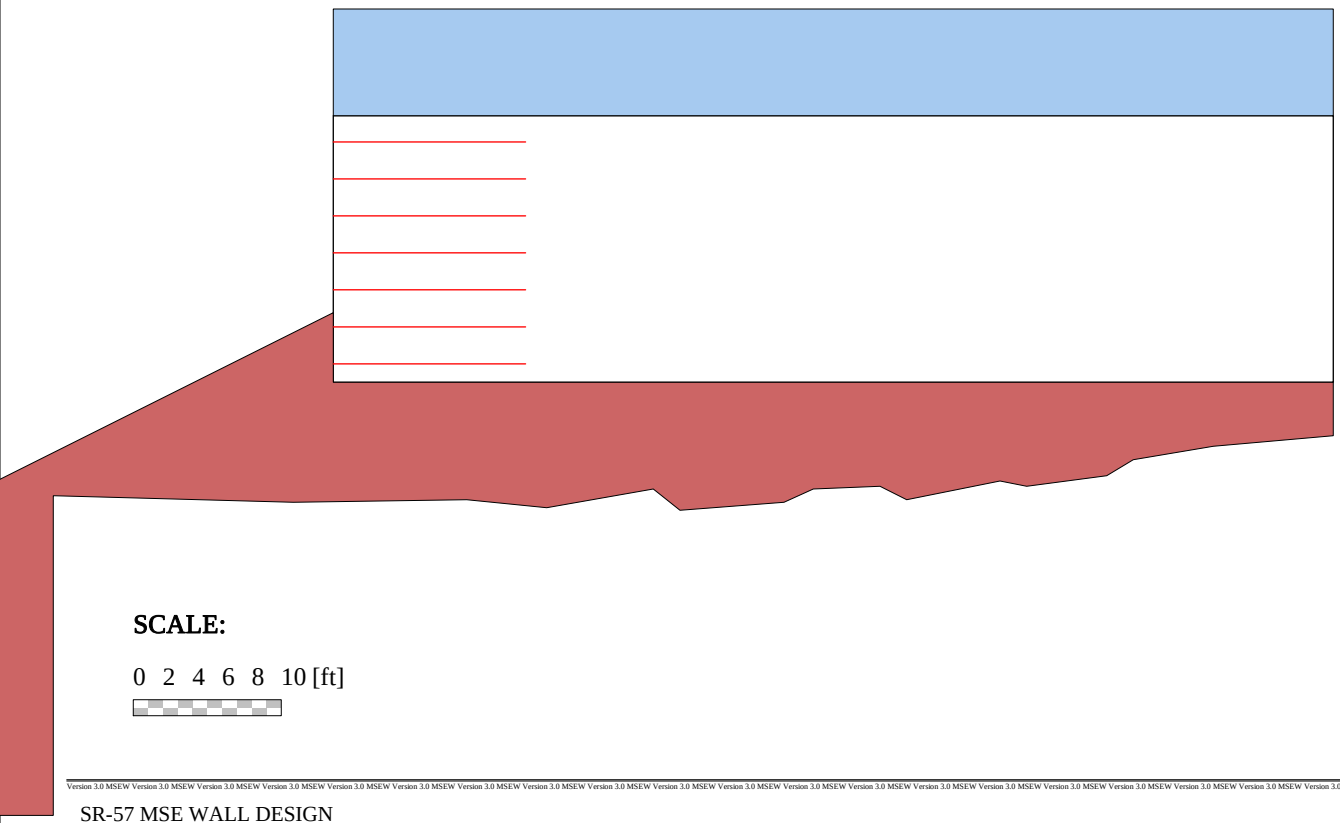
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	18.03	[ft]	{ Embedded depth is E = 4.70 ft, and height above top of finished bottom grade is H = 13.33 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 2.58, Meyerhof stress = 3072 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.128, Eccentricity, e/L = 0.1087, Fs-overturning = 4.60

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	13.00	1	N/A	7.47	8.30	8.302	37.474	3.341	0.0952	CALTRANS
2	3.75	13.00	1	N/A	7.65	8.49	8.495	32.382	3.869	0.0708	CALTRANS
3	6.25	13.00	1	N/A	8.14	9.04	9.040	27.603	4.598	0.0499	CALTRANS
4	8.75	13.00	1	N/A	9.14	10.16	10.156	23.195	5.678	0.0325	CALTRANS
5	11.25	13.00	1	N/A	10.84	12.04	12.041	22.713	7.452	0.0187	CALTRANS
6	13.75	13.00	1	N/A	13.98	15.53	15.530	22.560	10.993	0.0084	CALTRANS
7	16.25	13.00	1	N/A	19.17	21.30	21.303	19.954	22.791	0.0018	CALTRANS

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

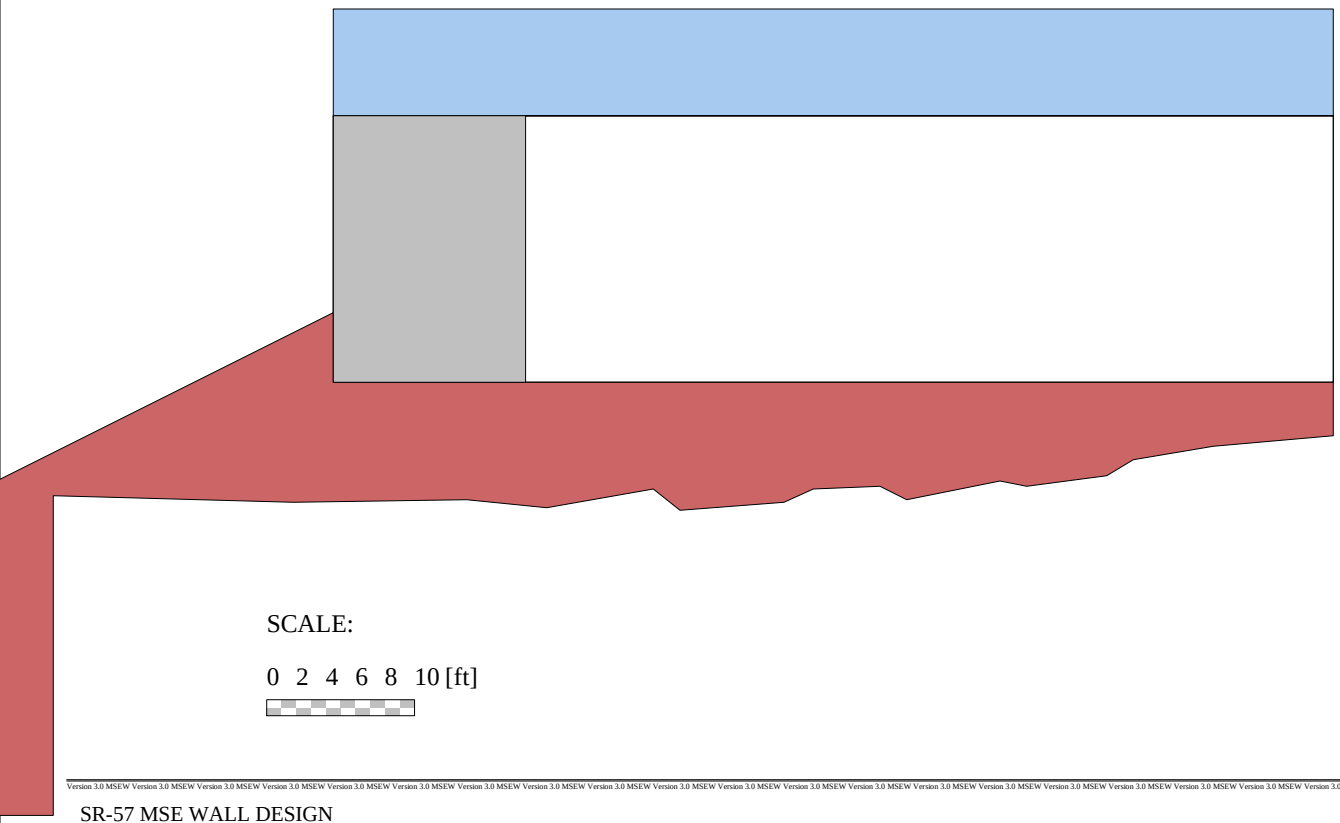
Bearing capacity, Fs = 1.10, Meyerhof stress = 5018 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.591, Eccentricity, e/L = 0.2605, Fs-overturning = 1.92

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	13.00	1	N/A	6.25	6.95	6.947	25.086	1.710	0.2257	CALTRANS
2	3.75	13.00	1	N/A	6.51	7.23	7.229	22.045	2.012	0.1636	CALTRANS
3	6.25	13.00	1	N/A	7.01	7.79	7.791	19.030	2.444	0.1114	CALTRANS
4	8.75	13.00	1	N/A	7.94	8.82	8.824	16.123	3.111	0.0693	CALTRANS
5	11.25	13.00	1	N/A	9.22	10.25	10.245	15.460	4.276	0.0371	CALTRANS
6	13.75	13.00	1	N/A	11.40	12.67	12.666	14.720	6.826	0.0148	CALTRANS
7	16.25	13.00	1	N/A	14.63	16.26	16.260	12.184	16.713	0.0026	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	7916	5527	[lb/ft ²]
Meyerhof stress, σ_V	3071.6	5018	[lb/ft ²]
Eccentricity, e	1.41	3.39	[ft]
Eccentricity, e/L	0.109	0.261	
Fs calculated	2.58	1.10	
Base length	13.00	13.00	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.128 and Fs-seismic = 1.591

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	13.00	3.341	1.710	1	CALTRANS
2	3.75	13.00	3.869	2.012	1	CALTRANS
3	6.25	13.00	4.598	2.444	1	CALTRANS
4	8.75	13.00	5.678	3.111	1	CALTRANS
5	11.25	13.00	7.452	4.276	1	CALTRANS
6	13.75	13.00	10.993	6.826	1	CALTRANS
7	16.25	13.00	22.791	16.713	1	CALTRANS

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1087, e/L seismic = 0.2605; Overturning: Fs-static = 4.60, Fs-seismic = 1.92

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	13.00	0.0952	0.2257	1	CALTRANS
2	3.75	13.00	0.0708	0.1636	1	CALTRANS
3	6.25	13.00	0.0499	0.1114	1	CALTRANS
4	8.75	13.00	0.0325	0.0693	1	CALTRANS
5	11.25	13.00	0.0187	0.0371	1	CALTRANS
6	13.75	13.00	0.0084	0.0148	1	CALTRANS
7	16.25	13.00	0.0018	0.0026	1	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	2.084	0.500	18226	2195.28	428.21	N/A	8.302	N/A	6.947
2	3.75	2.084	0.500	18226	2145.58	375.78	N/A	8.495	N/A	7.229
3	6.25	2.084	0.500	18226	2016.06	323.34	N/A	9.040	N/A	7.791
4	8.75	2.084	0.500	18226	1794.64	270.91	N/A	10.156	N/A	8.824
5	11.25	2.084	0.500	18226	1513.61	265.35	N/A	12.041	N/A	10.245
6	13.75	2.084	0.500	18226	1173.59	265.35	N/A	15.530	N/A	12.666
7	16.25	2.084	0.500	18226	855.56	265.35	N/A	21.303	N/A	16.260

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	2.084	2195.3	428.2	12.25	0.75	82264.9	N/A	37.474	65811.9	N/A	25.086
2	3.75	2.084	2145.6	375.8	10.75	2.25	69478.3	N/A	32.382	55582.6	N/A	22.045
3	6.25	2.084	2016.1	323.3	9.25	3.75	55648.4	N/A	27.603	44518.7	N/A	19.030
4	8.75	2.084	1794.6	270.9	7.75	5.25	41627.2	N/A	23.195	33301.7	N/A	16.123
5	11.25	2.084	1513.6	265.3	7.59	5.41	34378.7	N/A	22.713	27503.0	N/A	15.460
6	13.75	2.084	1173.6	265.3	7.59	5.41	26476.1	N/A	22.560	21180.9	N/A	14.720
7	16.25	2.084	855.6	265.3	7.59	5.41	17071.6	N/A	19.954	13657.3	N/A	12.184

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.084	0.500	2195	0.90	16403	18226	N/A	7.47	N/A	8.30	CALTRANS
2	3.75	2.084	0.500	2146	0.90	16403	18226	N/A	7.65	N/A	8.49	CALTRANS
3	6.25	2.084	0.500	2016	0.90	16403	18226	N/A	8.14	N/A	9.04	CALTRANS
4	8.75	2.084	0.500	1795	0.90	16403	18226	N/A	9.14	N/A	10.16	CALTRANS
5	11.25	2.084	0.500	1514	0.90	16403	18226	N/A	10.84	N/A	12.04	CALTRANS
6	13.75	2.084	0.500	1174	0.90	16403	18226	N/A	13.98	N/A	15.53	CALTRANS
7	16.25	2.084	0.500	856	0.90	16403	18226	N/A	19.17	N/A	21.30	CALTRANS

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.084	0.500	2623	0.90	16403	18226	N/A	6.25	N/A	6.95	CALTRANS
2	3.75	2.084	0.500	2521	0.90	16403	18226	N/A	6.51	N/A	7.23	CALTRANS
3	6.25	2.084	0.500	2339	0.90	16403	18226	N/A	7.01	N/A	7.79	CALTRANS
4	8.75	2.084	0.500	2066	0.90	16403	18226	N/A	7.94	N/A	8.82	CALTRANS
5	11.25	2.084	0.500	1779	0.90	16403	18226	N/A	9.22	N/A	10.25	CALTRANS
6	13.75	2.084	0.500	1439	0.90	16403	18226	N/A	11.40	N/A	12.67	CALTRANS
7	16.25	2.084	0.500	1121	0.90	16403	18226	N/A	14.63	N/A	16.26	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 MSE WALL DESIGN

PROJECT IDENTIFICATION

Title: SR-57 MSE WALL DESIGN
Project Number: RW684
Client: OCTA
Designer: RB
Station Number: ST19+45

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive, #800

Santa Ana, CA 92707
Telephone #: 714-424-2900
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....4_ST19+45_h=17.5.BEN
Original date and time of creating this file: Fri Jan 02 13:26:08 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	33.0 °
Equivalent cohesion, $c_{equiv.}$	800.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 2.20 N γ= 9.31

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

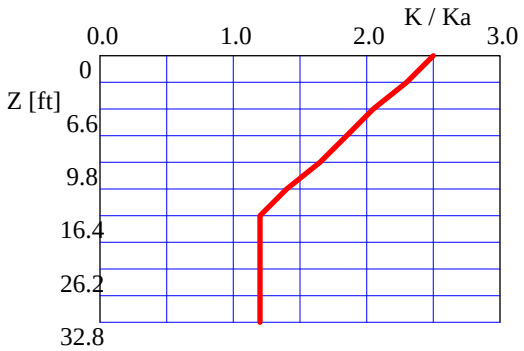
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	12.5	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

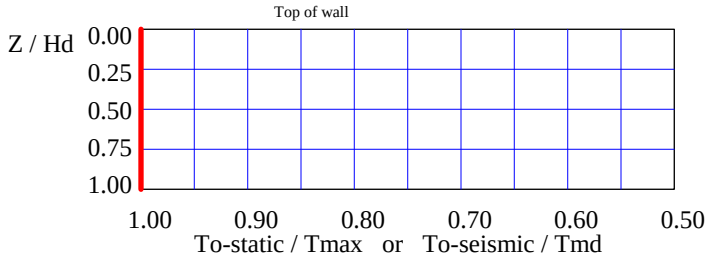


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	CALTRANS	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

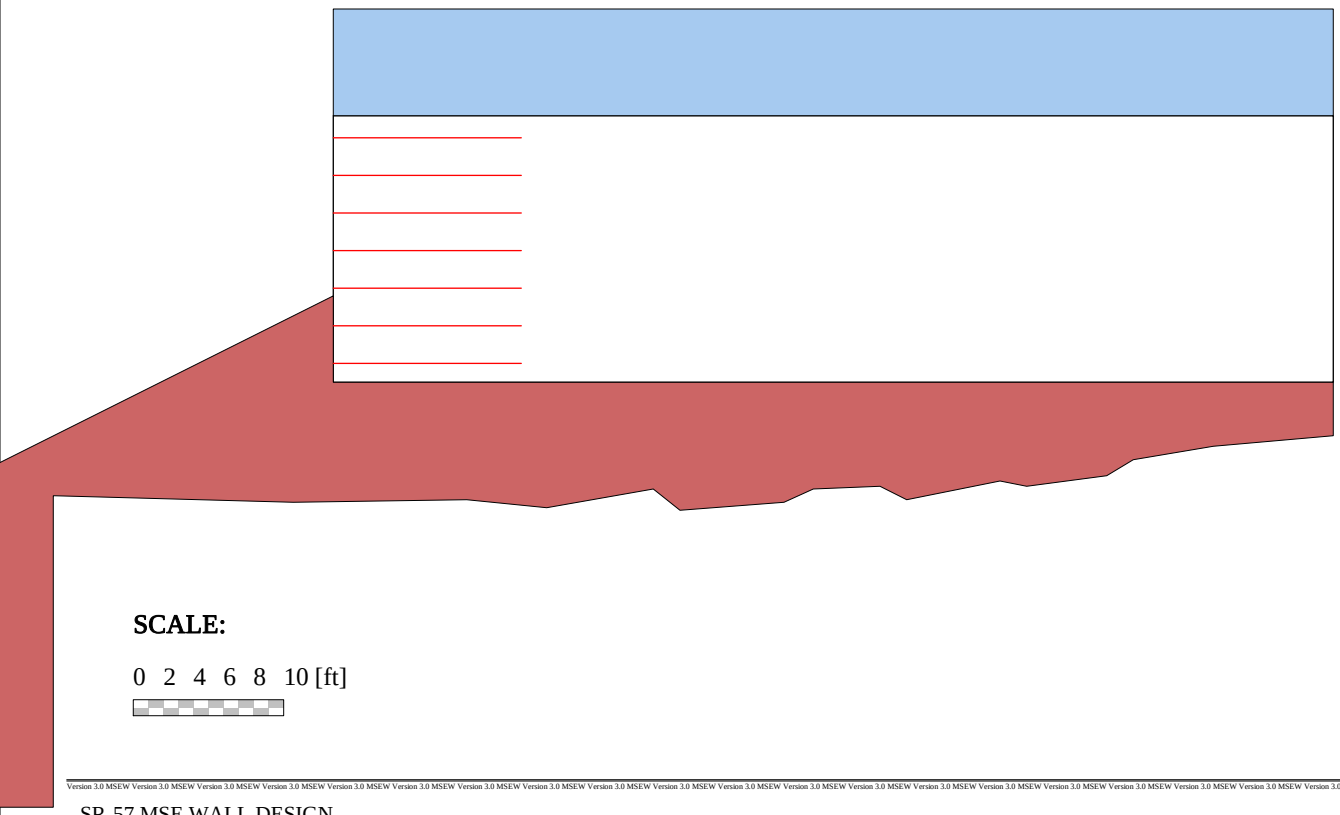
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	17.73	[ft]	{ Embedded depth is E = 5.73 ft, and height above top of finished bottom grade is H = 12.00 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 2.48, Meyerhof stress = 3067 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.054, Eccentricity, e/L = 0.1140, Fs-overturning = 4.39

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	12.50	1	N/A	7.48	8.31	8.315	35.883	3.266	0.0996	CALTRANS
2	3.75	12.50	1	N/A	7.69	8.54	8.541	30.835	3.792	0.0737	CALTRANS
3	6.25	12.50	1	N/A	8.23	9.15	9.145	26.127	4.524	0.0515	CALTRANS
4	8.75	12.50	1	N/A	9.30	10.33	10.334	21.705	5.619	0.0332	CALTRANS
5	11.25	12.50	1	N/A	11.11	12.35	12.347	21.478	7.448	0.0186	CALTRANS
6	13.75	12.50	1	N/A	14.55	16.16	16.162	21.332	11.230	0.0080	CALTRANS
7	16.25	12.50	1	N/A	22.09	24.54	24.541	20.182	25.593	0.0014	CALTRANS

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

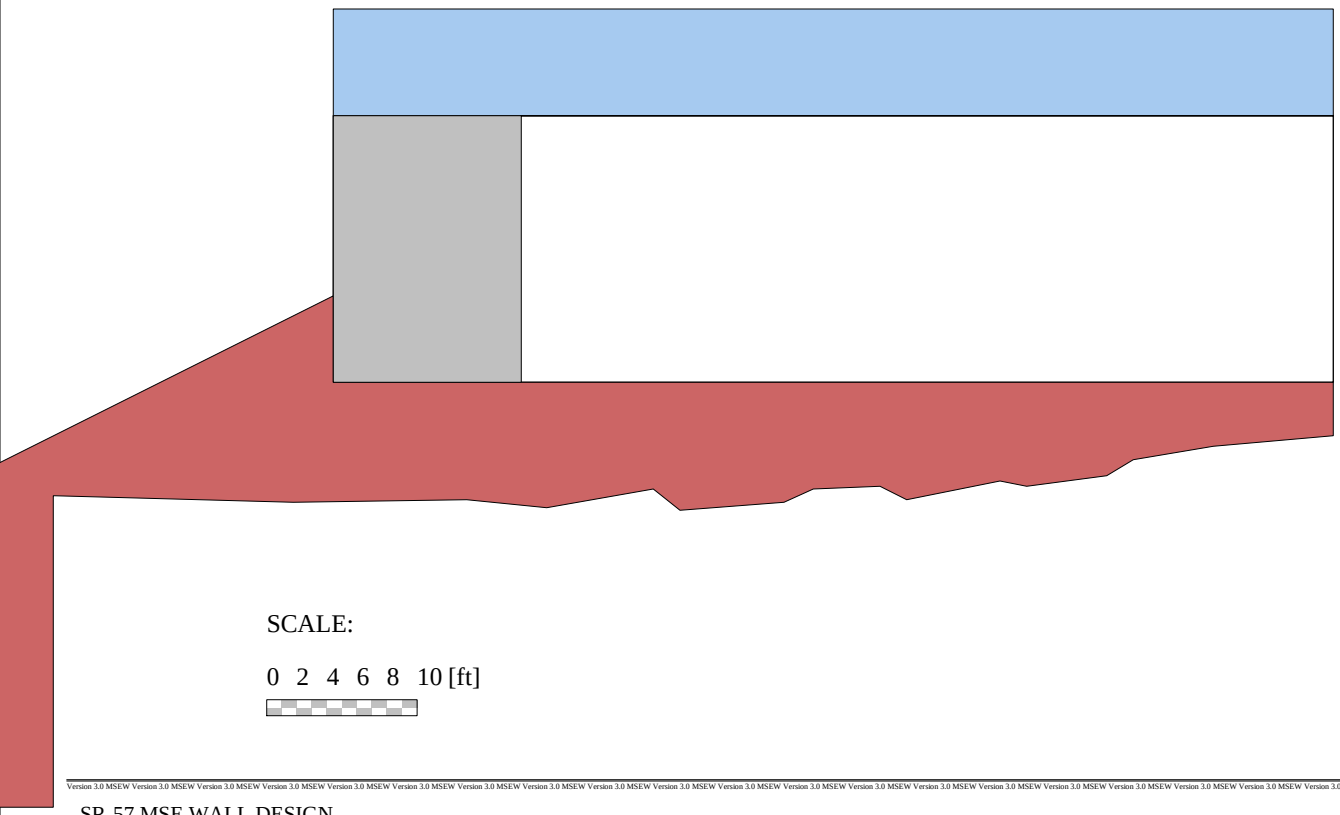
Bearing capacity, Fs = 1.00, Meyerhof stress = 5203 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.556, Eccentricity, e/L = 0.2725, Fs-overturning = 1.83

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	12.50	1	N/A	6.28	6.98	6.981	24.102	1.675	0.2355	CALTRANS
2	3.75	12.50	1	N/A	6.56	7.29	7.293	21.063	1.977	0.1696	CALTRANS
3	6.25	12.50	1	N/A	7.12	7.91	7.908	18.074	2.412	0.1145	CALTRANS
4	8.75	12.50	1	N/A	8.11	9.01	9.013	15.146	3.092	0.0702	CALTRANS
5	11.25	12.50	1	N/A	9.47	10.52	10.523	14.644	4.305	0.0366	CALTRANS
6	13.75	12.50	1	N/A	11.86	13.17	13.173	13.909	7.068	0.0139	CALTRANS
7	16.25	12.50	1	N/A	16.43	18.25	18.252	12.008	19.404	0.0019	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	7599	5200	[lb/ft ²]
Meyerhof stress, σ_V	3067.0	5203	[lb/ft ²]
Eccentricity, e	1.43	3.41	[ft]
Eccentricity, e/L	0.114	0.272	
Fs calculated	2.48	1.00	
Base length	12.50	12.50	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.054 and Fs-seismic = 1.556

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	12.50	3.266	1.675	1	CALTRANS
2	3.75	12.50	3.792	1.977	1	CALTRANS
3	6.25	12.50	4.524	2.412	1	CALTRANS
4	8.75	12.50	5.619	3.092	1	CALTRANS
5	11.25	12.50	7.448	4.305	1	CALTRANS
6	13.75	12.50	11.230	7.068	1	CALTRANS
7	16.25	12.50	25.593	19.404	1	CALTRANS

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1140, e/L seismic = 0.2725; Overturning: Fs-static = 4.39, Fs-seismic = 1.83

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	12.50	0.0996	0.2355	1	CALTRANS
2	3.75	12.50	0.0737	0.1696	1	CALTRANS
3	6.25	12.50	0.0515	0.1145	1	CALTRANS
4	8.75	12.50	0.0332	0.0702	1	CALTRANS
5	11.25	12.50	0.0186	0.0366	1	CALTRANS
6	13.75	12.50	0.0080	0.0139	1	CALTRANS
7	16.25	12.50	0.0014	0.0019	1	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	2.084	0.500	18226	2192.07	418.72	N/A	8.315	N/A	6.981
2	3.75	2.084	0.500	18226	2133.99	365.27	N/A	8.541	N/A	7.293
3	6.25	2.084	0.500	18226	1992.90	311.81	N/A	9.145	N/A	7.908
4	8.75	2.084	0.500	18226	1763.72	258.36	N/A	10.334	N/A	9.013
5	11.25	2.084	0.500	18226	1476.14	255.90	N/A	12.347	N/A	10.523
6	13.75	2.084	0.500	18226	1127.73	255.90	N/A	16.162	N/A	13.173
7	16.25	2.084	0.500	18226	742.69	255.90	N/A	24.541	N/A	18.252

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	2.084	2192.1	418.7	11.75	0.75	78657.5	N/A	35.883	62926.0	N/A	24.102
2	3.75	2.084	2134.0	365.3	10.25	2.25	65801.0	N/A	30.835	52640.8	N/A	21.063
3	6.25	2.084	1992.9	311.8	8.75	3.75	52068.7	N/A	26.127	41654.9	N/A	18.074
4	8.75	2.084	1763.7	258.4	7.25	5.25	38282.2	N/A	21.705	30625.7	N/A	15.146
5	11.25	2.084	1476.1	255.9	7.18	5.32	31704.5	N/A	21.478	25363.6	N/A	14.644
6	13.75	2.084	1127.7	255.9	7.18	5.32	24057.1	N/A	21.332	19245.6	N/A	13.909
7	16.25	2.084	742.7	255.9	7.18	5.32	14988.7	N/A	20.182	11991.0	N/A	12.008

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.084	0.500	2192	0.90	16403	18226	N/A	7.48	N/A	8.31	CALTRANS
2	3.75	2.084	0.500	2134	0.90	16403	18226	N/A	7.69	N/A	8.54	CALTRANS
3	6.25	2.084	0.500	1993	0.90	16403	18226	N/A	8.23	N/A	9.15	CALTRANS
4	8.75	2.084	0.500	1764	0.90	16403	18226	N/A	9.30	N/A	10.33	CALTRANS
5	11.25	2.084	0.500	1476	0.90	16403	18226	N/A	11.11	N/A	12.35	CALTRANS
6	13.75	2.084	0.500	1128	0.90	16403	18226	N/A	14.55	N/A	16.16	CALTRANS
7	16.25	2.084	0.500	743	0.90	16403	18226	N/A	22.09	N/A	24.54	CALTRANS

RESULTS for CONNECTION (seismic conditions)

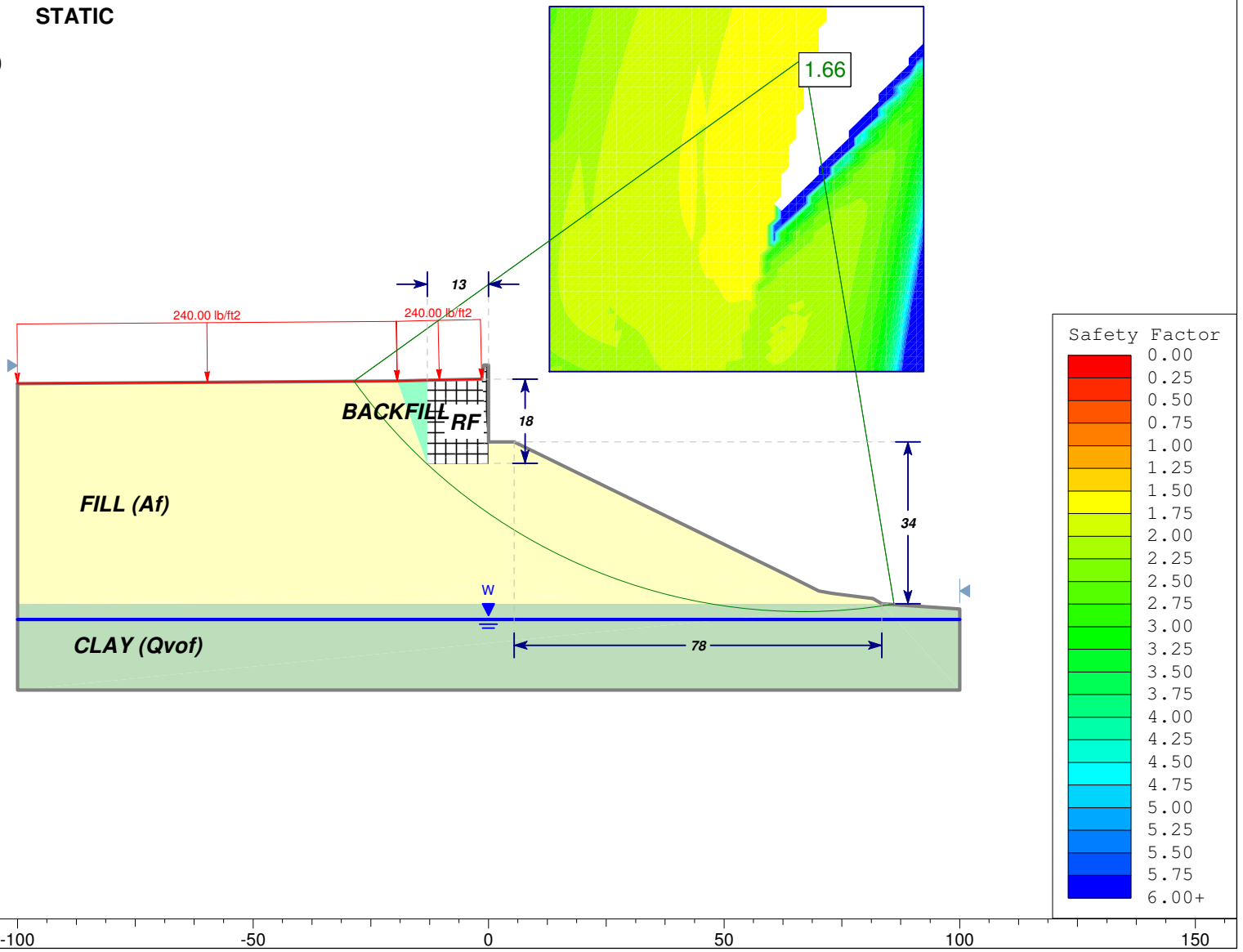
#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	2.084	0.500	2611	0.90	16403	18226	N/A	6.28	N/A	6.98	CALTRANS
2	3.75	2.084	0.500	2499	0.90	16403	18226	N/A	6.56	N/A	7.29	CALTRANS
3	6.25	2.084	0.500	2305	0.90	16403	18226	N/A	7.12	N/A	7.91	CALTRANS
4	8.75	2.084	0.500	2022	0.90	16403	18226	N/A	8.11	N/A	9.01	CALTRANS
5	11.25	2.084	0.500	1732	0.90	16403	18226	N/A	9.47	N/A	10.52	CALTRANS
6	13.75	2.084	0.500	1384	0.90	16403	18226	N/A	11.86	N/A	13.17	CALTRANS
7	16.25	2.084	0.500	999	0.90	16403	18226	N/A	16.43	N/A	18.25	CALTRANS

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees

Project Title:
SR-57 RETAINING WALL DESIGN
GLOBAL STABILITY ANALYSIS
RW684 ST16+70
STATIC



Slide Analysis Information

Document Name

File Name: RW684_ST16+70_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW684 ST16+70 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.659080
Center: 66.929, 474.266
Radius: 117.670
Left Slip Surface Endpoint: -28.615, 405.582
Right Slip Surface Endpoint: 86.053, 358.161
Resisting Moment=1.64836e+007 lb-ft
Driving Moment=9.93538e+006 lb-ft

Method: spencer
FS: 1.650570
Center: 65.340, 468.070
Radius: 112.196
Left Slip Surface Endpoint: -27.848, 405.587
Right Slip Surface Endpoint: 87.428, 358.070
Resisting Moment=1.61696e+007 lb-ft
Driving Moment=9.79636e+006 lb-ft
Resisting Horizontal Force=127114 lb
Driving Horizontal Force=77012.1 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 14117
Number of Invalid Surfaces: 14494
Error Codes:
Error Code -99 reported for 10062 surfaces
Error Code -103 reported for 1400 surfaces
Error Code -105 reported for 1 surface
Error Code -109 reported for 3031 surfaces

Method: spencer

Number of Valid Surfaces: 14104
Number of Invalid Surfaces: 14507
Error Codes:
Error Code -99 reported for 10062 surfaces
Error Code -103 reported for 1400 surfaces
Error Code -105 reported for 1 surface
Error Code -108 reported for 4 surfaces
Error Code -109 reported for 3031 surfaces
Error Code -111 reported for 9 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

List of All Coordinates

Search Grid

12.895	407.658
92.356	407.658
92.356	485.109
12.895	485.109

Material Boundary

-100.000	358.330
83.490	358.330

Material Boundary

81.580	359.440
82.050	359.110
83.490	358.330

Material Boundary

-13.000	405.781
-13.000	388.000
0.000	388.000
0.000	392.700

Material Boundary

-19.380	405.643
-13.000	388.000

External Boundary

-100.000	405.110
-100.000	403.950
-100.000	358.330
-100.000	340.000
100.000	340.000
100.000	357.240
83.490	358.330
81.580	359.440
75.860	360.150
72.880	360.590
70.100	361.050
63.300	364.440
5.427	392.700
-0.000	392.700
-0.010	409.030
-1.010	409.030
-1.490	406.030
-13.000	405.781
-19.380	405.643

Water Table

-100.000	355.000
100.000	355.000

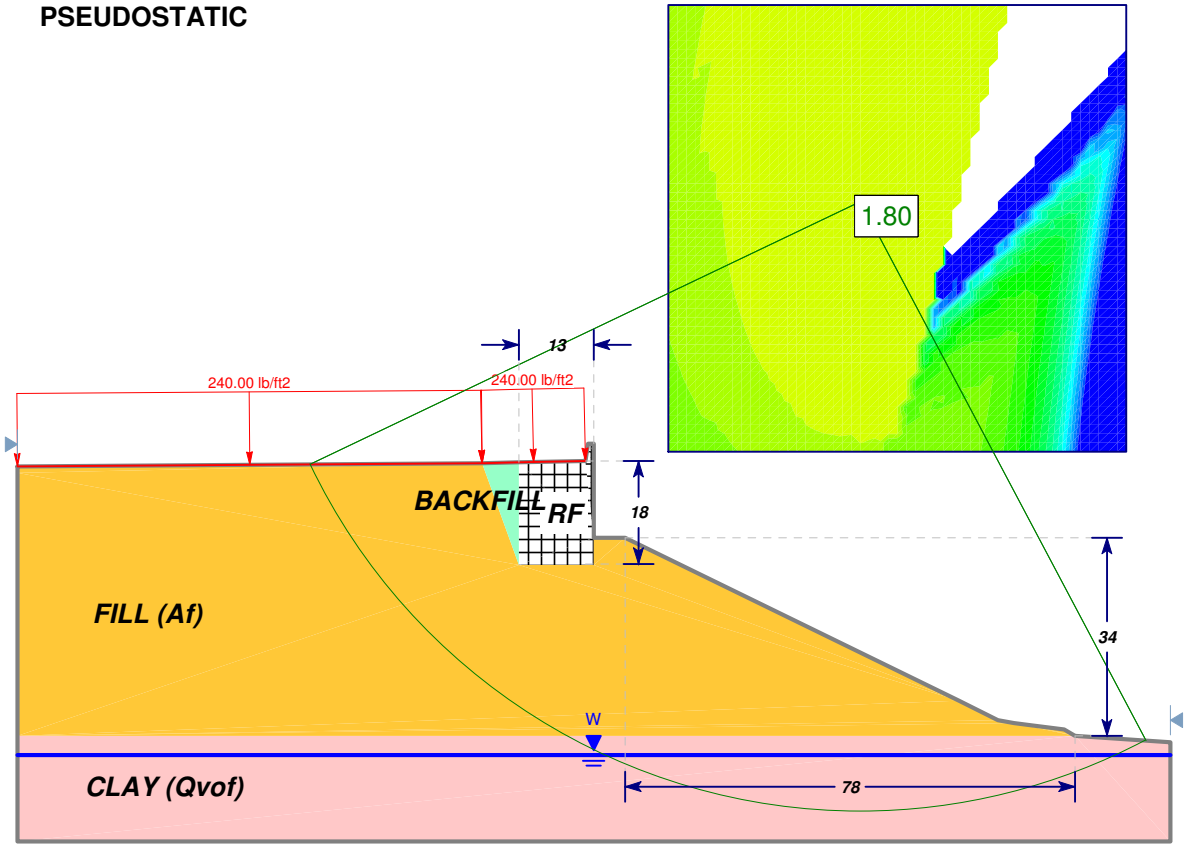
Distributed Load

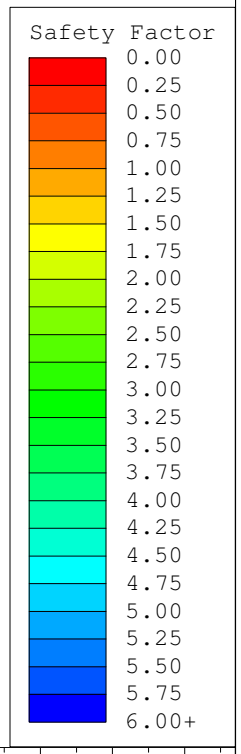
-1.490	406.030
-13.000	405.781
-19.380	405.643
-100.000	405.110

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees

Project Title:
SR-57 RETAINING WALL DESIGN
GLOBAL STABILITY ANALYSIS
RW684 ST16+70
PSEUDOSTATIC





Slide Analysis Information

Document Name

File Name: RW684_ST16+70_Pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW684 ST16+70 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.801600
Center: 46.269, 451.031
Radius: 105.812
Left Slip Surface Endpoint: -49.220, 405.446
Right Slip Surface Endpoint: 95.782, 357.518
Resisting Moment=4.45179e+007 lb-ft
Driving Moment=2.47102e+007 lb-ft

Method: spencer
FS: 1.799210
Center: 49.447, 454.129
Radius: 107.167
Left Slip Surface Endpoint: -46.034, 405.467
Right Slip Surface Endpoint: 95.822, 357.516
Resisting Moment=4.19617e+007 lb-ft
Driving Moment=2.33223e+007 lb-ft
Resisting Horizontal Force=348465 lb
Driving Horizontal Force=193677 lb

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 14117
Number of Invalid Surfaces: 14494
Error Codes:
Error Code -99 reported for 10062 surfaces
Error Code -103 reported for 1400 surfaces
Error Code -105 reported for 1 surface
Error Code -109 reported for 3031 surfaces

Method: spencer
Number of Valid Surfaces: 13998
Number of Invalid Surfaces: 14613
Error Codes:
Error Code -99 reported for 10062 surfaces
Error Code -103 reported for 1400 surfaces
Error Code -105 reported for 1 surface
Error Code -108 reported for 14 surfaces
Error Code -109 reported for 3031 surfaces
Error Code -111 reported for 105 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

List of All Coordinates

Search Grid

12.895	407.658
92.356	407.658
92.356	485.109
12.895	485.109

Material Boundary

-100.000	358.330
83.490	358.330

Material Boundary

81.580	359.440
82.050	359.110
83.490	358.330

Material Boundary

-13.000	405.781
-13.000	388.000
0.000	388.000
0.000	392.700

Material Boundary

-19.380	405.643
-13.000	388.000

External Boundary

-100.000	405.110
-100.000	403.950
-100.000	358.330
-100.000	340.000
100.000	340.000
100.000	357.240
83.490	358.330
81.580	359.440
75.860	360.150
72.880	360.590
70.100	361.050
63.300	364.440
5.427	392.700
-0.000	392.700
-0.010	409.030
-1.010	409.030
-1.490	406.030
-13.000	405.781
-19.380	405.643

Water Table

-100.000	355.000
100.000	355.000

Distributed Load

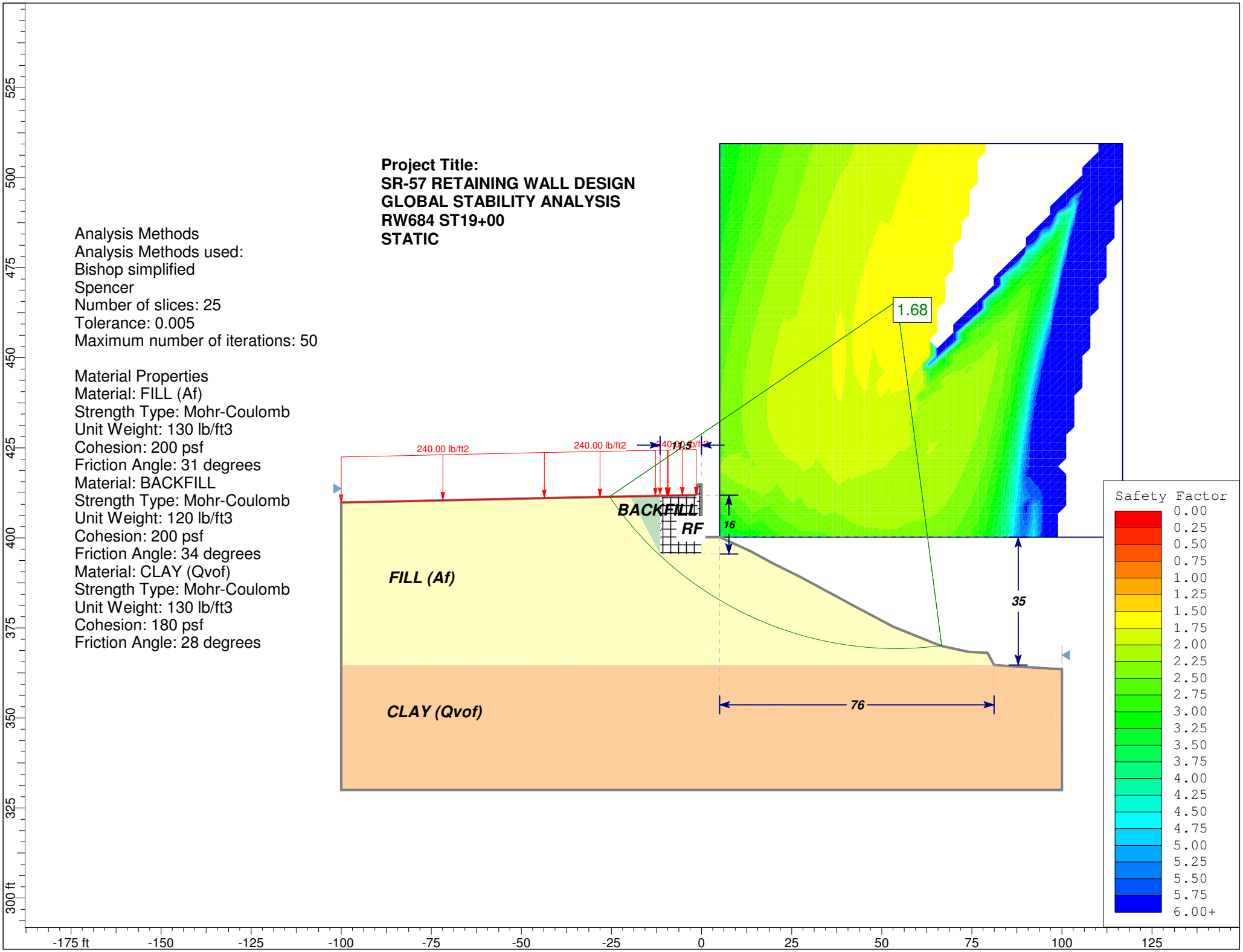
-1.490	406.030
-13.000	405.781
-19.380	405.643

-100.000 405.110

Project Title:
SR-57 RETAINING WALL DESIGN
GLOBAL STABILITY ANALYSIS
RW684 ST19+00
STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees



Slide Analysis Information

Document Name

File Name: RW684_ST19+00_Static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW684 ST19+00
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: None

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Global Minimums

Method: bishop simplified
FS: 1.675290
Center: 54.215, 465.765
Radius: 96.566
Left Slip Surface Endpoint: -25.588, 411.391
Right Slip Surface Endpoint: 66.625, 370.000
Resisting Moment=1.07328e+007 lb-ft
Driving Moment=6.40653e+006 lb-ft

Method: spencer
FS: 1.665260
Center: 67.637, 474.510
Radius: 112.019
Left Slip Surface Endpoint: -24.915, 411.404
Right Slip Surface Endpoint: 87.612, 364.286
Resisting Moment=1.52382e+007 lb-ft
Driving Moment=9.15068e+006 lb-ft
Resisting Horizontal Force=120233 lb
Driving Horizontal Force=72201.1 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 16034
Number of Invalid Surfaces: 12577
Error Codes:
Error Code -99 reported for 4917 surfaces
Error Code -100 reported for 6 surfaces
Error Code -101 reported for 3 surfaces
Error Code -102 reported for 7 surfaces
Error Code -103 reported for 299 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 636 surfaces
Error Code -108 reported for 13 surfaces
Error Code -109 reported for 4594 surfaces

Error Code -1000 reported for 2101 surfaces

Method: spencer
Number of Valid Surfaces: 15903
Number of Invalid Surfaces: 12708
Error Codes:
Error Code -99 reported for 4917 surfaces
Error Code -100 reported for 6 surfaces
Error Code -101 reported for 3 surfaces
Error Code -102 reported for 7 surfaces
Error Code -103 reported for 299 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 636 surfaces
Error Code -108 reported for 68 surfaces
Error Code -109 reported for 4594 surfaces
Error Code -111 reported for 76 surfaces
Error Code -1000 reported for 2101 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-101 = Only one (or zero) surface / slope intersections.

-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

5.000	400.180
116.852	400.180
116.852	509.489
5.000	509.489

Material Boundary

-100.000	409.800
-96.630	409.870
-96.235	409.883

Material Boundary

97.110	363.660
99.270	363.560
100.000	363.560

Material Boundary

-19.850	411.503
-11.500	395.500

Material Boundary

-100.000	364.710
81.190	364.710

Material Boundary

-11.500	395.500
-11.500	411.660

Material Boundary

-11.500	395.500
0.000	395.500
0.000	400.180

External Boundary

-100.000	409.800

-100.000	364.710
-100.000	330.000
100.000	330.000
100.000	363.560
97.110	363.660
81.190	364.710
79.350	368.090
74.090	368.340
66.710	369.970
64.340	370.810
60.940	372.230
53.220	375.310
41.960	381.260
37.230	383.860
27.500	389.080
19.830	392.890
13.490	396.330
5.000	400.180
0.000	400.180
0.000	414.350
0.000	414.860
-0.030	414.860
-0.670	414.860
-0.990	414.860
-1.000	414.860
-1.020	414.740
-1.480	411.860
-9.160	411.710
-9.480	411.700
-9.560	411.700
-11.000	411.670
-11.480	411.660
-11.500	411.660
-12.790	411.640
-19.850	411.503
-43.600	411.040
-91.758	409.981
-96.235	409.883

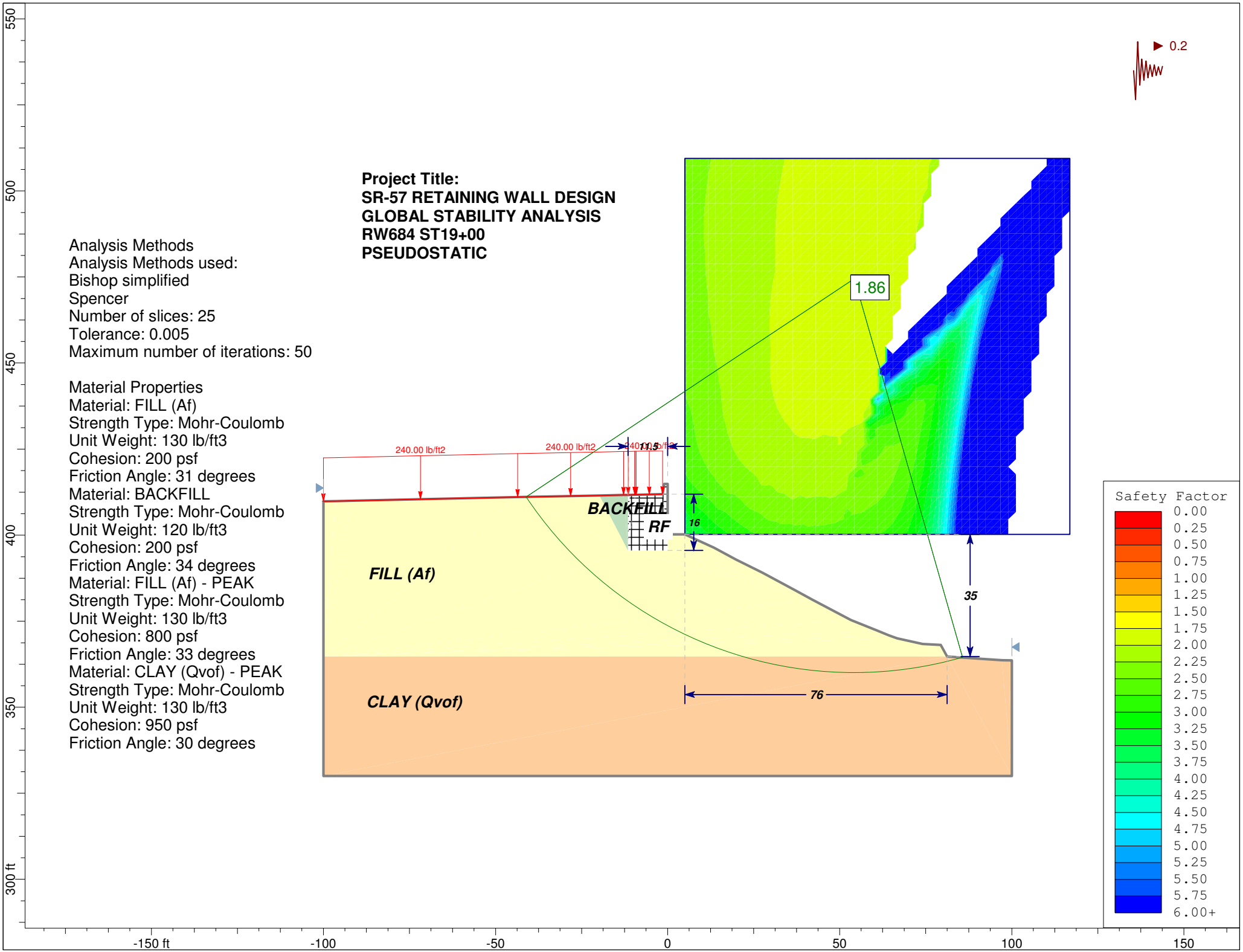
Distributed Load

-1.480	411.860
-9.160	411.710
-9.480	411.700
-9.560	411.700
-11.000	411.670
-11.480	411.660
-12.790	411.640
-19.850	411.503
-43.600	411.040
-91.758	409.981
-96.235	409.883
-100.000	409.800

Project Title:
SR-57 RETAINING WALL DESIGN
GLOBAL STABILITY ANALYSIS
RW684 ST19+00
PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees



Slide Analysis Information

Document Name

File Name: RW684_ST19+00_PseudoStatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW684 ST19+00
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Vertical, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Water Surface: None

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: None

Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Water Surface: None

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.861800
Center: 54.215, 474.510
Radius: 114.507
Left Slip Surface Endpoint: -41.124, 411.088
Right Slip Surface Endpoint: 85.688, 364.413
Resisting Moment=3.60359e+007 lb-ft
Driving Moment=1.93554e+007 lb-ft

Method: spencer
FS: 1.856140
Center: 54.215, 470.138
Radius: 110.596
Left Slip Surface Endpoint: -39.320, 411.123
Right Slip Surface Endpoint: 86.503, 364.360
Resisting Moment=3.45399e+007 lb-ft
Driving Moment=1.86084e+007 lb-ft
Resisting Horizontal Force=280446 lb
Driving Horizontal Force=151091 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 16047
Number of Invalid Surfaces: 12564
Error Codes:
Error Code -99 reported for 4917 surfaces

Error Code -100 reported for 6 surfaces
Error Code -101 reported for 3 surfaces
Error Code -102 reported for 7 surfaces
Error Code -103 reported for 299 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 636 surfaces
Error Code -109 reported for 4594 surfaces
Error Code -1000 reported for 2101 surfaces

Method: spencer
Number of Valid Surfaces: 15785
Number of Invalid Surfaces: 12826
Error Codes:
Error Code -99 reported for 4917 surfaces
Error Code -100 reported for 6 surfaces
Error Code -101 reported for 3 surfaces
Error Code -102 reported for 7 surfaces
Error Code -103 reported for 299 surfaces
Error Code -105 reported for 1 surface
Error Code -106 reported for 636 surfaces
Error Code -108 reported for 95 surfaces
Error Code -109 reported for 4594 surfaces
Error Code -111 reported for 167 surfaces
Error Code -1000 reported for 2101 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-101 = Only one (or zero) surface / slope intersections.

-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

5.000	400.180
116.852	400.180
116.852	509.489
5.000	509.489

Material Boundary

-100.000	409.800
-96.630	409.870
-96.235	409.883

Material Boundary

97.110	363.660
99.270	363.560
100.000	363.560

Material Boundary

-19.850	411.503
-11.500	395.500

Material Boundary

-100.000	364.710
81.190	364.710

Material Boundary

-11.500	395.500
-11.500	411.660

Material Boundary

-11.500	395.500
0.000	395.500
0.000	400.180

External Boundary

-100.000	409.800
-100.000	364.710
-100.000	330.000
100.000	330.000
100.000	363.560
97.110	363.660
81.190	364.710
79.350	368.090
74.090	368.340
66.710	369.970
64.340	370.810
60.940	372.230
53.220	375.310
41.960	381.260
37.230	383.860
27.500	389.080
19.830	392.890
13.490	396.330
5.000	400.180
0.000	400.180
0.000	414.350
0.000	414.860
-0.030	414.860
-0.670	414.860
-0.990	414.860
-1.000	414.860
-1.020	414.740
-1.480	411.860
-9.160	411.710
-9.480	411.700
-9.560	411.700
-11.000	411.670
-11.480	411.660
-11.500	411.660
-12.790	411.640
-19.850	411.503
-43.600	411.040
-91.758	409.981
-96.235	409.883

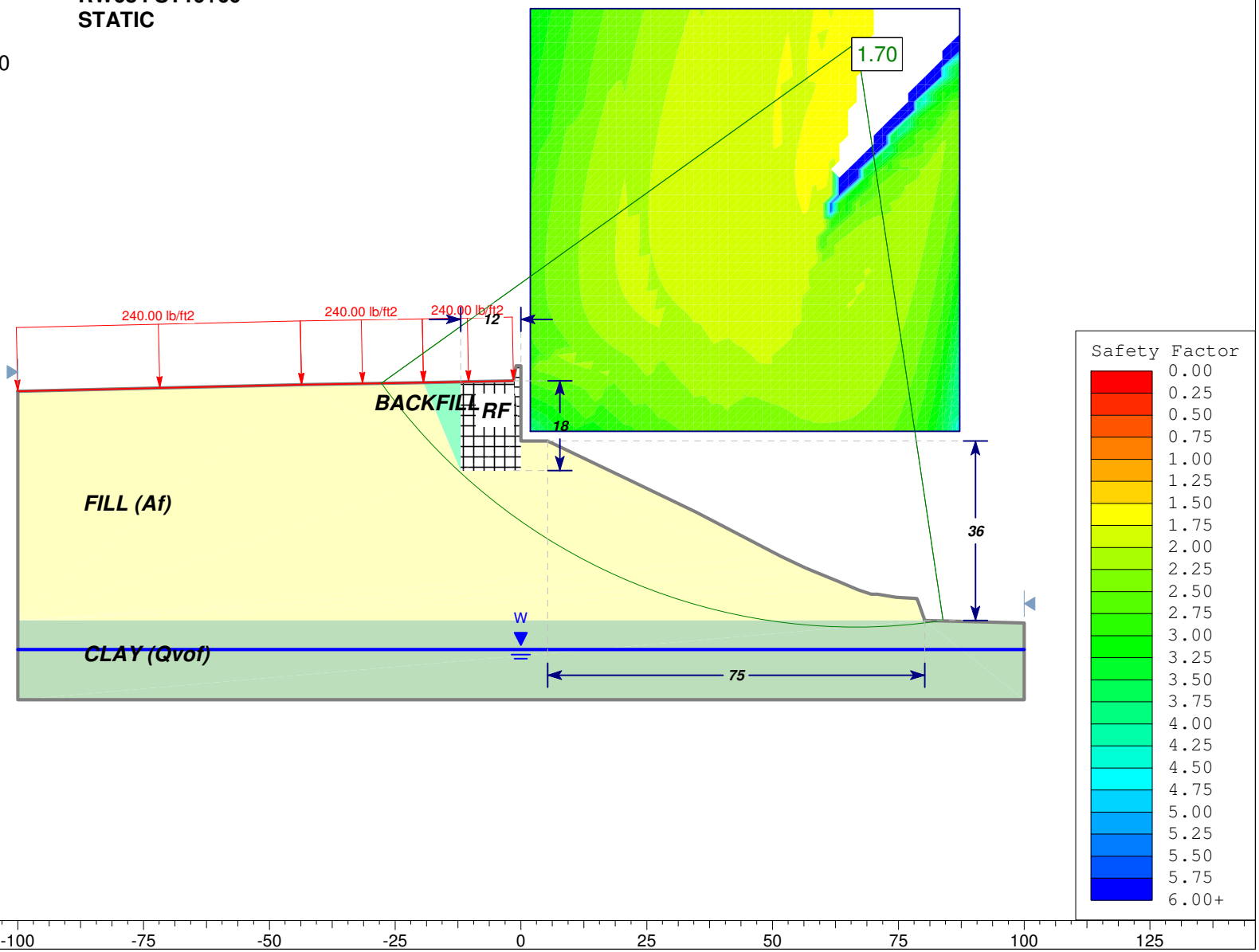
Distributed Load

-1.480	411.860
-9.160	411.710
-9.480	411.700
-9.560	411.700
-11.000	411.670
-11.480	411.660
-12.790	411.640
-19.850	411.503
-43.600	411.040
-91.758	409.981
-96.235	409.883
-100.000	409.800

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees

Project Title:
SR-57 RETAINING WALL DESIGN
GLOBAL STABILITY ANALYSIS
RW684 ST19+60
STATIC



Slide Analysis Information

Document Name

File Name: RW684_ST19+60_STATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DEGISN - GLOBAL STABILITY ANALYSIS - RW684 ST19+60 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 200 psf
Friction Angle: 31 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.698320
Center: 66.704, 480.635
Radius: 116.239
Left Slip Surface Endpoint: -27.765, 412.907
Right Slip Surface Endpoint: 83.897, 365.675
Resisting Moment=1.68036e+007 lb-ft
Driving Moment=9.89422e+006 lb-ft

Method: spencer
FS: 1.688740
Center: 64.998, 472.238
Radius: 108.799
Left Slip Surface Endpoint: -26.217, 412.933
Right Slip Surface Endpoint: 86.601, 365.606
Resisting Moment=1.61271e+007 lb-ft
Driving Moment=9.54975e+006 lb-ft
Resisting Horizontal Force=131010 lb
Driving Horizontal Force=77578.4 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 14661
Number of Invalid Surfaces: 13950
Error Codes:
Error Code -99 reported for 6269 surfaces
Error Code -100 reported for 8 surfaces
Error Code -103 reported for 2911 surfaces
Error Code -106 reported for 135 surfaces
Error Code -109 reported for 4624 surfaces
Error Code -113 reported for 3 surfaces

Method: spencer
Number of Valid Surfaces: 14608
Number of Invalid Surfaces: 14003
Error Codes:
Error Code -99 reported for 6269 surfaces
Error Code -100 reported for 8 surfaces
Error Code -103 reported for 2911 surfaces
Error Code -106 reported for 135 surfaces
Error Code -108 reported for 1 surface
Error Code -109 reported for 4624 surfaces
Error Code -111 reported for 52 surfaces
Error Code -113 reported for 3 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

List of All Coordinates

Search Grid

1.881	403.382
87.174	403.382
87.174	487.353
1.881	487.353

Material Boundary

-100.000	365.770
80.230	365.770

Material Boundary

-12.000	413.185
-12.000	395.500
0.000	395.500
0.000	401.440

Material Boundary

-19.350	413.049
-12.000	395.500

External Boundary

-100.000	411.320
-100.000	365.770
-100.000	350.000
100.000	350.000
100.000	365.260
80.230	365.770
78.900	369.510
78.650	370.140
77.860	370.160
74.500	370.380
70.820	370.970
69.580	370.970
67.040	371.870
62.950	373.570
58.270	375.510
56.440	376.280
51.610	378.560
34.800	387.320
22.798	393.066
5.306	401.440
0.000	401.440
0.000	416.380
-1.000	416.380
-1.480	413.380
-12.000	413.185
-19.350	413.049
-43.570	412.640

Water Table

-100.000	360.000
100.000	360.000

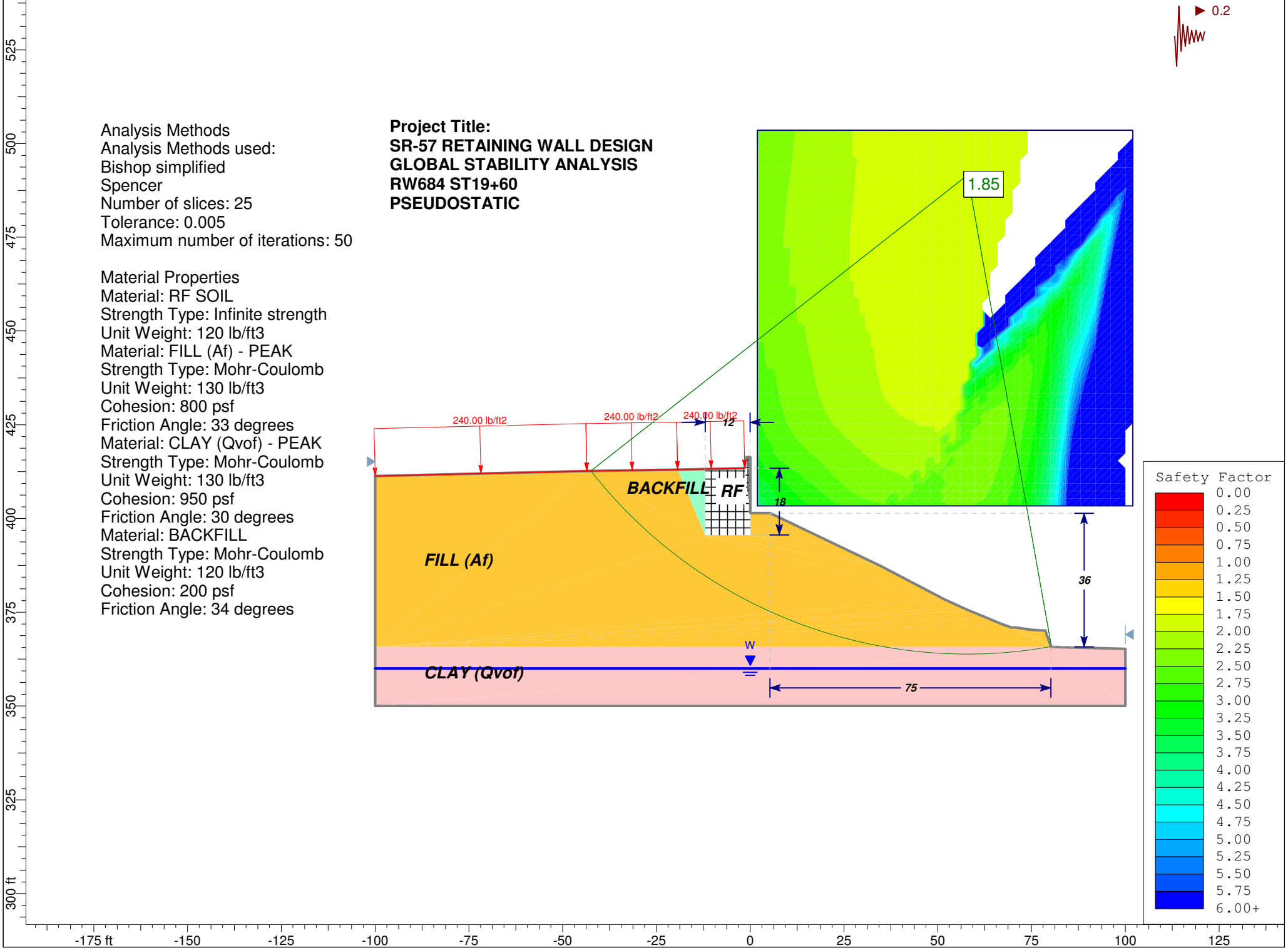
Distributed Load

-1.480	413.380
-12.000	413.185
-19.350	413.049
-43.570	412.640
-100.000	411.320

Analysis Methods
Analysis Methods used:
Bishop simplified
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees

Project Title:
SR-57 RETAINING WALL DESIGN
GLOBAL STABILITY ANALYSIS
RW684 ST19+60
PSEUDOSTATIC



Slide Analysis Information

Document Name

File Name: RW684_ST19+60_PSEUDOSTATIC.sli

Project Settings

Project Title: SR-57 RETAINING WALL DEGISN - GLOBAL STABILITY ANALYSIS - RW684 ST19+60 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2

Material Properties

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.854590
Center: 57.951, 491.557
Radius: 127.766
Left Slip Surface Endpoint: -42.543, 412.657
Right Slip Surface Endpoint: 80.336, 365.767
Resisting Moment=3.71881e+007 lb-ft
Driving Moment=2.00519e+007 lb-ft

Method: spencer
FS: 1.844550
Center: 55.949, 487.549
Radius: 124.458
Left Slip Surface Endpoint: -43.443, 412.642
Right Slip Surface Endpoint: 81.478, 365.738
Resisting Moment=3.76087e+007 lb-ft
Driving Moment=2.03891e+007 lb-ft
Resisting Horizontal Force=274824 lb
Driving Horizontal Force=148993 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 15340
Number of Invalid Surfaces: 13271
Error Codes:
Error Code -99 reported for 5815 surfaces
Error Code -100 reported for 5 surfaces
Error Code -103 reported for 2116 surfaces
Error Code -106 reported for 295 surfaces
Error Code -109 reported for 4927 surfaces

Error Code -113 reported for 3 surfaces
Error Code -1000 reported for 110 surfaces

Method: spencer
Number of Valid Surfaces: 15079
Number of Invalid Surfaces: 13532
Error Codes:
Error Code -99 reported for 5815 surfaces
Error Code -100 reported for 5 surfaces
Error Code -103 reported for 2116 surfaces
Error Code -106 reported for 295 surfaces
Error Code -108 reported for 55 surfaces
Error Code -109 reported for 4927 surfaces
Error Code -111 reported for 206 surfaces
Error Code -113 reported for 3 surfaces
Error Code -1000 reported for 110 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-100 = Both surface / slope intersections are on the same horizontal surface. In general, this will give a very high or infinite factor of safety (zero driving force), if calculated.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-113 = Surface intersects outside slope limits.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

1.881	403.382
102.006	403.382
102.006	503.581
1.881	503.581

Material Boundary

-100.000	365.770
80.230	365.770

Material Boundary

-12.000	413.185
-12.000	395.500
0.000	395.500
0.000	401.440

Material Boundary

-19.350	413.049
-12.000	395.500

External Boundary

-100.000	411.320
-100.000	365.770
-100.000	350.000
100.000	350.000
100.000	365.260
80.230	365.770
78.900	369.510
78.650	370.140
77.860	370.160
74.500	370.380
70.820	370.970
69.580	370.970
67.040	371.870
62.950	373.570
58.270	375.510
56.440	376.280
51.610	378.560
34.800	387.320
22.798	393.066
5.306	401.440
0.000	401.440
0.000	416.380

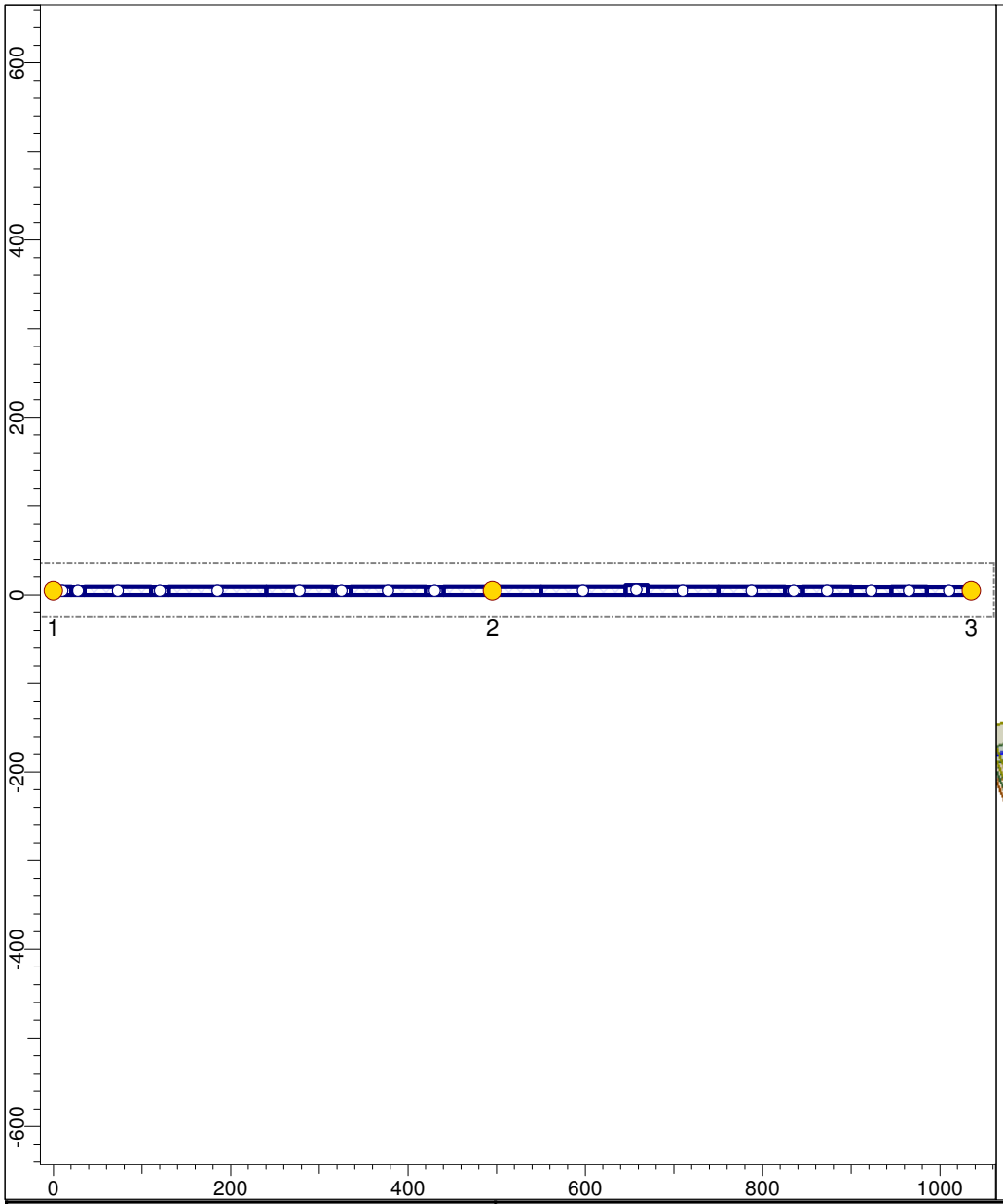
-1.000	416.380
-1.480	413.380
-12.000	413.185
-19.350	413.049
-43.570	412.640

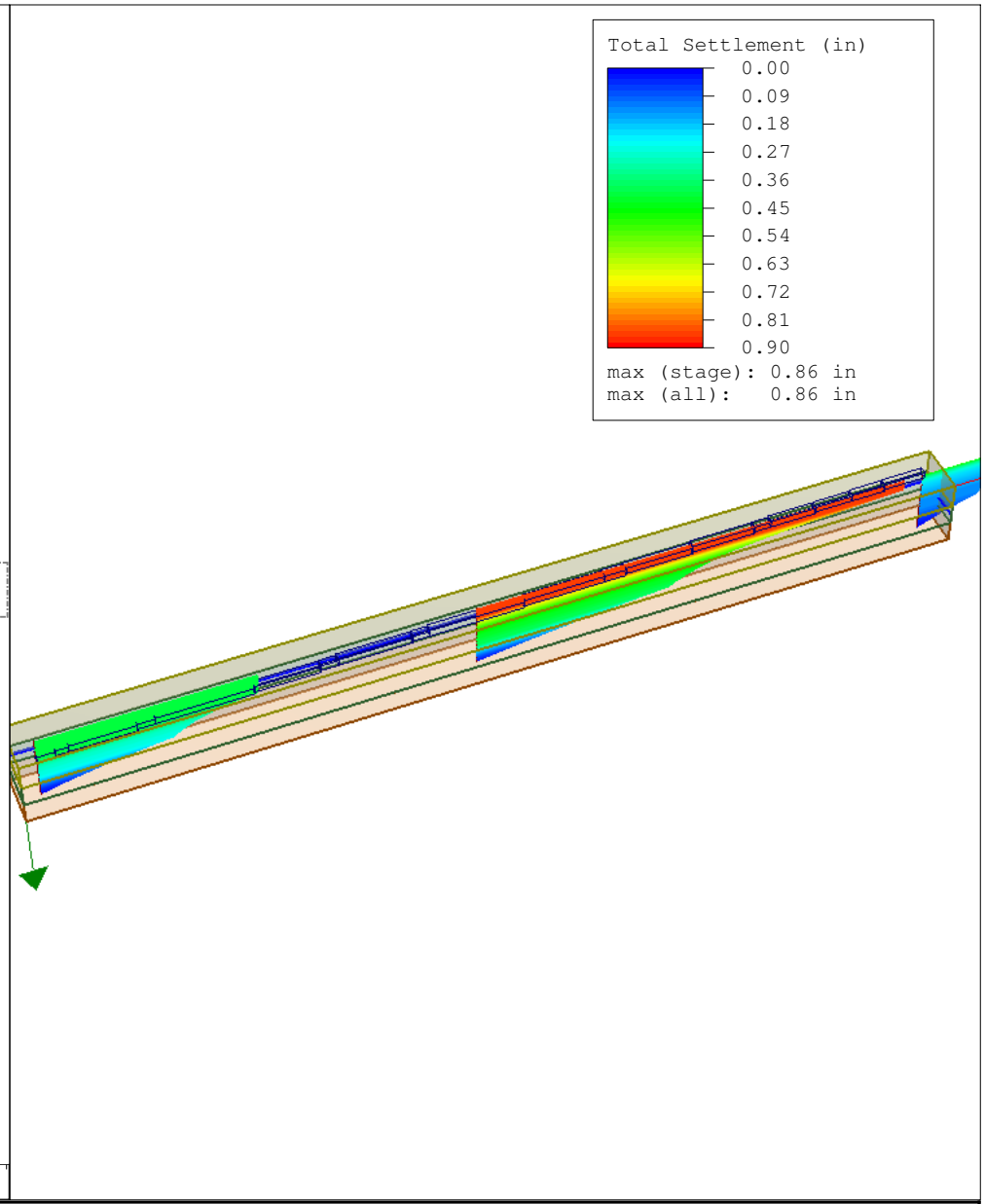
Water Table

-100.000	360.000
100.000	360.000

Distributed Load

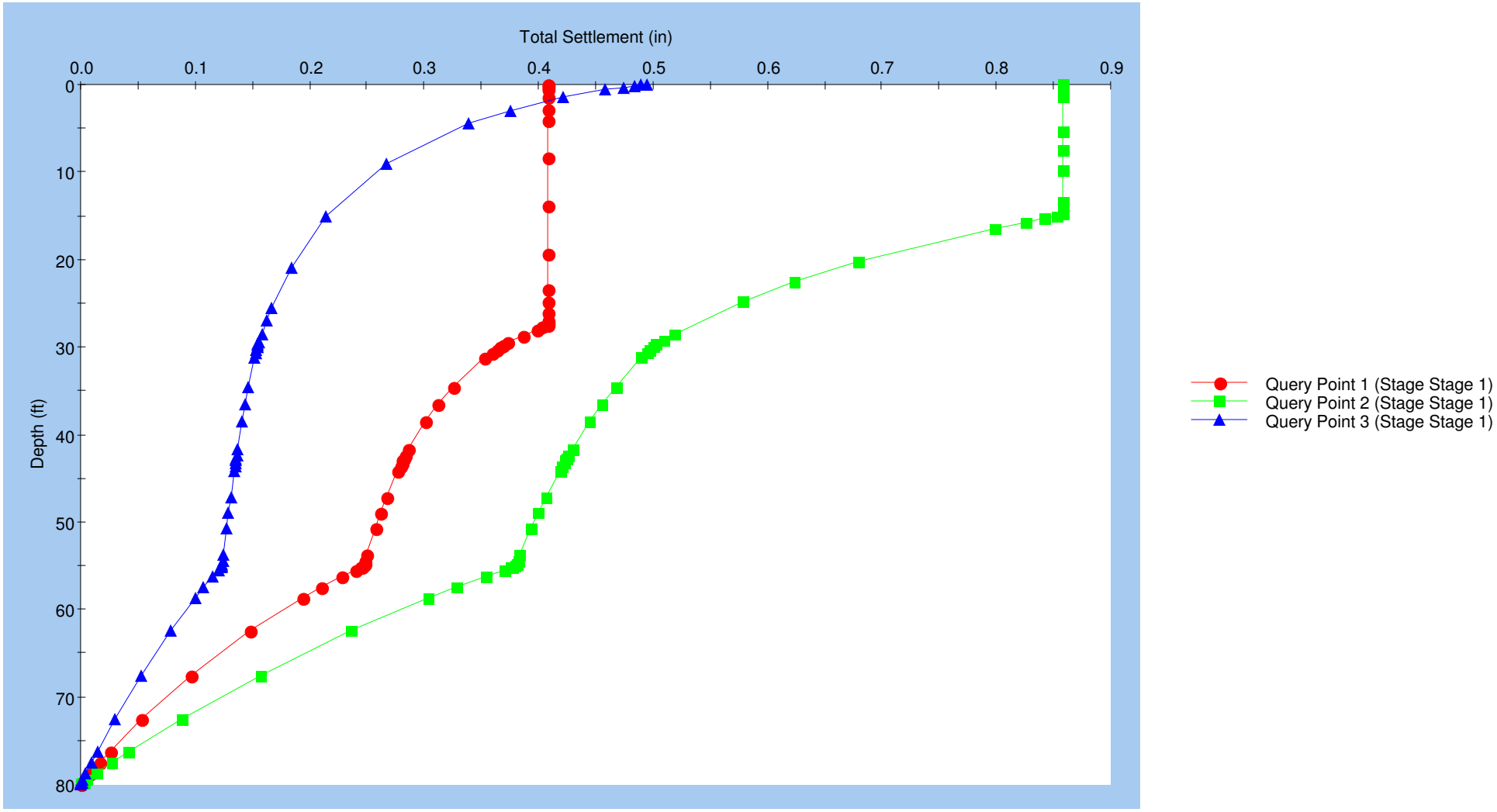
-1.480	413.380
-12.000	413.185
-19.350	413.049
-43.570	412.640
-100.000	411.320





rocscience SETTLE3D 1.011	*Project*	SR-57 SETTLEMENT ANALYSIS	
	Analysis Description	RW684	
	Drawn By RB	*Company*	CH2M HILL
	Date 1/5/2009, 11:18:11 AM	*File Name*	RW684_ST14+40.s3z

Total Settlement vs. Depth



Reference Stage: None

rocscience	*Project*	SR-57 SETTLEMENT ANALYSIS	
	Analysis Description	RW684	
	Drawn By RB	*Company*	CH2M HILL
SETTLE3D 1.011	*Date* 1/5/2009, 11:18:11 AM	*File Name*	RW684_ST14+40.s3z

Settle3D Analysis Information

Project Settings

Project Title: SR-57 SETTLEMENT ANALYSIS
Analysis: RW684
Author: RB
Company: CH2M HILL
Date Created: 1/5/2009, 11:18:11 AM
Stress Computation Method: Boussinesq
Groundwater method: Water Table
Water Unit Weight: 0.0624 kips/ft^3
Depth to water table: 43 [ft]

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.858636
Consolidation Settlement [in]	0	0.506508
Immediate Settlement [in]	0	0.352128
Loading Stress [ksf]	0	3.08521
Effective Stress [ksf]	0	8.13429
Total Stress [ksf]	0	10.4431
Total Strain	0	0.00717981
Pore Water Pressure [ksf]	0	2.3088
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 50.39 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.6036 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
985.2	-3.55271e-015
1035.59	-3.55271e-015
1035.59	8.62
985.2	8.62

Rectangular Load

Length: 40 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
945.2	1.5099e-014
985.2	1.5099e-014
985.2	9.1
945.2	9.1

Rectangular Load

Length: 45 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.6036 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
900.2	-3.55271e-015
945.2	-3.55271e-015
945.2	8.62
900.2	8.62

Rectangular Load

Length: 55 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
845.2	-6.21725e-015
900.2	-6.21725e-015
900.2	9.1
845.2	9.1

Rectangular Load

Length: 75 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 7.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
750.2	-3.55271e-015
825.2	-3.55271e-015
825.2	9.1
750.2	9.1

Rectangular Load

Length: 20 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.6036 ksf
Depth: 5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
825.2	-3.55271e-015
845.2	-3.55271e-015
845.2	8.62
825.2	8.62

Rectangular Load

Length: 80 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 10 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
670.2	-5.32907e-015
750.2	-5.32907e-015
750.2	9.1
670.2	9.1

Rectangular Load

Length: 25 ft
Width: 10.72 ft
Rotation angle: 0 degrees
Load: 3.0716 ksf
Depth: 12.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
645.2	-5.32907e-015
670.2	-5.32907e-015
670.2	10.72
645.2	10.72

Rectangular Load

Length: 95 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 12.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
550.2	-5.32907e-015
645.2	-5.32907e-015
645.2	9.1
550.2	9.1

Rectangular Load

Length: 110 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 15 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
440.2	-5.32907e-015
550.2	-5.32907e-015
550.2	9.1
440.2	9.1

Rectangular Load

Length: 20 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.6036 ksf

Depth: 15 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
420.2	-5.32907e-015
440.2	-5.32907e-015
440.2	8.62
420.2	8.62

Rectangular Load

Length: 85 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 17.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
335.2	-5.32907e-015
420.2	-5.32907e-015
420.2	9.1
335.2	9.1

Rectangular Load

Length: 20 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.6036 ksf
Depth: 17.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
315.2	-2.66454e-015
335.2	-2.66454e-015
335.2	8.62
315.2	8.62

Rectangular Load

Length: 75 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 20 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
240.2	-2.66454e-015
315.2	-2.66454e-015
315.2	9.1
240.2	9.1

Rectangular Load

Length: 110 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 22.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
130.2	-2.66454e-015
240.2	-2.66454e-015
240.2	9.1
130.2	9.1

Rectangular Load

Length: 20 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.6036 ksf
Depth: 22.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
110.2	0
130.2	0
130.2	8.62
110.2	8.62

Rectangular Load

Length: 75 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 25 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
35.2	0

110.2	0
110.2	9.1
35.2	9.1

Rectangular Load

Length: 15 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.6036 ksf
Depth: 25 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
20.2	0
35.2	0
35.2	8.62
20.2	8.62

Rectangular Load

Length: 20 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.0852 ksf
Depth: 27.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
0.2	0
20.2	0
20.2	9.1
0.2	9.1

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	FILL (Af)	30	0
2	SAND	25	30
3	CLAY	25	55

Soil Properties

FILL (Af)	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13

Immediate Settlement	Enabled
Es [ksf]	1500
Eur [ksf]	1500
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.025
Cre	0.0025
Pc [ksf]	10.5

SAND	
Unit Weight [kips/ft^3]	0.12
Saturated Unit Weight [kips/ft^3]	0.12
Immediate Settlement	Enabled
Es [ksf]	2000
Eur [ksf]	2000
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.01
Cre	0.001
OCR	2

CLAY	
Unit Weight [kips/ft^3]	0.13
Saturated Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.06
Cre	0.006
OCR	1

Query Points

String #	(X,Y) Location	Number of Divisions
1	0.2, 4.55	63
2	495.2, 4.55	59
3	1035.59, 4.31	57

Grid

Number of points: 292
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
1060.79	35.915
1060.79	-25.195
-24.995	-25.195
-24.995	35.915

Retaining Wall RW 698

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW698
Client: OCTA
Designer: RB
Station Number: 10+00

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92706
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....es\RW698STA10+00.BEN

Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	47.0 °
Equivalent cohesion, $c_{equiv.}$	250.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 0.00 N γ= 32.76

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

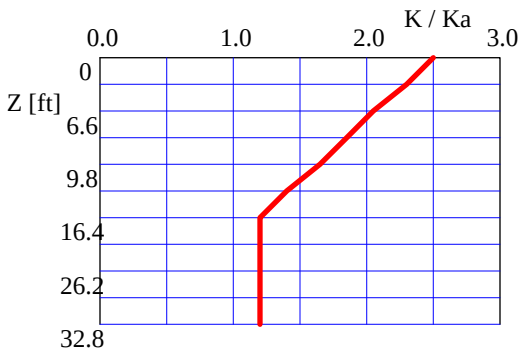
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

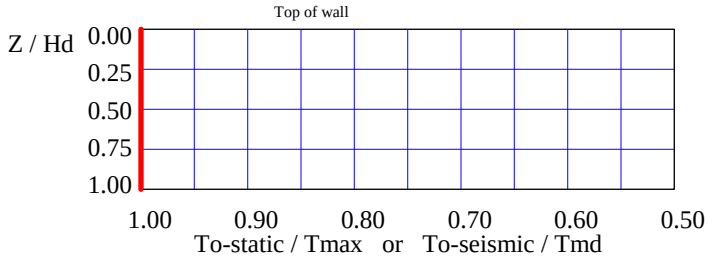


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

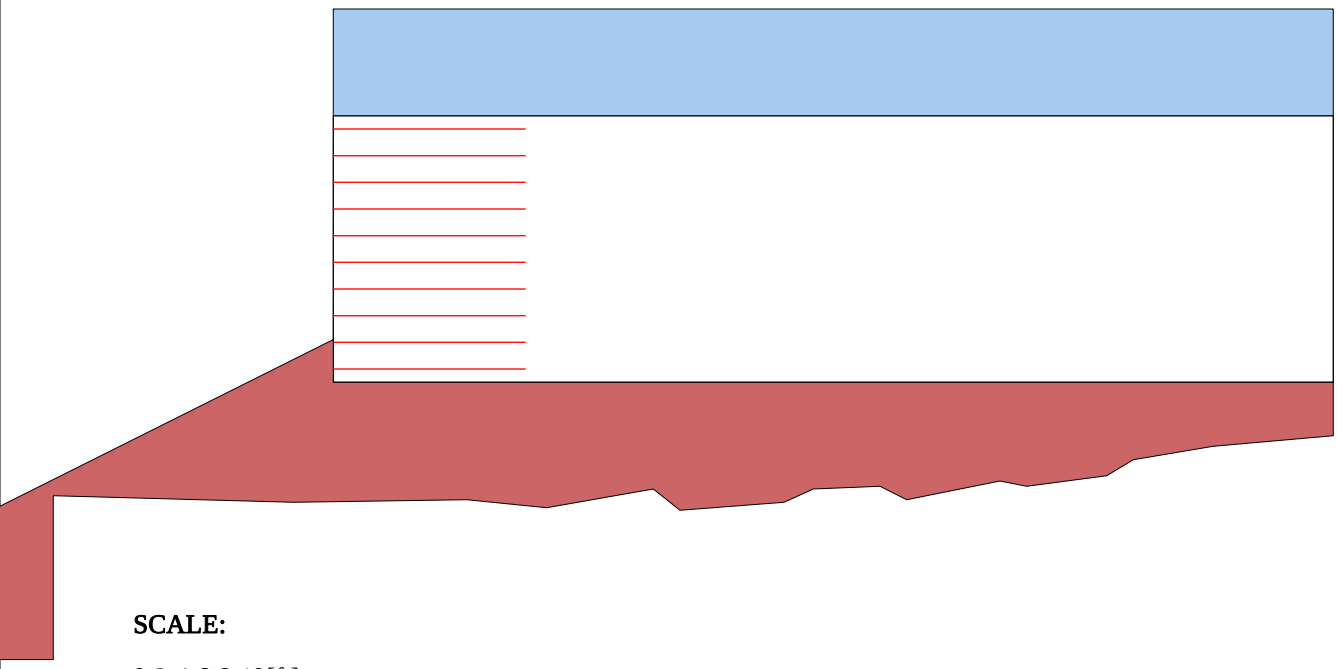
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	25.00	[ft]	{ Embedded depth is E = 4.00 ft, and height above top of finished bottom grade is H = 21.00 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10[ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 7.41, Meyerhof stress = 4095 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.199, Eccentricity, e/L = 0.1044, Fs-overturning = 4.79

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	18.00	1	N/A	6.25	6.95	6.950	25.342	3.356	0.0948	Caltrans W20
2	3.75	18.00	1	N/A	6.93	7.70	7.697	23.138	3.722	0.0770	Caltrans W20
3	6.25	18.00	1	N/A	7.38	8.20	8.197	20.842	4.178	0.0610	Caltrans W20
4	8.75	18.00	1	N/A	7.49	8.32	8.321	18.668	4.763	0.0468	Caltrans W20
5	11.25	18.00	1	N/A	7.72	8.57	8.573	16.231	5.543	0.0345	Caltrans W20
6	13.75	18.00	1	N/A	8.30	9.22	9.224	15.050	6.633	0.0240	Caltrans W20
7	16.25	18.00	1	N/A	9.42	10.47	10.471	15.093	8.276	0.0153	Caltrans W20
8	18.75	18.00	1	N/A	11.33	12.59	12.589	15.063	11.061	0.0084	Caltrans W20
9	21.25	18.00	1	N/A	15.01	16.68	16.681	14.960	16.993	0.0035	Caltrans W20
10	23.75	18.00	1	N/A	24.83	27.59	27.594	14.970	42.536	0.0005	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

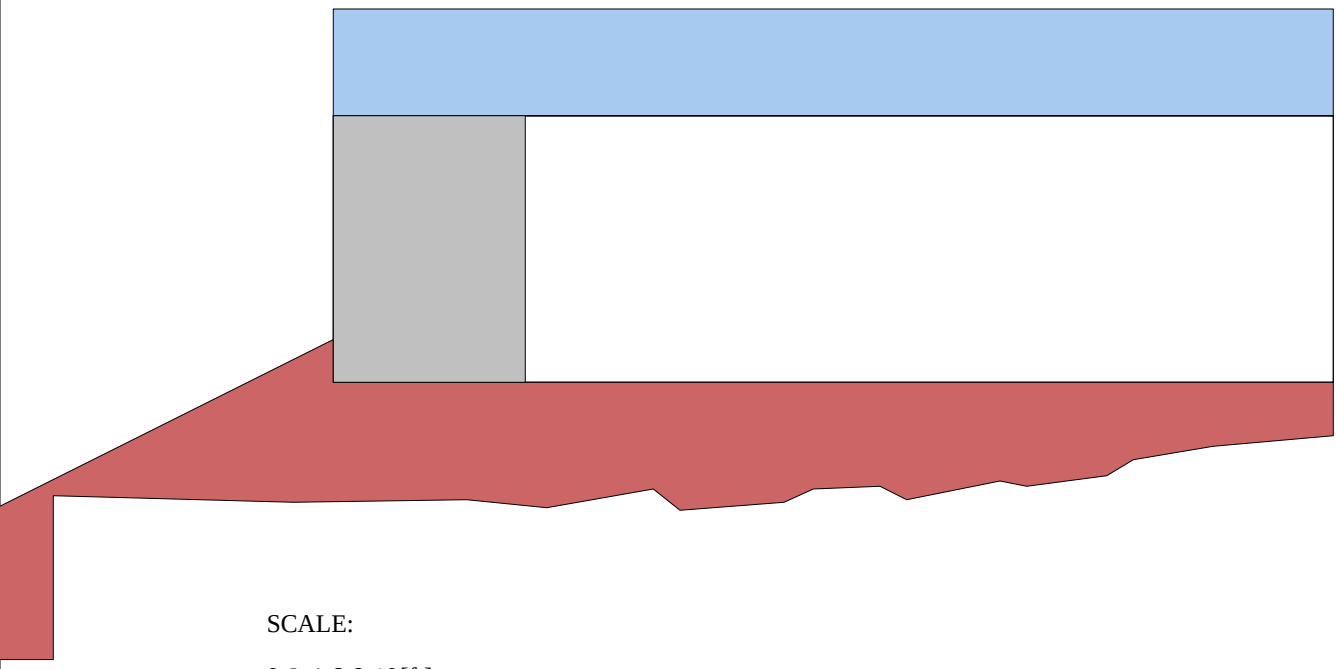
Bearing capacity, Fs = 2.70, Meyerhof stress = 6776 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.585, Eccentricity, e/L = 0.2609, Fs-overturning = 1.92

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	18.00	1	N/A	5.11	5.68	5.676	16.558	1.669	0.2355	Caltrans W20
2	3.75	18.00	1	N/A	5.65	6.27	6.273	15.087	1.867	0.1886	Caltrans W20
3	6.25	18.00	1	N/A	6.05	6.73	6.726	13.682	2.117	0.1469	Caltrans W20
4	8.75	18.00	1	N/A	6.25	6.94	6.942	12.460	2.446	0.1104	Caltrans W20
5	11.25	18.00	1	N/A	6.54	7.26	7.262	10.999	2.895	0.0791	Caltrans W20
6	13.75	18.00	1	N/A	7.03	7.81	7.808	10.192	3.545	0.0530	Caltrans W20
7	16.25	18.00	1	N/A	7.82	8.68	8.684	10.014	4.572	0.0321	Caltrans W20
8	18.75	18.00	1	N/A	9.08	10.09	10.092	9.660	6.431	0.0164	Caltrans W20
9	21.25	18.00	1	N/A	11.31	12.56	12.562	9.013	10.814	0.0059	Caltrans W20
10	23.75	18.00	1	N/A	16.10	17.89	17.891	7.765	33.201	0.0007	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	30330	18328	[lb/ft ²]
Meyerhof stress, σ_V	4094.6	6776	[lb/ft ²]
Eccentricity, e	1.88	4.70	[ft]
Eccentricity, e/L	0.104	0.261	
Fs calculated	7.41	2.70	
Base length	18.00	18.00	[ft]



SCALE:

0 2 4 6 8 10[ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.199 and Fs-seismic = 1.585

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	18.00	3.356	1.669	1	Caltrans W20
2	3.75	18.00	3.722	1.867	1	Caltrans W20
3	6.25	18.00	4.178	2.117	1	Caltrans W20
4	8.75	18.00	4.763	2.446	1	Caltrans W20
5	11.25	18.00	5.543	2.895	1	Caltrans W20
6	13.75	18.00	6.633	3.545	1	Caltrans W20
7	16.25	18.00	8.276	4.572	1	Caltrans W20
8	18.75	18.00	11.061	6.431	1	Caltrans W20
9	21.25	18.00	16.993	10.814	1	Caltrans W20
10	23.75	18.00	42.536	33.201	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1044, e/L seismic = 0.2609; Overturning: Fs-static = 4.79, Fs-seismic = 1.92

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	18.00	0.0948	0.2355	1	Caltrans W20
2	3.75	18.00	0.0770	0.1886	1	Caltrans W20
3	6.25	18.00	0.0610	0.1469	1	Caltrans W20
4	8.75	18.00	0.0468	0.1104	1	Caltrans W20
5	11.25	18.00	0.0345	0.0791	1	Caltrans W20
6	13.75	18.00	0.0240	0.0530	1	Caltrans W20
7	16.25	18.00	0.0153	0.0321	1	Caltrans W20
8	18.75	18.00	0.0084	0.0164	1	Caltrans W20
9	21.25	18.00	0.0035	0.0059	1	Caltrans W20
10	23.75	18.00	0.0005	0.0007	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2620.77	588.07	N/A	6.950	N/A	5.676
2	3.75	1.000	0.500	18213	2366.32	536.93	N/A	7.697	N/A	6.273
3	6.25	1.000	0.500	18213	2222.03	485.79	N/A	8.197	N/A	6.726
4	8.75	1.000	0.500	18213	2188.91	434.66	N/A	8.321	N/A	6.942
5	11.25	1.000	0.500	18213	2124.39	383.52	N/A	8.573	N/A	7.262
6	13.75	1.000	0.500	18213	1974.51	357.95	N/A	9.224	N/A	7.808
7	16.25	1.000	0.500	18213	1739.39	357.95	N/A	10.471	N/A	8.684
8	18.75	1.000	0.500	18213	1446.71	357.95	N/A	12.589	N/A	10.092
9	21.25	1.000	0.500	18213	1091.87	357.95	N/A	16.681	N/A	12.562
10	23.75	1.000	0.500	18213	660.03	357.95	N/A	27.594	N/A	17.891

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2620.8	588.1	17.25	0.75	66415.0	N/A	25.342	53132.0	N/A	16.558
2	3.75	1.000	2366.3	536.9	15.75	2.25	54752.4	N/A	23.138	43801.9	N/A	15.087
3	6.25	1.000	2222.0	485.8	14.25	3.75	46311.3	N/A	20.842	37049.0	N/A	13.682
4	8.75	1.000	2188.9	434.7	12.75	5.25	40862.6	N/A	18.668	32690.1	N/A	12.460
5	11.25	1.000	2124.4	383.5	11.25	6.75	34480.8	N/A	16.231	27584.6	N/A	10.999
6	13.75	1.000	1974.5	358.0	10.50	7.50	29715.7	N/A	15.050	23772.5	N/A	10.192
7	16.25	1.000	1739.4	358.0	10.50	7.50	26252.3	N/A	15.093	21001.9	N/A	10.014
8	18.75	1.000	1446.7	358.0	10.50	7.50	21792.1	N/A	15.063	17433.6	N/A	9.660
9	21.25	1.000	1091.9	358.0	10.50	7.50	16334.9	N/A	14.960	13067.9	N/A	9.013
10	23.75	1.000	660.0	358.0	10.50	7.50	9880.8	N/A	14.970	7904.6	N/A	7.765

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2621	0.90	16392	18213	N/A	6.25	N/A	6.95	Caltrans W20
2	3.75	1.000	0.500	2366	0.90	16392	18213	N/A	6.93	N/A	7.70	Caltrans W20
3	6.25	1.000	0.500	2222	0.90	16392	18213	N/A	7.38	N/A	8.20	Caltrans W20
4	8.75	1.000	0.500	2189	0.90	16392	18213	N/A	7.49	N/A	8.32	Caltrans W20
5	11.25	1.000	0.500	2124	0.90	16392	18213	N/A	7.72	N/A	8.57	Caltrans W20
6	13.75	1.000	0.500	1975	0.90	16392	18213	N/A	8.30	N/A	9.22	Caltrans W20
7	16.25	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
8	18.75	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
9	21.25	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
10	23.75	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	3209	0.90	16392	18213	N/A	5.11	N/A	5.68	Caltrans W20
2	3.75	1.000	0.500	2903	0.90	16392	18213	N/A	5.65	N/A	6.27	Caltrans W20
3	6.25	1.000	0.500	2708	0.90	16392	18213	N/A	6.05	N/A	6.73	Caltrans W20
4	8.75	1.000	0.500	2624	0.90	16392	18213	N/A	6.25	N/A	6.94	Caltrans W20
5	11.25	1.000	0.500	2508	0.90	16392	18213	N/A	6.54	N/A	7.26	Caltrans W20
6	13.75	1.000	0.500	2332	0.90	16392	18213	N/A	7.03	N/A	7.81	Caltrans W20
7	16.25	1.000	0.500	2097	0.90	16392	18213	N/A	7.82	N/A	8.68	Caltrans W20
8	18.75	1.000	0.500	1805	0.90	16392	18213	N/A	9.08	N/A	10.09	Caltrans W20
9	21.25	1.000	0.500	1450	0.90	16392	18213	N/A	11.31	N/A	12.56	Caltrans W20
10	23.75	1.000	0.500	1018	0.90	16392	18213	N/A	16.10	N/A	17.89	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW698
Client: OCTA
Designer: RB
Station Number: 10+10

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92706
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....es\RW698STA10+10.BEN

Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	47.0 °
Equivalent cohesion, $c_{equiv.}$	250.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 0.00 N γ= 32.76

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

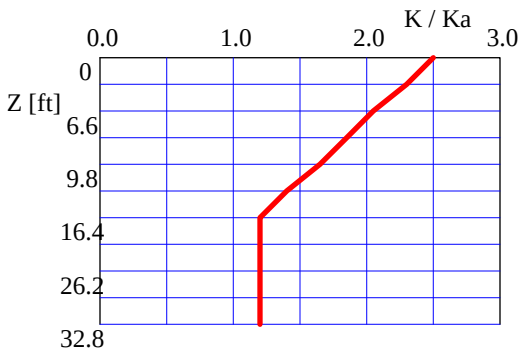
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

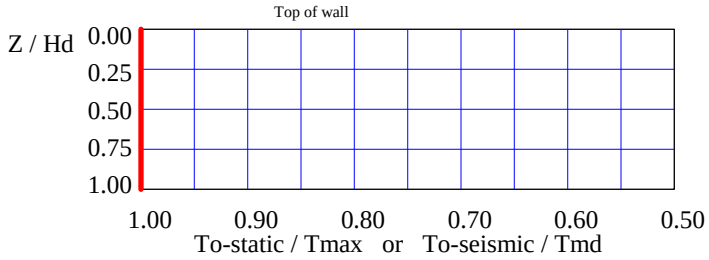


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

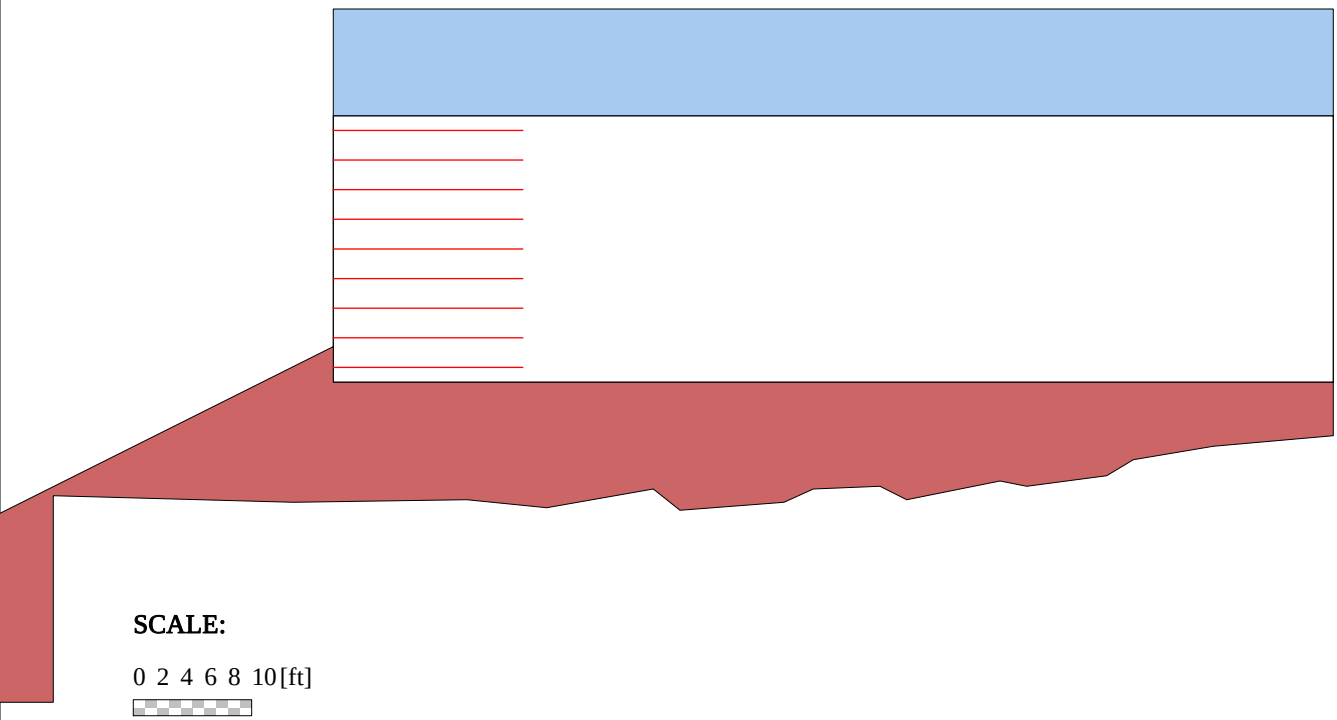
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	22.50	[ft]	{ Embedded depth is E = 3.00 ft, and height above top of finished bottom grade is H = 19.50 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 7.11, Meyerhof stress = 3754 lb/ft².
Foundation Interface: Direct sliding, Fs = 3.137, Eccentricity, e/L = 0.1084, Fs-overturning = 4.61

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	16.00	1	N/A	6.93	7.70	7.697	22.394	3.308	0.0974	Caltrans W20
2	3.75	16.00	1	N/A	7.38	8.20	8.197	20.105	3.714	0.0772	Caltrans W20
3	6.25	16.00	1	N/A	7.49	8.32	8.321	17.934	4.234	0.0593	Caltrans W20
4	8.75	16.00	1	N/A	7.72	8.57	8.573	15.501	4.927	0.0436	Caltrans W20
5	11.25	16.00	1	N/A	8.30	9.22	9.224	13.252	5.896	0.0303	Caltrans W20
6	13.75	16.00	1	N/A	9.42	10.47	10.471	13.290	7.357	0.0193	Caltrans W20
7	16.25	16.00	1	N/A	11.33	12.59	12.589	13.264	9.832	0.0107	Caltrans W20
8	18.75	16.00	1	N/A	15.01	16.68	16.681	13.174	15.105	0.0044	Caltrans W20
9	21.25	16.00	1	N/A	24.83	27.59	27.594	13.182	37.810	0.0006	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

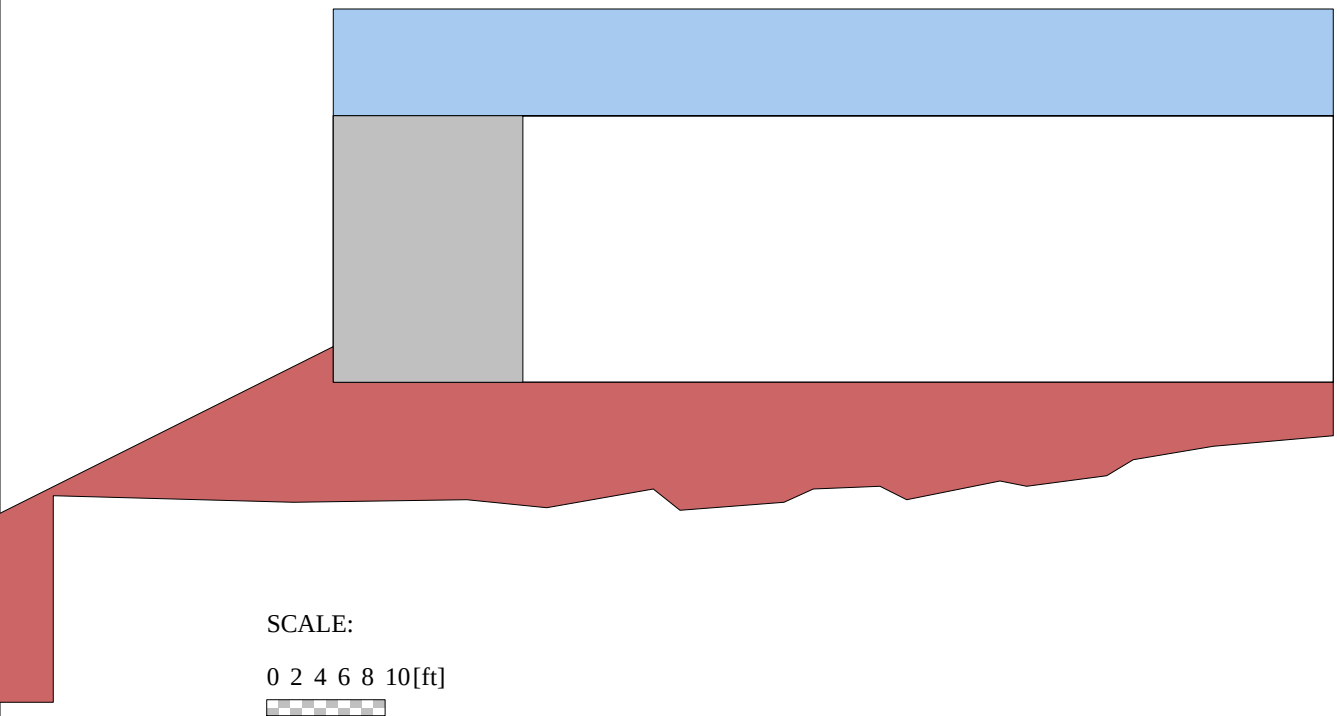
Bearing capacity, Fs = 2.50, Meyerhof stress = 6325 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.567, Eccentricity, e/L = 0.2676, Fs-overturning = 1.87

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	16.00	1	N/A	5.66	6.29	6.287	14.635	1.659	0.2387	Caltrans W20
2	3.75	16.00	1	N/A	6.07	6.74	6.745	13.235	1.882	0.1860	Caltrans W20
3	6.25	16.00	1	N/A	6.27	6.96	6.965	12.009	2.174	0.1398	Caltrans W20
4	8.75	16.00	1	N/A	6.56	7.29	7.290	10.545	2.573	0.1001	Caltrans W20
5	11.25	16.00	1	N/A	7.14	7.93	7.932	9.117	3.151	0.0671	Caltrans W20
6	13.75	16.00	1	N/A	7.95	8.84	8.837	8.973	4.064	0.0407	Caltrans W20
7	16.25	16.00	1	N/A	9.27	10.30	10.299	8.681	5.716	0.0208	Caltrans W20
8	18.75	16.00	1	N/A	11.60	12.88	12.884	8.141	9.613	0.0075	Caltrans W20
9	21.25	16.00	1	N/A	16.70	18.55	18.552	7.090	29.512	0.0008	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	26685	15838	[lb/ft ²]
Meyerhof stress, σ_V	3753.8	6325	[lb/ft ²]
Eccentricity, e	1.73	4.28	[ft]
Eccentricity, e/L	0.108	0.268	
Fs calculated	7.11	2.50	
Base length	16.00	16.00	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 3.137 and Fs-seismic = 1.567

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	16.00	3.308	1.659	1	Caltrans W20
2	3.75	16.00	3.714	1.882	1	Caltrans W20
3	6.25	16.00	4.234	2.174	1	Caltrans W20
4	8.75	16.00	4.927	2.573	1	Caltrans W20
5	11.25	16.00	5.896	3.151	1	Caltrans W20
6	13.75	16.00	7.357	4.064	1	Caltrans W20
7	16.25	16.00	9.832	5.716	1	Caltrans W20
8	18.75	16.00	15.105	9.613	1	Caltrans W20
9	21.25	16.00	37.810	29.512	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1084, e/L seismic = 0.2676; Overturning: Fs-static = 4.61, Fs-seismic = 1.87

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	16.00	0.0974	0.2387	1	Caltrans W20
2	3.75	16.00	0.0772	0.1860	1	Caltrans W20
3	6.25	16.00	0.0593	0.1398	1	Caltrans W20
4	8.75	16.00	0.0436	0.1001	1	Caltrans W20
5	11.25	16.00	0.0303	0.0671	1	Caltrans W20
6	13.75	16.00	0.0193	0.0407	1	Caltrans W20
7	16.25	16.00	0.0107	0.0208	1	Caltrans W20
8	18.75	16.00	0.0044	0.0075	1	Caltrans W20
9	21.25	16.00	0.0006	0.0008	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2366.32	530.40	N/A	7.697	N/A	6.287
2	3.75	1.000	0.500	18213	2222.03	478.23	N/A	8.197	N/A	6.745
3	6.25	1.000	0.500	18213	2188.91	426.06	N/A	8.321	N/A	6.965
4	8.75	1.000	0.500	18213	2124.39	373.89	N/A	8.573	N/A	7.290
5	11.25	1.000	0.500	18213	1974.51	321.72	N/A	9.224	N/A	7.932
6	13.75	1.000	0.500	18213	1739.39	321.72	N/A	10.471	N/A	8.837
7	16.25	1.000	0.500	18213	1446.71	321.72	N/A	12.589	N/A	10.299
8	18.75	1.000	0.500	18213	1091.87	321.72	N/A	16.681	N/A	12.884
9	21.25	1.000	0.500	18213	660.03	321.72	N/A	27.594	N/A	18.552

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2366.3	530.4	15.25	0.75	52992.5	N/A	22.394	42394.0	N/A	14.635
2	3.75	1.000	2222.0	478.2	13.75	2.25	44673.6	N/A	20.105	35738.9	N/A	13.235
3	6.25	1.000	2188.9	426.1	12.25	3.75	39255.1	N/A	17.934	31404.1	N/A	12.009
4	8.75	1.000	2124.4	373.9	10.75	5.25	32929.2	N/A	15.501	26343.3	N/A	10.545
5	11.25	1.000	1974.5	321.7	9.25	6.75	26167.0	N/A	13.252	20933.6	N/A	9.117
6	13.75	1.000	1739.4	321.7	9.25	6.75	23117.3	N/A	13.290	18493.8	N/A	8.973
7	16.25	1.000	1446.7	321.7	9.25	6.75	19189.7	N/A	13.264	15351.7	N/A	8.681
8	18.75	1.000	1091.9	321.7	9.25	6.75	14384.2	N/A	13.174	11507.3	N/A	8.141
9	21.25	1.000	660.0	321.7	9.25	6.75	8700.8	N/A	13.182	6960.6	N/A	7.090

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	1.000	0.500	2366	0.90	16392	18213	N/A	6.93	N/A	7.70	Caltrans W20
2	3.75	1.000	0.500	2222	0.90	16392	18213	N/A	7.38	N/A	8.20	Caltrans W20
3	6.25	1.000	0.500	2189	0.90	16392	18213	N/A	7.49	N/A	8.32	Caltrans W20
4	8.75	1.000	0.500	2124	0.90	16392	18213	N/A	7.72	N/A	8.57	Caltrans W20
5	11.25	1.000	0.500	1975	0.90	16392	18213	N/A	8.30	N/A	9.22	Caltrans W20
6	13.75	1.000	0.500	1739	0.90	16392	18213	N/A	9.42	N/A	10.47	Caltrans W20
7	16.25	1.000	0.500	1447	0.90	16392	18213	N/A	11.33	N/A	12.59	Caltrans W20
8	18.75	1.000	0.500	1092	0.90	16392	18213	N/A	15.01	N/A	16.68	Caltrans W20
9	21.25	1.000	0.500	660	0.90	16392	18213	N/A	24.83	N/A	27.59	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break Specified	Fs-overall connection break Actual	Fs-overall Metal Mats strength Specified	Fs-overall Metal Mats strength Actual	Product name
1	1.25	1.000	0.500	2897	0.90	16392	18213	N/A	5.66	N/A	6.29	Caltrans W20
2	3.75	1.000	0.500	2700	0.90	16392	18213	N/A	6.07	N/A	6.74	Caltrans W20
3	6.25	1.000	0.500	2615	0.90	16392	18213	N/A	6.27	N/A	6.96	Caltrans W20
4	8.75	1.000	0.500	2498	0.90	16392	18213	N/A	6.56	N/A	7.29	Caltrans W20
5	11.25	1.000	0.500	2296	0.90	16392	18213	N/A	7.14	N/A	7.93	Caltrans W20
6	13.75	1.000	0.500	2061	0.90	16392	18213	N/A	7.95	N/A	8.84	Caltrans W20
7	16.25	1.000	0.500	1768	0.90	16392	18213	N/A	9.27	N/A	10.30	Caltrans W20
8	18.75	1.000	0.500	1414	0.90	16392	18213	N/A	11.60	N/A	12.88	Caltrans W20
9	21.25	1.000	0.500	982	0.90	16392	18213	N/A	16.70	N/A	18.55	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

AASHTO DESIGN METHOD
SR-57 Improvements

PROJECT IDENTIFICATION

Title: SR-57 Improvements
Project Number: RW698
Client: OCTA
Designer: Kaustav Bose
Station Number: 11+10

Description:

Company's information:

Name: CH2M HILL
Street: 6 Hutton Center Drive
#700
Santa Ana, CA 92706
Telephone #:
Fax #:
E-Mail:

Original file path and name: \\cheron\Projects\OCTA\370900_SR57NBWideningPSE\Design\.....
.....SEWRW698STA11+10.BEN

Original date and time of creating this file: Thu Jan 08 09:08:00 2009

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using METAL MATS/GRIDS as reinforcing material.

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

SOIL DATA

REINFORCED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

RETAINED SOIL

Unit weight, γ	120.0 lb/ft ^{3}
Design value of internal angle of friction, ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight, $\gamma_{equiv.}$	130.0 lb/ft ^{3}
Equivalent internal angle of friction, $\phi_{equiv.}$	47.0 °
Equivalent cohesion, $c_{equiv.}$	250.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Ka (external stability) = 0.2827 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 0.00 N γ= 54.05

SEISMICITY

Maximum ground acceleration coefficient, A = 0.200
Design acceleration coefficient in Internal Stability: Kh = 0.250
Design acceleration coefficient in External Stability: Kh = 0.250

Kae (Kh > 0) = 0.4504 Kae (Kh = 0) = 0.2827 Δ Kae = 0.1677 (see eq. 37 in DEMO 82)
Seismic soil-metal mats friction coefficient, F* is 80.0% of its specified static value.

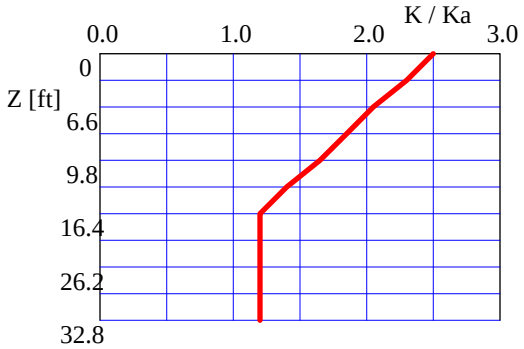
Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Metal mats/grids (Analysis)

D A T A	Metal mats type #1	Metal mats type #2	Metal mats type #3	Metal mats type #4	Metal mats type #5
Yield strength of steel, Fy [kips/in ²]	65.0	N/A	N/A	N/A	N/A
Gross width of grid, b [in]	6.0	N/A	N/A	N/A	N/A
Vertical spacing, Sv [ft]	Varies	N/A	N/A	N/A	N/A
Design cross section area, Ac [in ²]	0.14	N/A	N/A	N/A	N/A
Thickness of transverse element, t [in]	0.4	N/A	N/A	N/A	N/A
Distance between transverse bars, St [in]	6.0	N/A	N/A	N/A	N/A
Friction angle along reinforcement-soil interface,	ρ				
@ the top	51.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	34.00	N/A	N/A	N/A	N/A
Pullout resistance factor, F*					
@ the top	1.25	N/A	N/A	N/A	N/A
@ 19.7 ft or below	0.62	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.00	N/A	N/A	N/A	N/A

Variation of Lateral Earth Pressure Coefficient With Depth

Z	K / Ka
0 ft	2.50
3.3 ft	2.30
6.6 ft	2.05
9.8 ft	1.85
13.1 ft	1.65
16.4 ft	1.40
19.7 ft	1.20

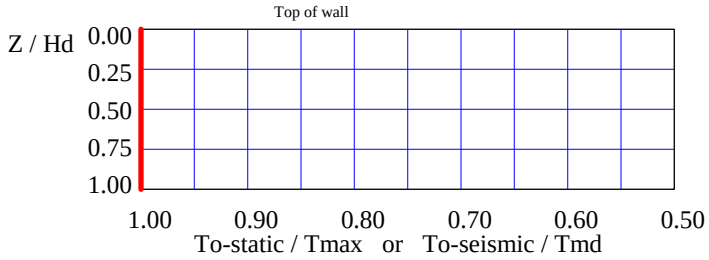


Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

INPUT DATA: Facia and Connection (Analysis)

FACIA type: Full height precast concrete panels.
Depth of panel is 0.50 ft. Horizontal distance to Center of Gravity of panel is 0.25 ft.
Average unit weight of panel is γ_f = 150.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Caltrans ..	N/A	N/A	N/A	N/A
Strength reduction at the connection, CRu = Fyc / Fy	0.90	N/A	N/A	N/A	N/A

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

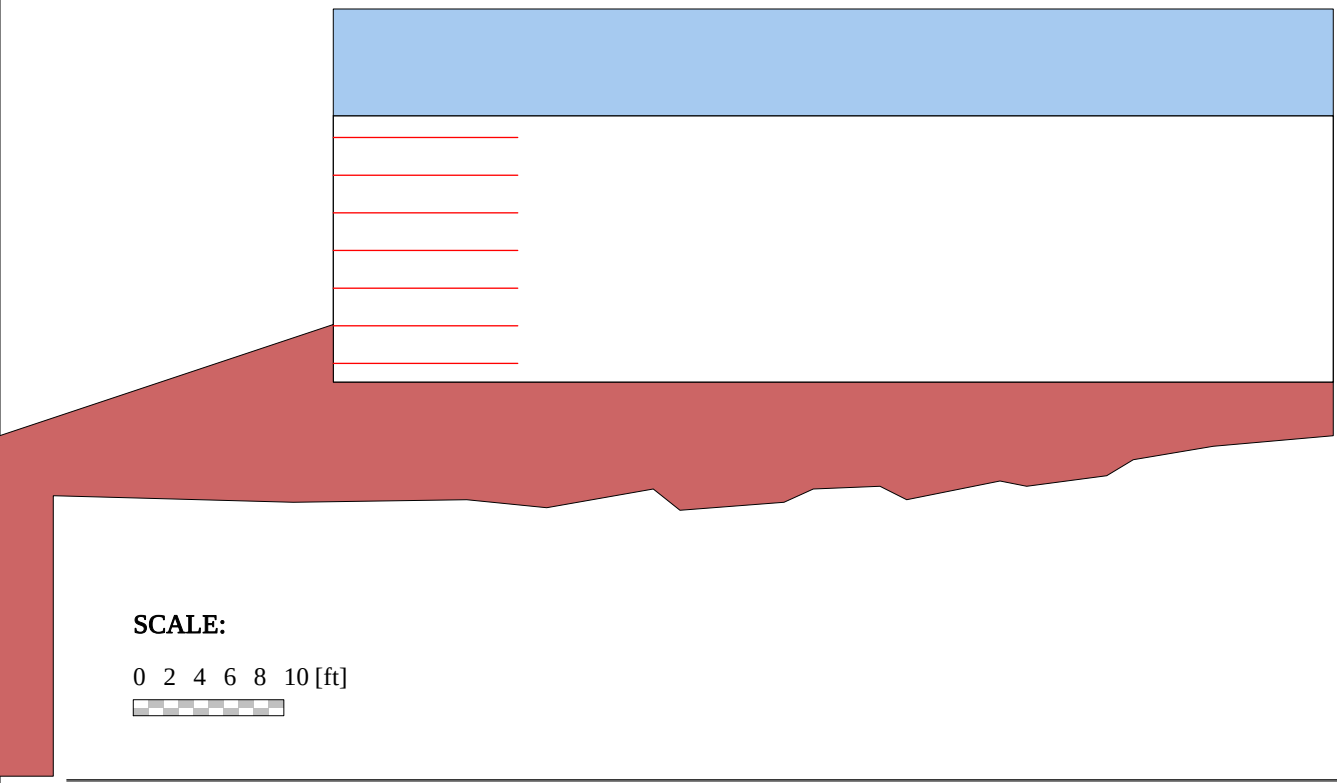
INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	17.71	[ft]	{ Embedded depth is E = 3.83 ft, and height above top of finished bottom grade is H = 13.88 ft }
Batter, ω	0.0	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

U N I F O R M S U R C H A R G E

Uniformly distributed dead load is 240.0 [lb/ft ²]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 8 10 [ft]

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 10.60, Meyerhof stress = 3100 lb/ft².
Foundation Interface: Direct sliding, Fs = 2.996, Eccentricity, e/L = 0.1185, Fs-overturning = 4.22

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	12.25	1	N/A	7.48	8.31	8.310	16.847	3.204	0.1035	Caltrans W20
2	3.75	12.25	1	N/A	7.68	8.54	8.538	14.433	3.721	0.0765	Caltrans W20
3	6.25	12.25	1	N/A	8.23	9.15	9.146	12.173	4.441	0.0535	Caltrans W20
4	8.75	12.25	1	N/A	9.30	10.34	10.339	10.053	5.517	0.0344	Caltrans W20
5	11.25	12.25	1	N/A	11.12	12.36	12.360	9.952	7.318	0.0193	Caltrans W20
6	13.75	12.25	1	N/A	14.58	16.19	16.195	9.884	11.052	0.0082	Caltrans W20
7	16.25	12.25	1	N/A	22.29	24.77	24.767	9.395	25.371	0.0014	Caltrans W20

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

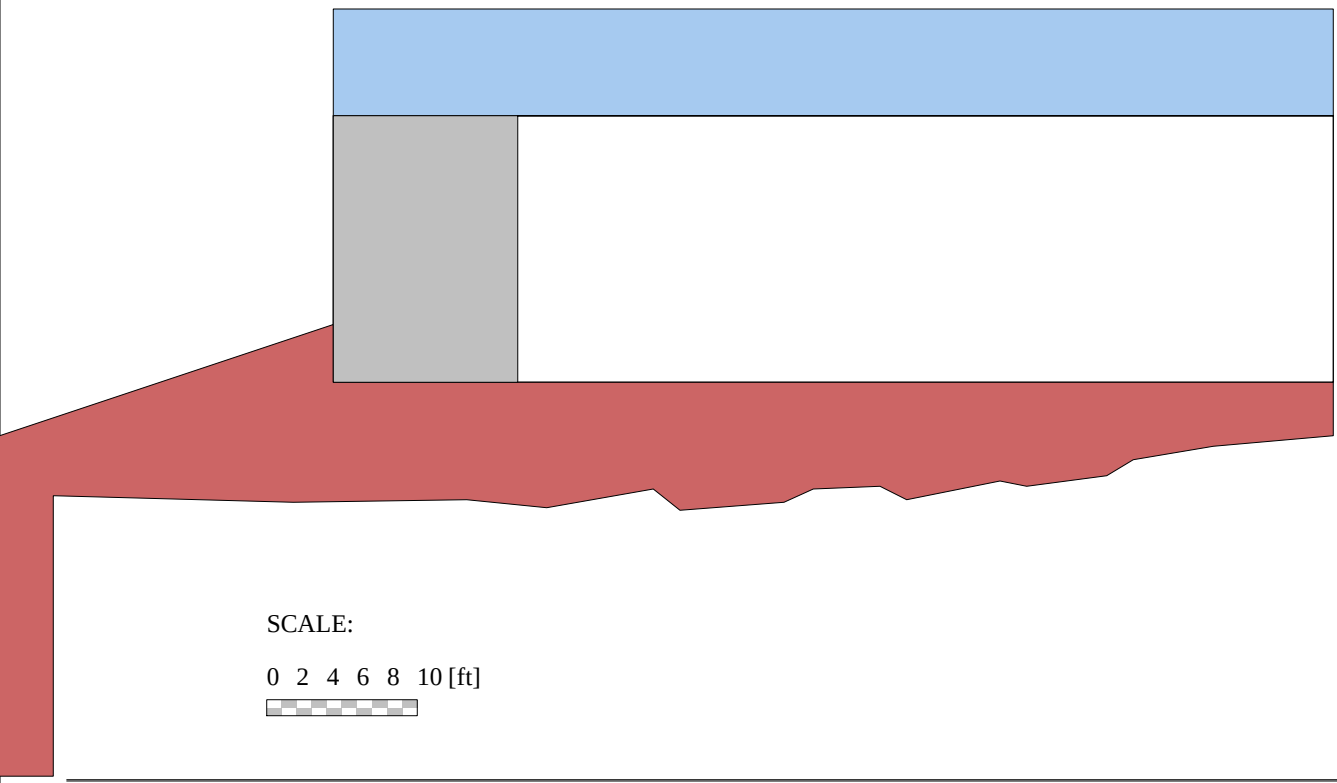
Bearing capacity, Fs = 3.43, Meyerhof stress = 5452 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.526, Eccentricity, e/L = 0.2831, Fs-overturning = 1.77

METAL MATS				CONNECTION							
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [pullout resistance]	Fs-overall [connection break]	Fs-overall [metal mats strength]	Metal mats strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.25	12.25	1	N/A	6.27	6.97	6.970	11.305	1.643	0.2446	Caltrans W20
2	3.75	12.25	1	N/A	6.56	7.29	7.287	9.855	1.940	0.1761	Caltrans W20
3	6.25	12.25	1	N/A	7.12	7.91	7.910	8.422	2.368	0.1188	Caltrans W20
4	8.75	12.25	1	N/A	8.12	9.03	9.025	7.021	3.037	0.0727	Caltrans W20
5	11.25	12.25	1	N/A	9.49	10.54	10.542	6.791	4.232	0.0379	Caltrans W20
6	13.75	12.25	1	N/A	11.89	13.21	13.210	6.450	6.962	0.0143	Caltrans W20
7	16.25	12.25	1	N/A	16.57	18.41	18.408	5.586	19.282	0.0020	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

BEARING CAPACITY for GIVEN LAYOUT

	STATIC	SEISMIC	UNITS
(Water table does not affect bearing capacity)			
Ultimate bearing capacity, q-ult	32843	18673	[lb/ft ²]
Meyerhof stress, σ_V	3099.6	5452	[lb/ft ²]
Eccentricity, e	1.45	3.47	[ft]
Eccentricity, e/L	0.118	0.283	
Fs calculated	10.60	3.43	
Base length	12.25	12.25	[ft]



Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

DIRECT SLIDING for GIVEN LAYOUT (for METAL MATS/GRIDS reinforcements)

Along reinforced and foundation soils interface: Fs-static = 2.996 and Fs-seismic = 1.526

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	Fs Static	Fs Seismic	Metal Mats Type #	Product name
1	1.25	12.25	3.204	1.643	1	Caltrans W20
2	3.75	12.25	3.721	1.940	1	Caltrans W20
3	6.25	12.25	4.441	2.368	1	Caltrans W20
4	8.75	12.25	5.517	3.037	1	Caltrans W20
5	11.25	12.25	7.318	4.232	1	Caltrans W20
6	13.75	12.25	11.052	6.962	1	Caltrans W20
7	16.25	12.25	25.371	19.282	1	Caltrans W20

ECCENTRICITY for GIVEN LAYOUT

At interface with foundation: e/L static = 0.1185, e/L seismic = 0.2831; Overturning: Fs-static = 4.22, Fs-seismic = 1.77

#	Metal Mats Elevation [ft]	Metal Mats Length [ft]	e / L Static	e / L Seismic	Metal Mats Type #	Product name
1	1.25	12.25	0.1035	0.2446	1	Caltrans W20
2	3.75	12.25	0.0765	0.1761	1	Caltrans W20
3	6.25	12.25	0.0535	0.1188	1	Caltrans W20
4	8.75	12.25	0.0344	0.0727	1	Caltrans W20
5	11.25	12.25	0.0193	0.0379	1	Caltrans W20
6	13.75	12.25	0.0082	0.0143	1	Caltrans W20
7	16.25	12.25	0.0014	0.0020	1	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for STRENGTH [Note: Actual Fs-overall = (Yield stress) / (Actual stress)]

#	Metal Mats Elevation [ft]	Coverage ratio, Rc=b/Sh	Horizontal spacing, Sh [ft]	Long-term strength Fy·Ac·Rc/b [lb/ft]	Tmax [lb/ft]	Tmd [lb/ft]	Specified minimum Fs-overall static	Actual calculated Fs-overall static	Specified minimum Fs-overall seismic	Actual calculated Fs-overall seismic
1	1.25	1.000	0.500	18213	2191.82	421.14	N/A	8.310	N/A	6.970
2	3.75	1.000	0.500	18213	2133.18	366.21	N/A	8.538	N/A	7.287
3	6.25	1.000	0.500	18213	1991.32	311.28	N/A	9.146	N/A	7.910
4	8.75	1.000	0.500	18213	1761.63	256.35	N/A	10.339	N/A	9.025
5	11.25	1.000	0.500	18213	1473.60	254.04	N/A	12.360	N/A	10.542
6	13.75	1.000	0.500	18213	1124.64	254.04	N/A	16.195	N/A	13.210
7	16.25	1.000	0.500	18213	735.37	254.04	N/A	24.767	N/A	18.408

RESULTS for PULLOUT

#	Metal Mats Elevation [ft]	Coverage Ratio Rc=b/Sh	Tmax [lb/ft]	Tmd [lb/ft]	Le [ft]	La [ft]	Avail.Static Pullout, Pr [lb/ft]	Specified Static Fs	Actual Static Fs	Avail.Seism. Pullout, Pr [lb/ft]	Specified Seismic Fs	Actual Seismic Fs
1	1.25	1.000	2191.8	421.1	11.50	0.75	36925.6	N/A	16.847	29540.4	N/A	11.305
2	3.75	1.000	2133.2	366.2	10.00	2.25	30788.5	N/A	14.433	24630.8	N/A	9.855
3	6.25	1.000	1991.3	311.3	8.50	3.75	24240.8	N/A	12.173	19392.6	N/A	8.422
4	8.75	1.000	1761.6	256.3	7.00	5.25	17709.5	N/A	10.053	14167.6	N/A	7.021
5	11.25	1.000	1473.6	254.0	6.94	5.31	14665.0	N/A	9.952	11732.0	N/A	6.791
6	13.75	1.000	1124.6	254.0	6.94	5.31	11116.2	N/A	9.884	8893.0	N/A	6.450
7	16.25	1.000	735.4	254.0	6.94	5.31	6909.0	N/A	9.395	5527.2	N/A	5.586

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

RESULTS for CONNECTION (static conditions)

#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2192	0.90	16392	18213	N/A	7.48	N/A	8.31	Caltrans W20
2	3.75	1.000	0.500	2133	0.90	16392	18213	N/A	7.68	N/A	8.54	Caltrans W20
3	6.25	1.000	0.500	1991	0.90	16392	18213	N/A	8.23	N/A	9.15	Caltrans W20
4	8.75	1.000	0.500	1762	0.90	16392	18213	N/A	9.30	N/A	10.34	Caltrans W20
5	11.25	1.000	0.500	1474	0.90	16392	18213	N/A	11.12	N/A	12.36	Caltrans W20
6	13.75	1.000	0.500	1125	0.90	16392	18213	N/A	14.58	N/A	16.19	Caltrans W20
7	16.25	1.000	0.500	735	0.90	16392	18213	N/A	22.29	N/A	24.77	Caltrans W20

RESULTS for CONNECTION (seismic conditions)

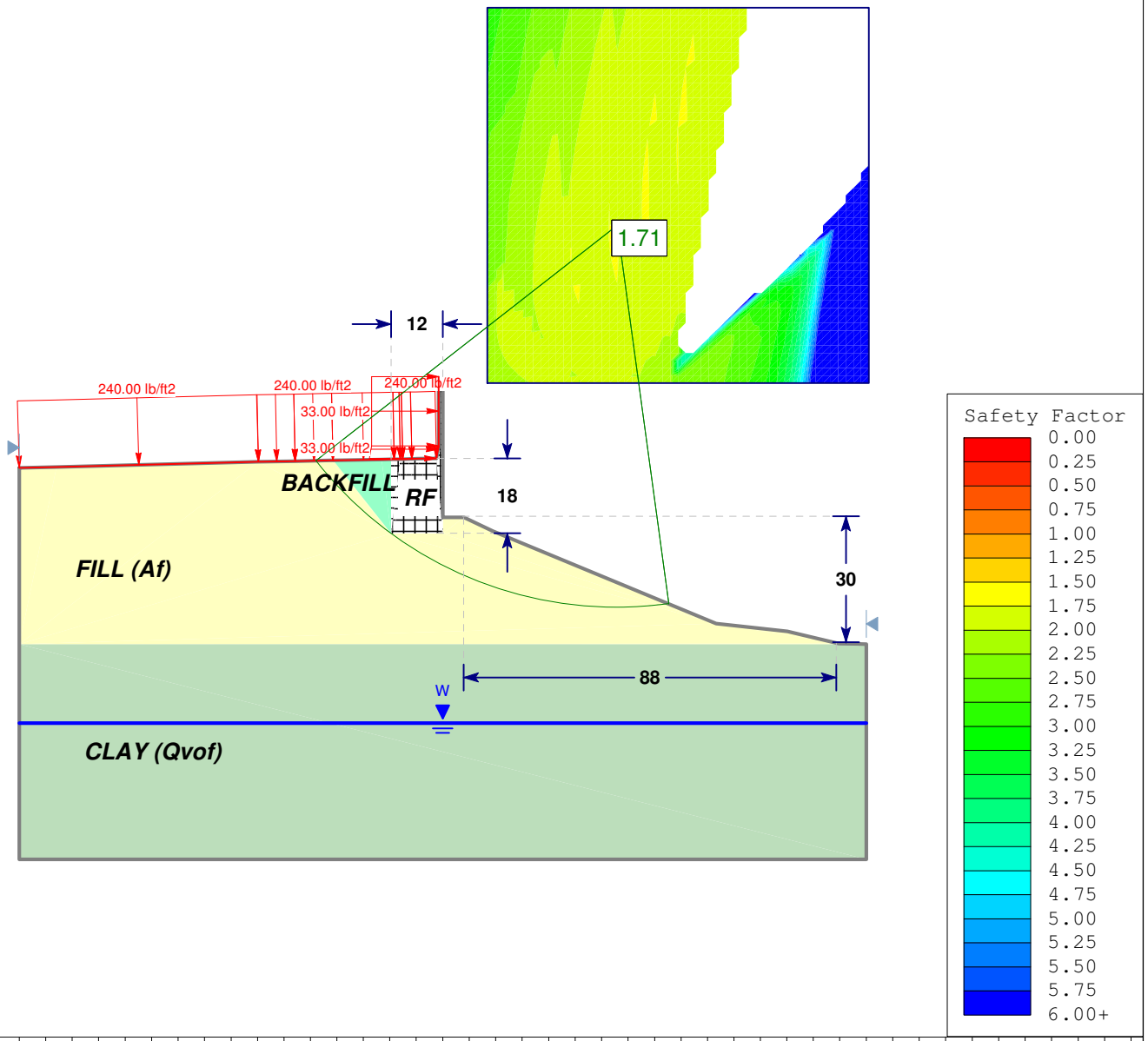
#	Metal Mats Elevation [ft]	Coverage ratio Rc=b/Sh	Horizontal spacing, Sh [ft]	Connection force, To [lb/ft]	Reduction factor for connection break, CRu	Long-term connection strength,Tac (break criterion) [lb/ft]	Metal Mats long-term strength, [lb/ft]	Fs-overall connection break		Fs-overall Metal Mats strength		Product name
								Specified	Actual	Specified	Actual	
1	1.25	1.000	0.500	2613	0.90	16392	18213	N/A	6.27	N/A	6.97	Caltrans W20
2	3.75	1.000	0.500	2499	0.90	16392	18213	N/A	6.56	N/A	7.29	Caltrans W20
3	6.25	1.000	0.500	2303	0.90	16392	18213	N/A	7.12	N/A	7.91	Caltrans W20
4	8.75	1.000	0.500	2018	0.90	16392	18213	N/A	8.12	N/A	9.03	Caltrans W20
5	11.25	1.000	0.500	1728	0.90	16392	18213	N/A	9.49	N/A	10.54	Caltrans W20
6	13.75	1.000	0.500	1379	0.90	16392	18213	N/A	11.89	N/A	13.21	Caltrans W20
7	16.25	1.000	0.500	989	0.90	16392	18213	N/A	16.57	N/A	18.41	Caltrans W20

Copyright © 1998-2008 ADAMA Engineering, Inc. License number MSEW-301754

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW698 ST11+10 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: Sta 11+10 - static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW698 ST11+10 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.710560
Center: 41.106, 477.499
Radius: 90.232
Left Slip Surface Endpoint: -29.990, 421.938
Right Slip Surface Endpoint: 53.333, 388.100
Resisting Moment=7.88351e+006 lb-ft
Driving Moment=4.60872e+006 lb-ft

Method: spencer
FS: 1.710710
Center: 41.106, 477.499
Radius: 90.232
Left Slip Surface Endpoint: -29.990, 421.938
Right Slip Surface Endpoint: 53.333, 388.100
Resisting Moment=7.88416e+006 lb-ft
Driving Moment=4.60872e+006 lb-ft
Resisting Horizontal Force=78217.4 lb
Driving Horizontal Force=45722.3 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 10498
Number of Invalid Surfaces: 18113
Error Codes:
Error Code -99 reported for 10605 surfaces
Error Code -106 reported for 168 surfaces
Error Code -109 reported for 7340 surfaces

Method: spencer
Number of Valid Surfaces: 10489
Number of Invalid Surfaces: 18122
Error Codes:
Error Code -99 reported for 10605 surfaces
Error Code -106 reported for 168 surfaces
Error Code -108 reported for 6 surfaces
Error Code -109 reported for 7340 surfaces
Error Code -111 reported for 3 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

List of All Coordinates

Search Grid

10.489	440.269
100.539	440.269
100.539	528.913
10.489	528.913

Material Boundary

-1.186	424.486
-1.030	425.460

Material Boundary

-12.250	404.750
-0.030	404.750
-0.030	425.460

Material Boundary

-7.753	422.350
-6.161	422.380

Material Boundary

-25.940	422.010
-25.931	421.999
-12.250	404.750

Material Boundary

-100.000	378.630
100.000	378.630

Material Boundary

-12.250	404.750
-12.250	422.266

External Boundary

-100.000	420.250
-100.000	378.630
-100.000	327.775
100.000	327.775
100.000	378.630
97.900	378.672
93.500	378.760
81.330	381.670
64.490	383.480
11.720	405.330
4.970	408.584
-0.020	408.584
-0.020	410.990
-0.020	414.960
-0.030	425.460
-0.030	441.790
-1.030	441.790
-1.030	425.460
-1.160	424.650
-1.186	424.486
-1.510	422.460
-6.161	422.380
-7.330	422.360
-7.753	422.350
-9.510	422.310
-10.050	422.300
-11.510	422.280
-12.250	422.266
-14.464	422.225
-25.931	422.010
-25.940	422.010
-26.555	421.999
-34.900	421.850
-43.580	421.680

-91.240	420.472

Water Table

-100.000	360.000
100.000	360.000

Distributed Load

-1.510	422.460
-6.161	422.380
-7.330	422.360
-7.753	422.350
-9.510	422.310
-10.050	422.300
-11.510	422.280
-14.464	422.225
-25.931	422.010
-25.940	422.010
-26.555	421.999
-34.900	421.850
-43.580	421.680
-91.240	420.472
-100.000	420.250

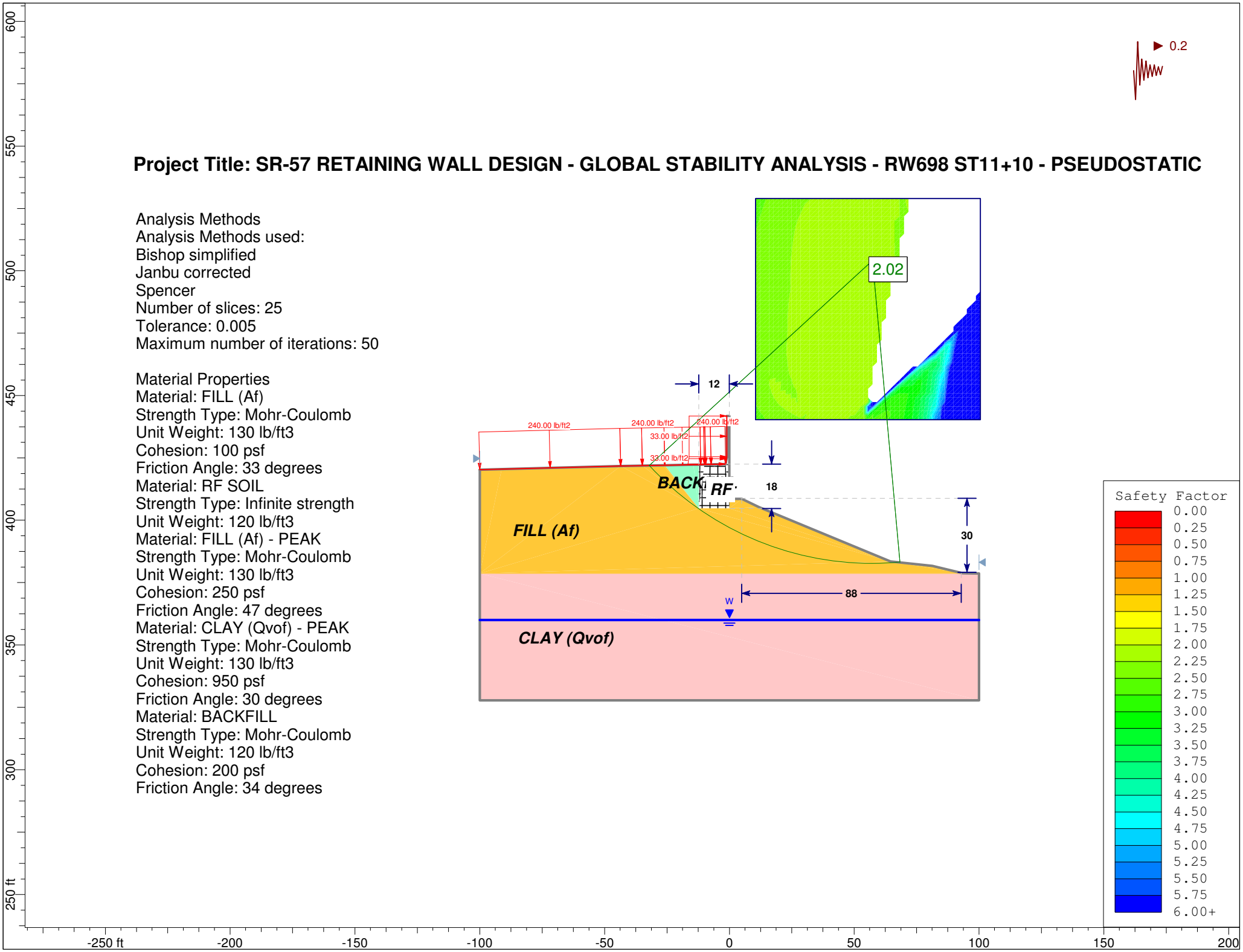
Distributed Load

-1.030	441.790
-1.030	425.460
-1.160	424.650
-1.186	424.486
-1.510	422.460

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW698 ST11+10 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 33 degrees
Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 250 psf
Friction Angle: 47 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: Sta 11+10 - pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW689 ST11+10 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Horizontal, Magnitude: 33 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: RF SOIL
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 250 psf
Friction Angle: 47 degrees
Water Surface: Water Table
Hu value: automatically calculated

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Hu value: automatically calculated

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.015010
Center: 57.315, 504.092
Radius: 121.520
Left Slip Surface Endpoint: -32.190, 421.898
Right Slip Surface Endpoint: 68.301, 383.070
Resisting Moment=2.05583e+007 lb-ft
Driving Moment=1.02026e+007 lb-ft

Method: spencer
FS: 2.025060
Center: 59.116, 516.503
Radius: 132.648
Left Slip Surface Endpoint: -33.835, 421.869
Right Slip Surface Endpoint: 63.417, 383.924
Resisting Moment=2.10906e+007 lb-ft
Driving Moment=1.04148e+007 lb-ft
Resisting Horizontal Force=145008 lb
Driving Horizontal Force=71606.9 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 10498
Number of Invalid Surfaces: 18113
Error Codes:
Error Code -99 reported for 10605 surfaces
Error Code -106 reported for 168 surfaces
Error Code -109 reported for 7340 surfaces

Method: spencer
Number of Valid Surfaces: 10281
Number of Invalid Surfaces: 18330
Error Codes:
Error Code -99 reported for 10605 surfaces
Error Code -106 reported for 168 surfaces
Error Code -108 reported for 5 surfaces
Error Code -109 reported for 7340 surfaces
Error Code -111 reported for 203 surfaces
Error Code -112 reported for 9 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

10.489	440.269
100.539	440.269
100.539	528.913
10.489	528.913

Material Boundary

-1.186	424.486
-1.030	425.460

Material Boundary

-12.250	404.750
-0.030	404.750
-0.030	425.460

Material Boundary

-7.753	422.350
-6.161	422.380

Material Boundary

-25.940	422.010
-25.931	421.999
-12.250	404.750

Material Boundary

-100.000	378.630
100.000	378.630

Material Boundary

-12.250	404.750
-12.250	422.266

External Boundary

-100.000	420.250
-100.000	378.630
-100.000	327.775
100.000	327.775
100.000	378.630
97.900	378.672
93.500	378.760
81.330	381.670
64.490	383.480
11.720	405.330
4.970	408.584
-0.020	408.584
-0.020	410.990
-0.020	414.960
-0.030	425.460
-0.030	441.790
-1.030	441.790
-1.030	425.460

-1.160	424.650
-1.186	424.486
-1.510	422.460
-6.161	422.380
-7.330	422.360
-7.753	422.350
-9.510	422.310
-10.050	422.300
-11.510	422.280
-12.250	422.266
-14.464	422.225
-25.931	422.010
-25.940	422.010
-26.555	421.999
-34.900	421.850
-43.580	421.680
-91.240	420.472

Water Table

-100.000	360.000
100.000	360.000

Distributed Load

-1.510	422.460
-6.161	422.380
-7.330	422.360
-7.753	422.350
-9.510	422.310
-10.050	422.300
-11.510	422.280
-14.464	422.225
-25.931	422.010
-25.940	422.010
-26.555	421.999
-34.900	421.850
-43.580	421.680
-91.240	420.472
-100.000	420.250

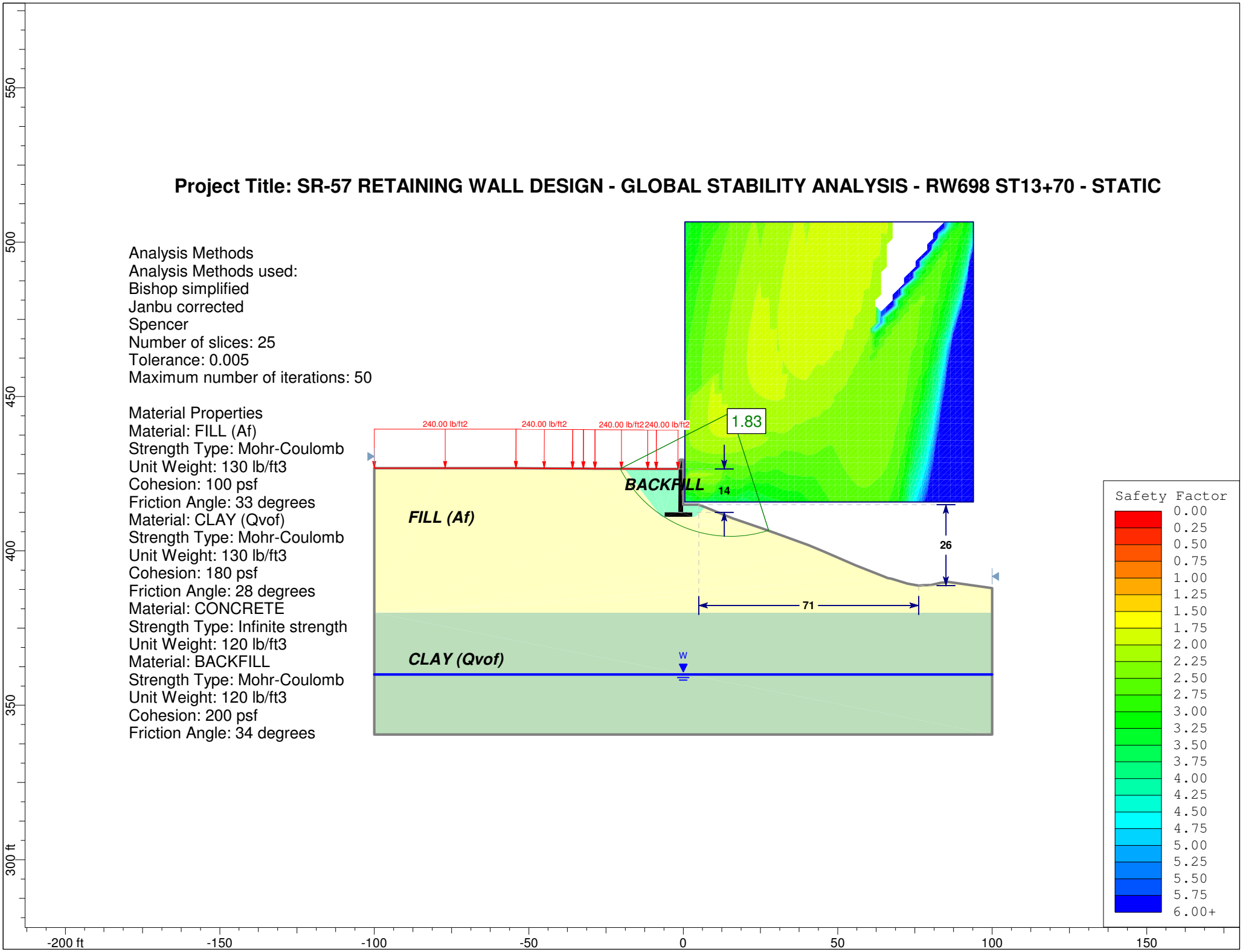
Distributed Load

-1.030	441.790
-1.030	425.460
-1.160	424.650
-1.186	424.486
-1.510	422.460

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW698 ST13+70 - STATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees



Slide Analysis Information

Document Name

File Name: Sta 13+70 - static.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW698 ST13+70 - STATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2

Material Properties

Material: FILL (Af)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof)
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 180 psf
Friction Angle: 28 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 1.826980
Center: 15.426, 444.867
Radius: 40.234
Left Slip Surface Endpoint: -20.420, 426.597
Right Slip Surface Endpoint: 27.634, 406.531
Resisting Moment=1.62875e+006 lb-ft
Driving Moment=891498 lb-ft

Method: janbu corrected
FS: 1.765230
Center: 17.294, 443.053
Radius: 39.802
Left Slip Surface Endpoint: -18.944, 426.590
Right Slip Surface Endpoint: 30.520, 405.513
Resisting Horizontal Force=38681.8 lb
Driving Horizontal Force=21913.2 lb

Method: spencer
FS: 1.825590
Center: 15.426, 444.867
Radius: 40.234
Left Slip Surface Endpoint: -20.420, 426.597
Right Slip Surface Endpoint: 27.634, 406.531
Resisting Moment=1.62751e+006 lb-ft
Driving Moment=891498 lb-ft
Resisting Horizontal Force=35352 lb
Driving Horizontal Force=19364.7 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 19910
Number of Invalid Surfaces: 8701
Error Codes:
Error Code -99 reported for 6565 surfaces
Error Code -102 reported for 1 surface
Error Code -103 reported for 206 surfaces
Error Code -105 reported for 9 surfaces
Error Code -106 reported for 142 surfaces
Error Code -107 reported for 234 surfaces
Error Code -109 reported for 1544 surfaces

Method: janbu corrected
Number of Valid Surfaces: 19878
Number of Invalid Surfaces: 8733
Error Codes:
Error Code -99 reported for 6565 surfaces
Error Code -102 reported for 1 surface
Error Code -103 reported for 206 surfaces
Error Code -105 reported for 9 surfaces
Error Code -106 reported for 142 surfaces
Error Code -107 reported for 234 surfaces
Error Code -108 reported for 31 surfaces
Error Code -109 reported for 1544 surfaces
Error Code -112 reported for 1 surface

Method: spencer
Number of Valid Surfaces: 19827
Number of Invalid Surfaces: 8784
Error Codes:
Error Code -99 reported for 6565 surfaces
Error Code -102 reported for 1 surface
Error Code -103 reported for 206 surfaces
Error Code -105 reported for 9 surfaces
Error Code -106 reported for 142 surfaces
Error Code -107 reported for 234 surfaces
Error Code -108 reported for 31 surfaces
Error Code -109 reported for 1544 surfaces
Error Code -111 reported for 51 surfaces
Error Code -112 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

0.479	415.840
93.896	415.840
93.896	506.551
0.479	506.551

Material Boundary

-2.310	426.520
-1.530	426.520

Material Boundary

-100.000	380.000
100.000	380.000

Material Boundary

-1.530	426.520
-1.627	412.500
-6.083	412.500
-6.083	411.000
2.917	411.000
2.917	412.500
-0.060	412.500
-0.060	414.990

Material Boundary

2.917	411.000
3.917	411.000
7.059	414.160

Material Boundary

-19.054	426.591
-7.083	411.000
-6.083	411.000

External Boundary

-99.700	426.800
-100.000	426.800
-100.000	380.000
-100.000	340.493
100.000	340.493
100.000	380.000
100.000	387.960
85.740	389.950
84.870	389.760
83.380	389.720
80.120	388.930
77.450	388.900
76.430	388.730
76.180	388.740
72.660	389.380
67.340	390.990
66.200	391.200
64.790	391.760
55.910	395.290
45.520	399.740
40.620	401.820
39.940	402.080
29.430	405.910
25.323	407.330
16.040	410.540
7.059	414.160
5.000	414.990
-0.060	414.990
-0.060	425.630
-0.060	426.520
-0.060	429.520
-0.520	429.520
-0.730	429.520
-0.950	429.520
-1.060	429.520
-1.390	427.450
-1.530	426.520
-8.740	426.560
-11.500	426.560
-19.054	426.591
-28.590	426.630
-32.360	426.640
-35.870	426.670
-54.170	426.800
-77.680	426.800
-78.120	426.800

Water Table

-100.000	360.000
100.000	360.000

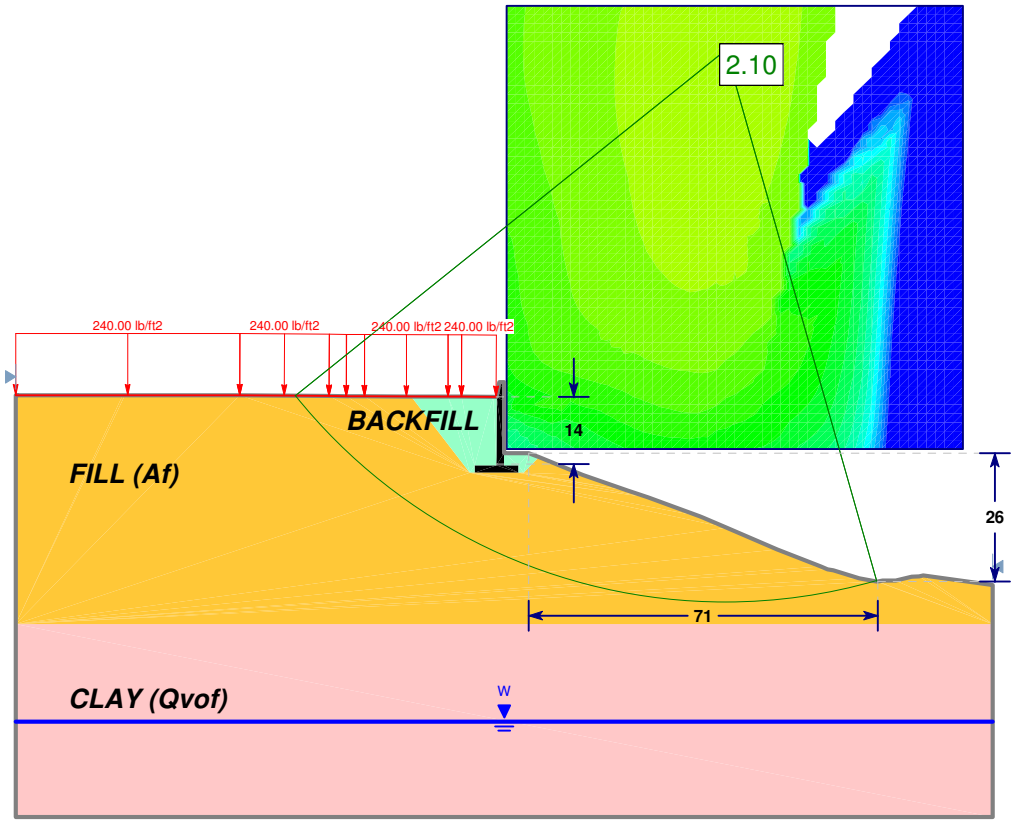
Distributed Load

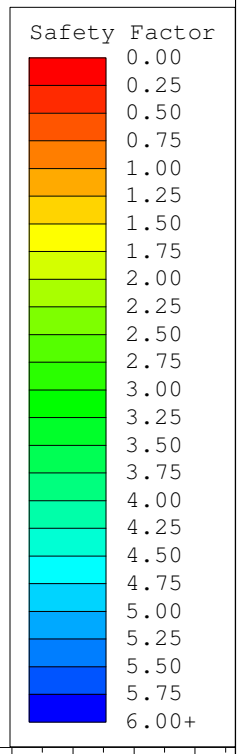
-1.716	426.521
-8.740	426.560
-11.500	426.560
-28.590	426.630
-32.360	426.640
-35.870	426.670
-54.170	426.800
-77.680	426.800
-78.120	426.800
-99.700	426.800
-100.000	426.800

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW698 ST13+70 - PSEUDOSTATIC

Analysis Methods
Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Material Properties
Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees





Slide Analysis Information

Document Name

File Name: Sta 13+70 - pseudostatic.sli

Project Settings

Project Title: SR-57 RETAINING WALL DESIGN - GLOBAL STABILITY ANALYSIS - RW698 ST13+70 - PSEUDOSTATIC
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.2
1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Normal to boundary, Magnitude: 240 lb/ft2

Material Properties

Material: CONCRETE
Strength Type: Infinite strength
Unit Weight: 120 lb/ft3

Material: FILL (Af) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 800 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: CLAY (Qvof) - PEAK
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 950 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: BACKFILL
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: bishop simplified
FS: 2.103910
Center: 45.319, 497.480
Radius: 113.052
Left Slip Surface Endpoint: -42.850, 426.720
Right Slip Surface Endpoint: 76.237, 388.738
Resisting Moment=3.02914e+007 lb-ft
Driving Moment=1.43977e+007 lb-ft

Method: janbu corrected
FS: 2.030580
Center: 37.846, 457.567
Radius: 78.546
Left Slip Surface Endpoint: -34.362, 426.657
Right Slip Surface Endpoint: 75.812, 388.807
Resisting Horizontal Force=278478 lb
Driving Horizontal Force=137142 lb

Method: spencer
FS: 2.106940
Center: 45.319, 497.480
Radius: 113.052
Left Slip Surface Endpoint: -42.850, 426.720
Right Slip Surface Endpoint: 76.237, 388.738
Resisting Moment=3.0335e+007 lb-ft
Driving Moment=1.43977e+007 lb-ft
Resisting Horizontal Force=246107 lb
Driving Horizontal Force=116808 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 20144
Number of Invalid Surfaces: 8467
Error Codes:
Error Code -99 reported for 6565 surfaces
Error Code -102 reported for 1 surface
Error Code -103 reported for 206 surfaces
Error Code -105 reported for 9 surfaces
Error Code -106 reported for 142 surfaces
Error Code -109 reported for 1544 surfaces

Method: janbu corrected
Number of Valid Surfaces: 20097
Number of Invalid Surfaces: 8514
Error Codes:
Error Code -99 reported for 6565 surfaces
Error Code -102 reported for 1 surface
Error Code -103 reported for 206 surfaces
Error Code -105 reported for 9 surfaces
Error Code -106 reported for 142 surfaces
Error Code -108 reported for 29 surfaces
Error Code -109 reported for 1544 surfaces
Error Code -111 reported for 6 surfaces
Error Code -112 reported for 12 surfaces

Method: spencer
Number of Valid Surfaces: 19801
Number of Invalid Surfaces: 8810
Error Codes:
Error Code -99 reported for 6565 surfaces
Error Code -102 reported for 1 surface
Error Code -103 reported for 206 surfaces
Error Code -105 reported for 9 surfaces
Error Code -106 reported for 142 surfaces
Error Code -108 reported for 36 surfaces
Error Code -109 reported for 1544 surfaces
Error Code -111 reported for 295 surfaces
Error Code -112 reported for 12 surfaces

Error Codes

The following errors were encountered during the computation:

-99 = Slip surface intersects an infinite strength material. If infinite strength regions are defined for a model, a large number of potential slip surfaces may show this error code. This is Normal.

-102 = Two surface / slope intersections, but resulting arc is actually outside soil region.

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

0.479	415.840
93.896	415.840
93.896	506.551
0.479	506.551

Material Boundary

-2.310	426.520
-1.530	426.520

Material Boundary

-100.000	380.000
100.000	380.000

Material Boundary

-1.530	426.520
-1.627	412.500
-6.083	412.500

-6.083	411.000
2.917	411.000
2.917	412.500
-0.060	412.500
-0.060	414.990

Material Boundary

2.917	411.000
3.917	411.000
7.059	414.160

Material Boundary

-19.054	426.591
-7.083	411.000
-6.083	411.000

External Boundary

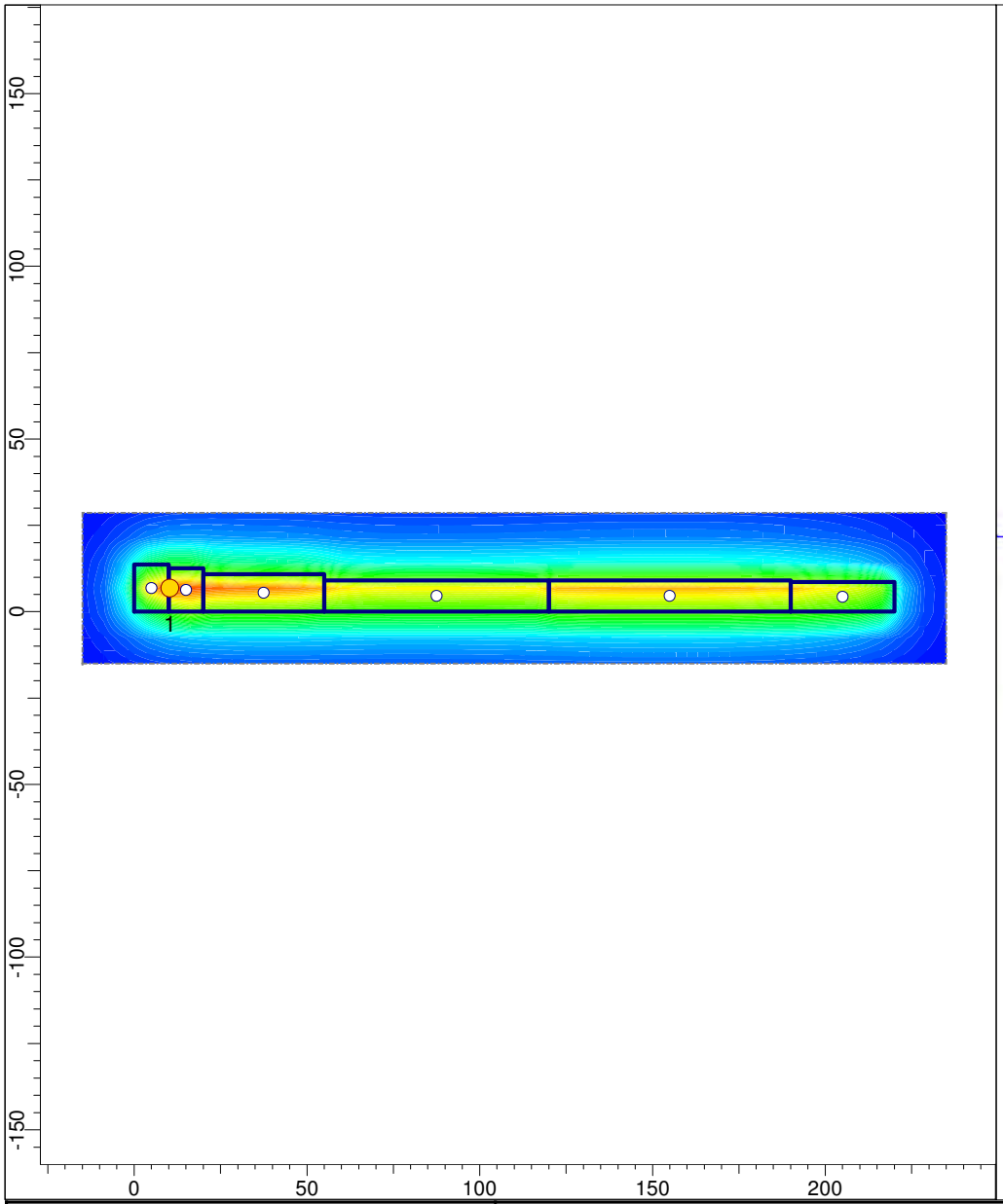
-99.700	426.800
-100.000	426.800
-100.000	380.000
-100.000	340.493
100.000	340.493
100.000	380.000
100.000	387.960
85.740	389.950
84.870	389.760
83.380	389.720
80.120	388.930
77.450	388.900
76.430	388.730
76.180	388.740
72.660	389.380
67.340	390.990
66.200	391.200
64.790	391.760
55.910	395.290
45.520	399.740
40.620	401.820
39.940	402.080
29.430	405.910
25.323	407.330
16.040	410.540
7.059	414.160
5.000	414.990
-0.060	414.990
-0.060	425.630
-0.060	426.520
-0.060	429.520
-0.520	429.520
-0.730	429.520
-0.950	429.520
-1.060	429.520
-1.390	427.450
-1.530	426.520
-8.740	426.560
-11.500	426.560
-19.054	426.591
-28.590	426.630
-32.360	426.640
-35.870	426.670
-54.170	426.800
-77.680	426.800
-78.120	426.800

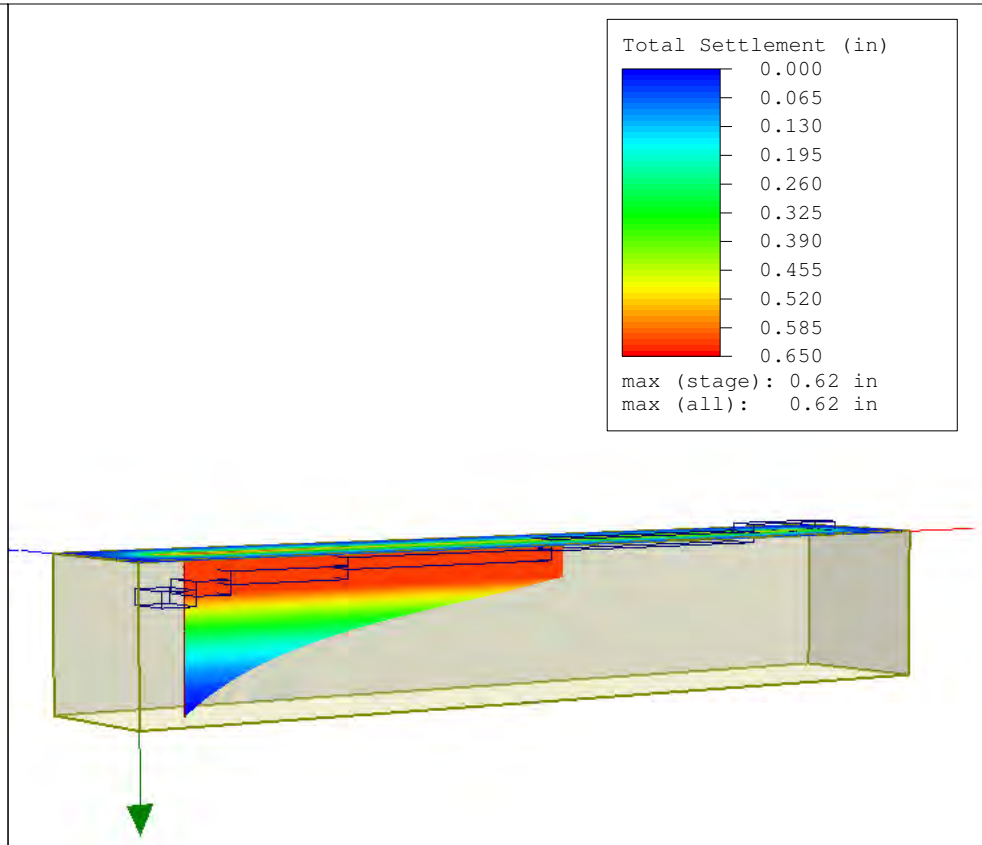
Water Table

-100.000	360.000
100.000	360.000

Distributed Load

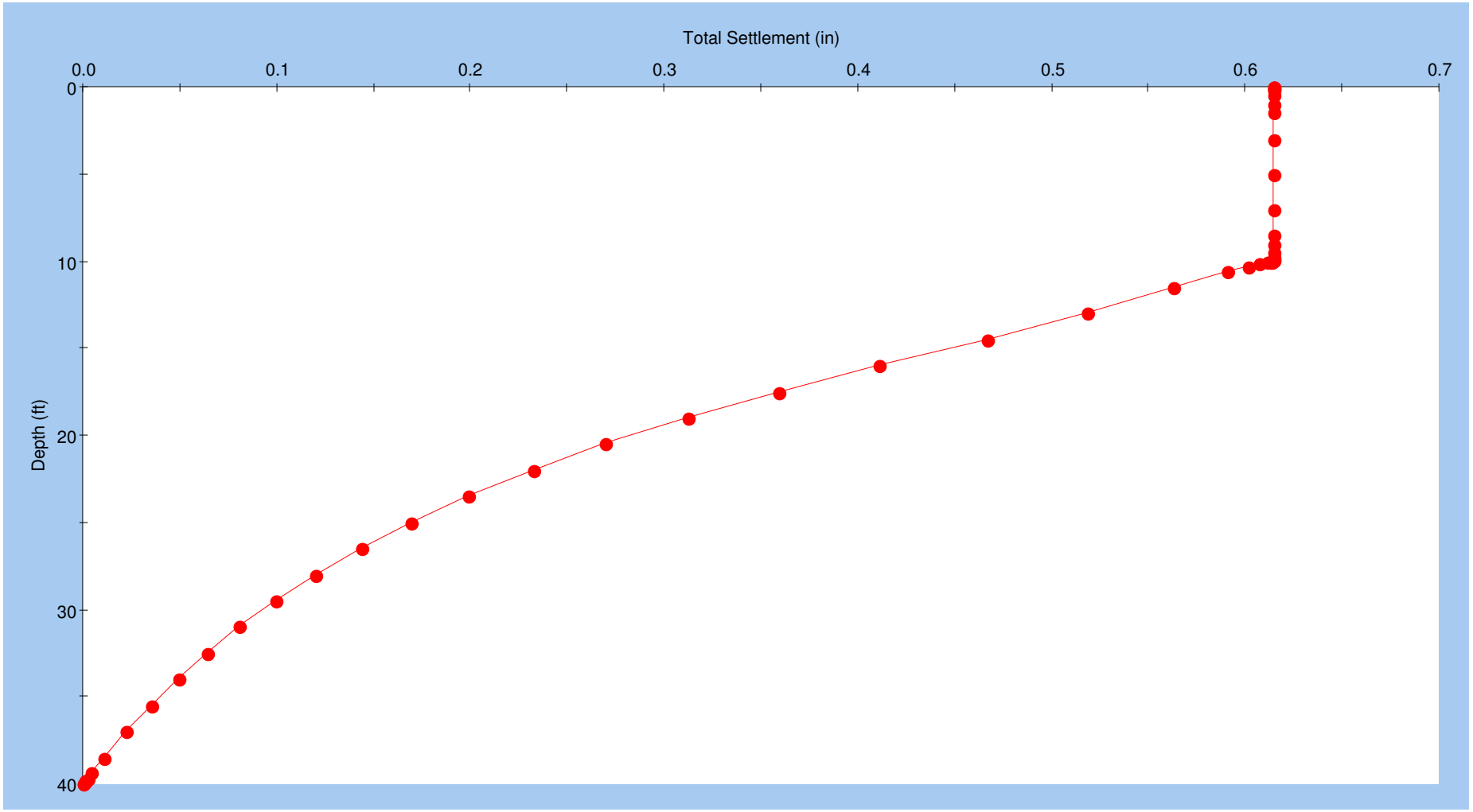
-1.716	426.521
-8.740	426.560
-11.500	426.560
-28.590	426.630
-32.360	426.640
-35.870	426.670
-54.170	426.800
-77.680	426.800
-78.120	426.800
-99.700	426.800
-100.000	426.800





rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW698 ST10+00 to ST12+20	
	Drawn By RB	*Company*	CH2M HILL
	Date 2/25/2009, 11:19:38 AM	*File Name*	RW698_ST10+00_ST12+20.s3z

Total Settlement vs. Depth



Query Point 1 (Stage Stage 1)
Reference Stage: None

rocscience	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW698 ST10+00 to ST12+20	
	Drawn By	RB	*Company* CH2M HILL
SETTLE3D 1.011	*Date*	2/25/2009, 11:19:38 AM	*File Name* RW698_ST10+00_ST12+20.s3z

Settle3D Analysis Information

Project Settings

Project Title: SR-57 Settlement Analysis
Analysis: RW698 ST10+00 to ST12+20
Author: RB
Company: CH2M HILL
Date Created: 2/25/2009, 11:19:38 AM
Stress Computation Method: Boussinesq

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.616967
Consolidation Settlement [in]	0	0.242374
Immediate Settlement [in]	0	0.448226
Loading Stress [ksf]	0	4.21504
Total Stress [ksf]	0	6.00839
Total Strain	0	0.0076297
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 30 ft
Width: 8.62 ft
Rotation angle: 0 degrees
Load: 2.604 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
190	5.55112e-017
220	5.55112e-017
220	8.62
190	8.62

Rectangular Load

Length: 70 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.09 ksf
Depth: 2.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
120	0
190	0
190	9.1
120	9.1

Rectangular Load

Length: 65 ft
Width: 9.1 ft
Rotation angle: 0 degrees
Load: 3.09 ksf
Depth: 5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
55	0
120	0
120	9.1
55	9.1

Rectangular Load

Length: 35 ft
Width: 10.82 ft
Rotation angle: 0 degrees
Load: 3.42 ksf
Depth: 7.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
20	0
55	0
55	10.82
20	10.82

Rectangular Load

Length: 10 ft
Width: 12.54 ft

Rotation angle: 0 degrees
Load: 3.754 ksf
Depth: 10 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
10	0
20	0
20	12.54
10	12.54

Rectangular Load

Length: 10 ft
Width: 13.64 ft
Rotation angle: 0 degrees
Load: 4.16 ksf
Depth: 12.5 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
2.84217e-014	0
10	0
10	13.64
2.84217e-014	13.64

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	FILL (Af)	40	0

Soil Properties

FILL (Af)	
Unit Weight [kips/ft^3]	0.13
Immediate Settlement	Enabled
Es [ksf]	1600
Eur [ksf]	1600
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.02
Cre	0.002
Pc [ksf]	17

Query Points

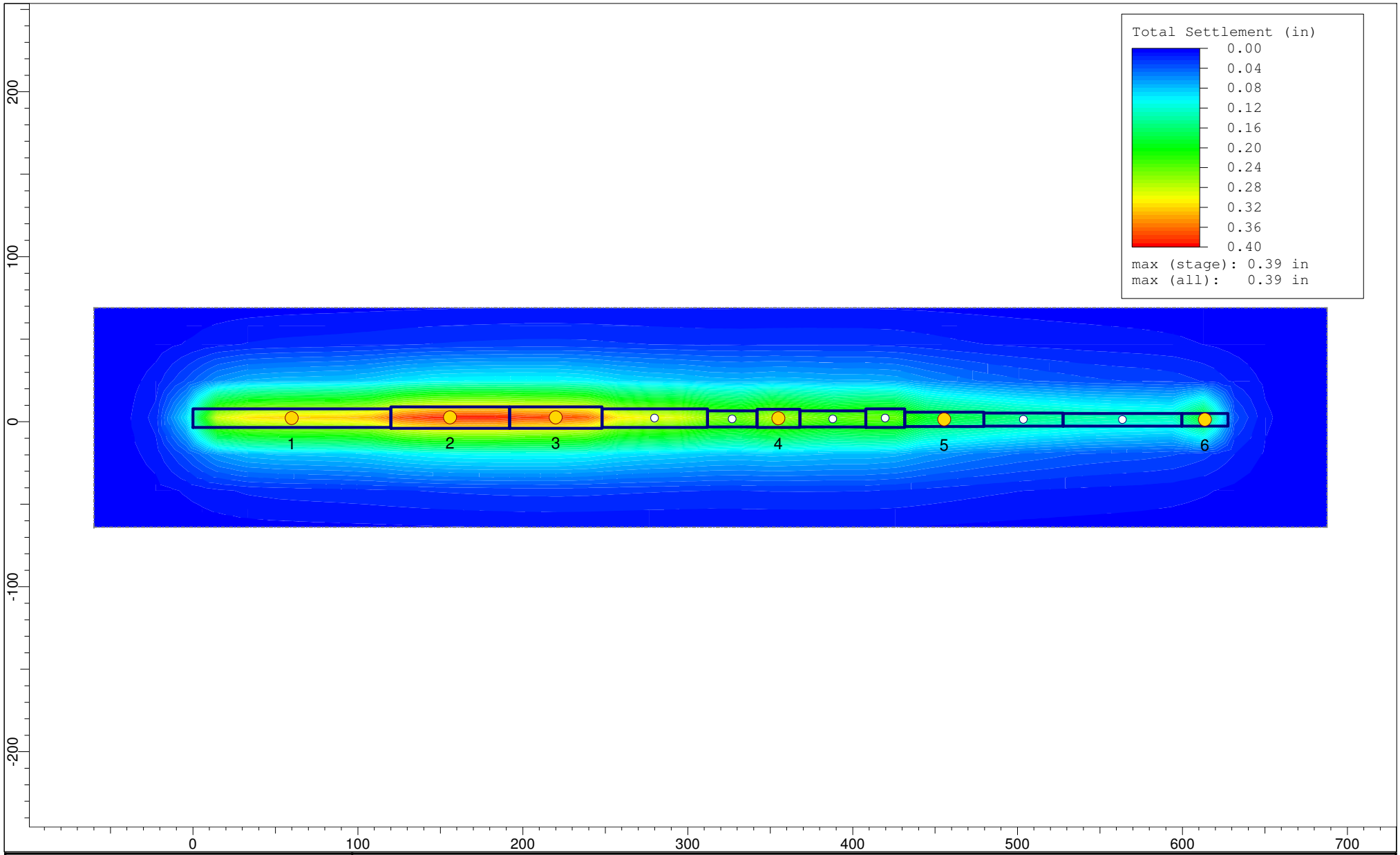
String #	(X,Y) Location	Number of Divisions
1	10.297, 6.804	49

Grid

Number of points: 287
Expansion Factor: 2

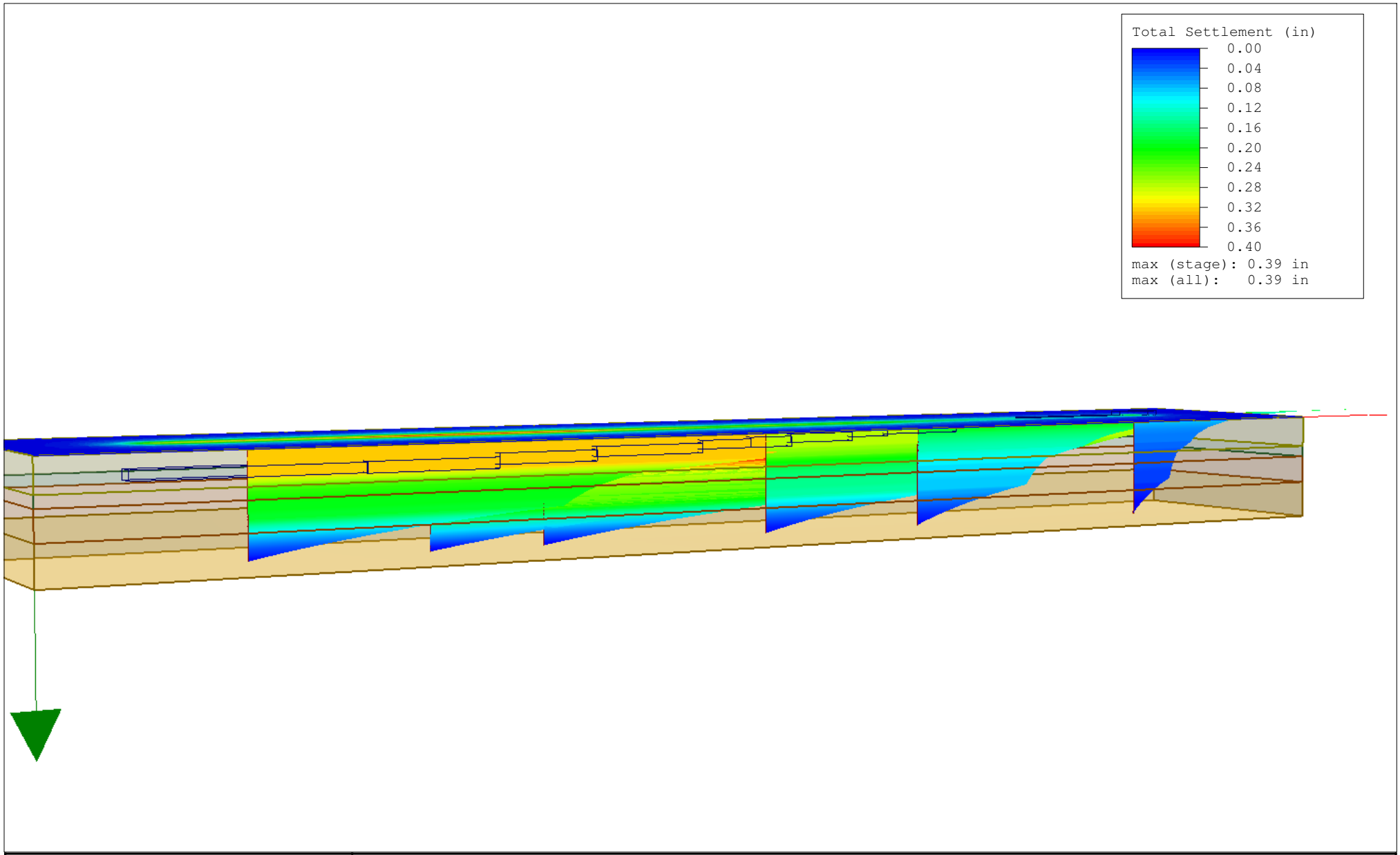
Grid Coordinates

X [ft]	Y [ft]
235	28.64
235	-15
-15	-15
-15	28.64



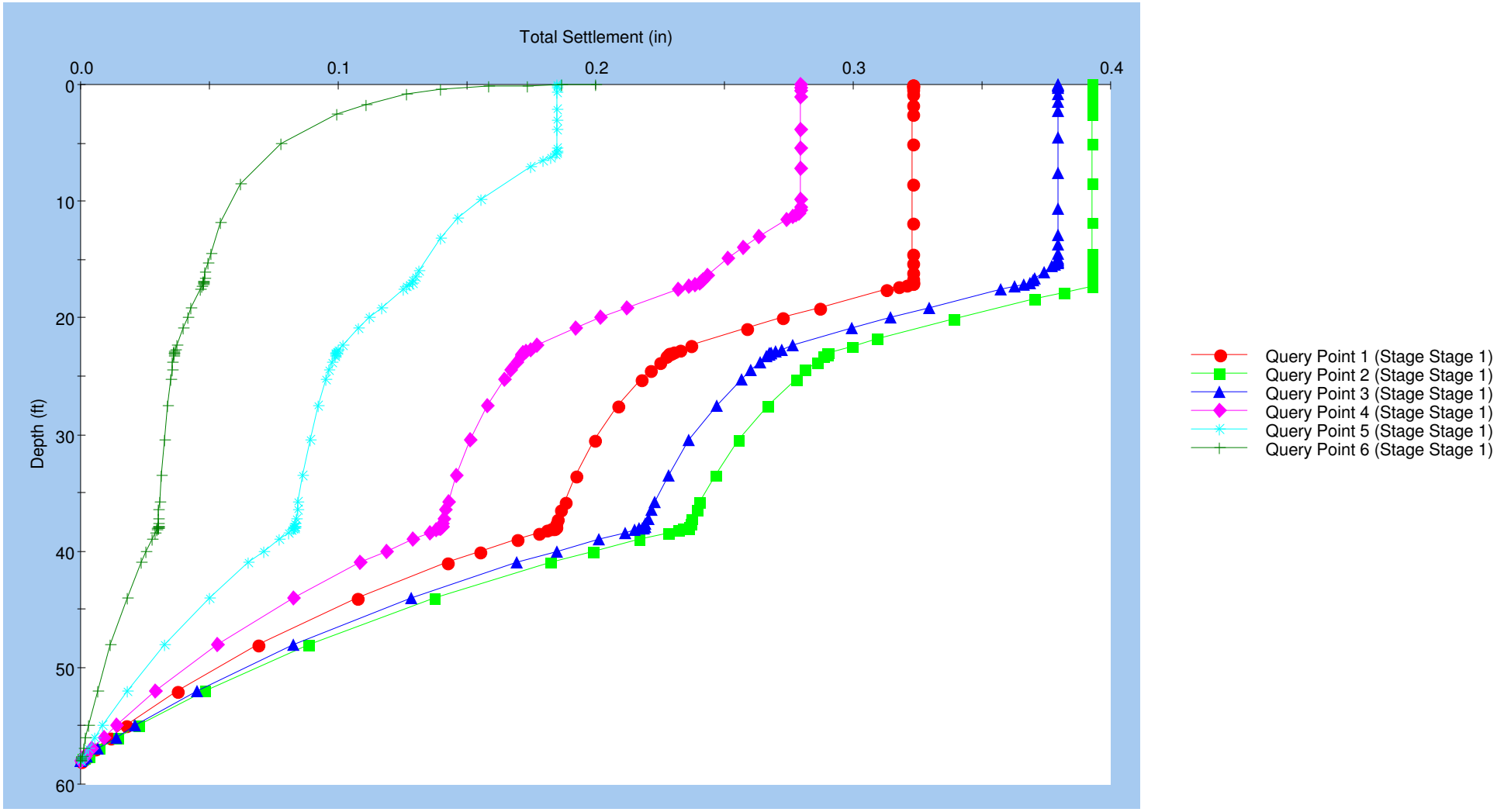
rocscience	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW698 ST12+43.44 to ST19+25.67	
	Drawn By	RB	*Company* CH2M HILL
	Date	2/26/2009, 12:19:01 PM	*File Name* RW698_ST12+43_ST19+26.s3z

SETTLE3D 1.011



rocscience	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW698 ST12+43.44 to ST19+25.67	
	Drawn By	RB	*Company* CH2M HILL
SETTLE3D 1.011	*Date*	2/26/2009, 12:19:01 PM	*File Name* RW698_ST12+43_ST19+26.s3z

Total Settlement vs. Depth



Reference Stage: None

rocscience SETTLE3D 1.011	*Project*	SR-57 Settlement Analysis	
	Analysis Description	RW698 ST12+43.44 to ST19+25.67	
	Drawn By	RB	*Company* CH2M HILL
	Date	2/26/2009, 12:19:01 PM	*File Name* RW698_ST12+43_ST19+26.s3z

Settle3D Analysis Information

Project Settings

Project Title: SR-57 Settlement Analysis
Analysis: RW698 ST12+43.44 to ST19+25.67
Author: RB
Company: CH2M HILL
Date Created: 2/26/2009, 12:19:01 PM
Stress Computation Method: Boussinesq

Stage Settings

Stage #	Name
1	Stage 1

Results

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.394082
Consolidation Settlement [in]	0	0.321576
Immediate Settlement [in]	0	0.0732374
Loading Stress [ksf]	0	1.82645
Total Stress [ksf]	0	7.88833
Total Strain	0	0.0322742
Degree of Consolidation [%]	0	100

Loads

Rectangular Load

Length: 120 ft
Width: 11.25 ft
Rotation angle: 0 degrees
Load: 1.5732 ksf
Depth: 17 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
0	-3.5
120	-3.5
120	7.75
0	7.75

Rectangular Load

Length: 72 ft
Width: 13 ft
Rotation angle: 0 degrees
Load: 1.75934 ksf
Depth: 17.25 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
120	-4
192	-4
192	9
120	9

Rectangular Load

Length: 56 ft
Width: 13 ft
Rotation angle: 0 degrees
Load: 1.75934 ksf
Depth: 15.25 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
192	-4
248	-4
248	9
192	9

Rectangular Load

Length: 64 ft
Width: 11.25 ft
Rotation angle: 0 degrees
Load: 1.5732 ksf
Depth: 13 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
248	-3.5
312	-3.5
312	7.75
248	7.75

Rectangular Load

Length: 30 ft
Width: 9.75 ft

Rotation angle: 0 degrees
Load: 1.38794 ksf
Depth: 11 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
312	-3.25
342	-3.25
342	6.5
312	6.5

Rectangular Load

Length: 26 ft
Width: 11 ft
Rotation angle: 0 degrees
Load: 1.63869 ksf
Depth: 11 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
342	-3.5
368	-3.5
368	7.5
342	7.5

Rectangular Load

Length: 40 ft
Width: 9.75 ft
Rotation angle: 0 degrees
Load: 1.38794 ksf
Depth: 9 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
368	-3.25
408	-3.25
408	6.5
368	6.5

Rectangular Load

Length: 23.56 ft
Width: 11.25 ft
Rotation angle: 0 degrees
Load: 1.5732 ksf
Depth: 7 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
408	-3.5
431.56	-3.5
431.56	7.75
408	7.75

Rectangular Load

Length: 48 ft
Width: 8.75 ft
Rotation angle: 0 degrees
Load: 1.14814 ksf
Depth: 6 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
431.56	-3
479.56	-3
479.56	5.75
431.56	5.75

Rectangular Load

Length: 48 ft
Width: 8 ft
Rotation angle: 0 degrees
Load: 0.97315 ksf
Depth: 4 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
479.56	-2.75
527.56	-2.75
527.56	5.25
479.56	5.25

Rectangular Load

Length: 72 ft
Width: 7.75 ft
Rotation angle: 0 degrees
Load: 0.78367 ksf
Depth: 2 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]

527.56	-2.75
599.56	-2.75
599.56	5
527.56	5

Rectangular Load

Length: 28 ft
Width: 7.75 ft
Rotation angle: 0 degrees
Load: 0.78367 ksf
Depth: 0 ft
Installation Stage: Stage 1

Coordinates

X [ft]	Y [ft]
599.56	-2.75
627.56	-2.75
627.56	5
599.56	5

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	FILL 1 (Af)	17	0
2	FILL 2 (Af)	6	17
3	FILL 3 (Af)	15	23
4	CLAY (Qvof)	20	38

Soil Properties

FILL 1 (Af)	
Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.02
Cre	0.002
OCR	11

FILL 2 (Af)	
Unit Weight [kips/ft^3]	0.13
Immediate Settlement	Enabled
Es [ksf]	1600
Eur [ksf]	1600
Primary Consolidation	Enabled

Material Type	Non-Linear
Cce	0.02
Cre	0.002
OCR	7

FILL 3 (Af)	
Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.03
Cre	0.003
OCR	4

CLAY (Qvof)	
Unit Weight [kips/ft^3]	0.13
Primary Consolidation	Enabled
Material Type	Non-Linear
Cce	0.03
Cre	0.003
OCR	1

Query Points

String #	(X,Y) Location	Number of Divisions
1	60, 2.125	65
2	156, 2.5	67
3	220, 2.5	71
4	355, 2	67
5	455.56, 1.375	67
6	613.56, 1.125	65

Grid

Number of points: 287
Expansion Factor: 2

Grid Coordinates

X [ft]	Y [ft]
687.56	69
687.56	-64
-60	-64
-60	69

APPENDIX E.3

Pile Foundation

Axial Pile Analysis

DRIVEN PILE ANALYSIS - STATIC ANALYSIS

Job Name:	SR-57 Northbound Widening Project - North Segment
Job No.	370900.03.GE.FR
Location:	Orange County, California
Subject:	Pile Capacity Estimate at the location of Sign Structure 630
Date:	4/7/2008

Pile Type (Concrete, Steel H, Steel Pipe Close End, Steel Pipe Opent End)	1	
Pile Shape (Circular, Rectangle,Other)	2	
Pile Dimension	12	inches
Depth to Ground Water	42	ft
Unit Weight of Water	62.4	pcf
Depth Interval	1	ft
Ground Surface Elevation	327	ft
Atmospheric Pressure	2000	psf
Alpha-Factor Set (1,2,3)	3	
PI for Beta Method	40	
Limiting unit skin friction - Cohesive	7000	psf
Limiting unit skin friction - Cohesionless	4000	psf
Limiting unit End Bearing - Cohesive	60000	psf
Limiting unit End Bearing - Cohesionless	0	psf

Pile Capacity Calculation Methods		Resistance Factor
α-Tomlinson (1987) Method	1	0.5
α-API Method	0	0
β-Esrig and kirby (1979)	0	0

Pile Perimeter	4.00	ft
Pile Area	1.00	ft^2
Pile Length	**30**	ft
Pile Cut-off Elevation	**307**	ft
Pile Tip Elevation	**277**	ft
Pile Capacity	**100**	kips

Depth to Top of Layer (ft)	Depth to Bottom of Layer (ft)	Middle Height of Layer (ft)	Elevation (ft)	Pile Location	Soil Type	Bearing Layer (Y/N)	Bearing Length (ft)	Total Unit Weight (pcf)	Standard Penetration Test N-value	Effective Friction Angle (degree)	Undrained Shear Strength (psf)	Total Overburden Pressure (psf)	Pore Water Pressure (psf)	Effective Overburden Pressure (psf)
0	16	8	311	0	1	N	0	120.0	0	0	0	960.00	0.00	960.00
16	17	16.5	310	0	1	N	0	120.0	0	0	1500	1980.00	0.00	1980.00
17	18	17.5	309	0	1	N	0	120.0	0	0	1500	2100.00	0.00	2100.00
18	19	18.5	308	0	1	N	0	120.0	0	0	1500	2220.00	0.00	2220.00
19	20	19.5	307	0	1	N	0	120.0	0	0	1500	2340.00	0.00	2340.00
20	21	20.5	306	1	1	Y	1	120.0	0	0	1500	2460.00	0.00	2460.00
21	22	21.5	305	1	1	Y	2	120.0	0	0	1500	2580.00	0.00	2580.00
22	23	22.5	304	1	1	Y	3	120.0	0	0	1500	2700.00	0.00	2700.00
23	24	23.5	303	1	1	Y	4	120.0	0	0	1500	2820.00	0.00	2820.00
24	25	24.5	302	1	1	Y	5	120.0	0	0	1500	2940.00	0.00	2940.00
25	26	25.5	301	1	1	Y	6	120.0	0	0	1500	3060.00	0.00	3060.00
26	27	26.5	300	1	1	Y	7	120.0	0	0	1500	3180.00	0.00	3180.00
27	28	27.5	299	1	1	Y	8	120.0	0	0	1500	3300.00	0.00	3300.00
28	29	28.5	298	1	1	Y	9	120.0	0	0	1500	3420.00	0.00	3420.00
29	30	29.5	297	1	1	Y	10	120.0	0	0	1500	3540.00	0.00	3540.00
30	31	30.5	296	1	1	Y	11	120.0	0	0	784	3660.00	0.00	3660.00
31	32	31.5	295	1	1	Y	12	120.0	0	0	601	3780.00	0.00	3780.00
32	33	32.5	294	1	1	Y	13	120.0	0	0	601	3900.00	0.00	3900.00
33	34	33.5	293	1	1	Y	14	120.0	0	0	784	4020.00	0.00	4020.00
34	35	34.5	292	1	1	Y	15	120.0	0	0	1187	4140.00	0.00	4140.00
35	36	35.5	291	1	1	Y	16	120.0	0	0	1714	4260.00	0.00	4260.00
36	37	36.5	290	1	1	Y	17	120.0	0	0	1714	4380.00	0.00	4380.00
37	38	37.5	289	1	1	Y	18	120.0	0	0	1274	4500.00	0.00	4500.00
38	39	38.5	288	1	1	Y	19	120.0	0	0	1449	4620.00	0.00	4620.00
39	40	39.5	287	1	1	Y	20	120.0	0	0	2590	4740.00	0.00	4740.00
40	41	40.5	286	1	1	Y	21	120.0	0	0	3014	4860.00	0.00	4860.00
41	42	41.5	285	1	1	Y	22	120.0	0	0	3229	4980.00	0.00	4980.00
42	43	42.5	284	1	1	Y	23	120.0	0	0	4293	5100.00	31.20	5068.80
43	44	43.5	283	1	1	Y	24	120.0	0	0	4921	5220.00	93.60	5126.40
44	45	44.5	282	1	1	Y	25	120.0	0	0	4816	5340.00	156.00	5184.00
45	46	45.5	281	1	1	Y	26	120.0	0	0	3445	5460.00	218.40	5241.60
46	47	46.5	280	1	1	Y	27	120.0	0	0	6387	5580.00	280.80	5299.20
47	48	47.5	279	1	1	Y	28	120.0	0	0	8000	5700.00	343.20	5356.80
48	49	48.5	278	1	1	Y	29	120.0	0	0	3121	5820.00	405.60	5414.40
49	50	49.5	277	1	1	Y	30	120.0	0	0	7225	5940.00	468.00	5472.00
50	51	50.5	276	0	1	Y		120.0	0	0	8000	6060.00	530.40	5529.60
51	52	51.5	275	0	1	Y		120.0	0	0	8000	6180.00	592.80	5587.20
52	53	52.5	274	0	1	Y		120.0	0	0	8000	6300.00	655.20	5644.80
53	54	53.5	273	0	1	Y		120.0	0	0	8000	6420.00	717.60	5702.40
54	55	54.5	272	0	1	Y		120.0	0	0	7225	6540.00	780.00	5760.00
55	56	55.5	271	0	1	Y		120.0	0	0	8000	6660.00	842.40	5817.60
56	57	56.5	270	0	1	Y		120.0	0	0	8000	6780.00	904.80	5875.20
57	58	57.5	269	0	1	Y		120.0	0	0	8000	6900.00	967.20	5932.80
58	59	58.5	268	0	1	Y		120.0	0	0	8000	7020.00	1029.60	5990.40
59	60	59.5	267	0	1	Y		120.0	0	0	8000	7140.00	1092.00	6048.00
60	61	60.5	266	0	1	Y		120.0	0	0	8000	7260.00	1154.40	6105.60
61	62	61.5	265	0	1	Y		120.0	0	0	8000	7380.00	1216.80	6163.20
62	63	62.5	264	0	1	Y		120.0	0	0	8000	7500.00	1279.20	6220.80
63	64	63.5	263	0	1	Y		120.0	0	0	8000	7620.00	1341.60	6278.40
64	65	64.5	262	0	1	Y		130.0	0	0	8000	7745.00	1404.00	6341.00
65	66	65.5	261	0	1	Y		130.0	0	0	8000	7875.00	1466.40	6408.60
66	67	66.5	260	0	1	Y		130.0	0	0	0	8005.00	1528.80	6476.20
67	68	67.5	259	0	1	Y		130.0	0	0	0	8135.00	1591.20	6543.80
68	69	68.5	258	0	1	Y		130.0	0	0	0	8265.00	1653.60	6611.40
69	70	69.5	257	0	1	Y		130.0	0	0	0	8395.00	1716.00	6679.00
70	71	70.5	256	0	1	Y		130.0	0	0	0	8525.00	1778.40	6746.60
71	72	71.5	255	0	1	Y		130.0	0	0	0	8655.00	1840.80	6814.20
72	73	72.5	254	0	1	Y		130.0	0	0	0	8785.00	1903.20	6881.80
73	74	73.5	253	0	1	Y		130.0	0	0	0	8915.00	1965.60	6949.40
74	75	74.5	252	0	1	Y		130.0	0	0	0	9045.00	2028.00	7017.00
75	76	75.5	251	0	1	Y		130.0	0	0	0	9175.00	2090.40	7084.60
76	77	76.5	250	0	1	Y		130.0	0	0	0	9305.00	2152.80	7152.20
77	78	77.5	249	0	1	Y		130.0	0	0	0	9435.00	2215.20	7219.80
78	79	78.5	248	0	1	Y		130.0	0	0	0	9565.00	2277.60	7287.40
79	80	79.5	247	0	1	Y		130.0	0	0	0	9695.00	2340.00	7355.00
80	81	80.5	246	0	1	Y		130.0	0	0	0	9825.00	2402.40	7422.60
81	82	81.5	245	0	1	Y		130.0	0	0	0	9955.00	2464.80	7490.20
82	83	82.5	244	0	1	Y		130.0	0	0	0	10085.00	2527.20	7557.80
83	84	83.5	243	0	1	Y	14	130.0	0	0	0	10215.00	2589.60	7625.40

Depth to Top of Layer (ft)	FHWA Method α	Unit Ultimate - Cohesive Side Friction (psf)	Unit Ultimate - Cohesive End Bearing (psf)	kδ	δ	δ/φ	Cf	Unit Ultimate - Cohesionless Side Friction (psf)	Unit Ultimate - Cohesionless End Bearing (psf)	Total Capacity (kips)
0	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
16	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**0**
17	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**0**
18	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**0**
19	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**0**
20	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**9**
21	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**12**
22	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**14**
23	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**17**
24	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**20**
25	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**22**
26	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**25**
27	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**27**
28	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**30**
29	0.85	1275	13500	0.00	0	0.00	0.00	0	0	**32**
30	0.96	752	7057	0.00	0	0.00	0.00	0	0	**31**
31	0.97	586	5412	0.00	0	0.00	0.00	0	0	**31**
32	0.97	586	5412	0.00	0	0.00	0.00	0	0	**32**
33	0.96	752	7057	0.00	0	0.00	0.00	0	0	**34**
34	0.91	1082	10683	0.00	0	0.00	0.00	0	0	**38**
35	0.80	1366	15427	0.00	0	0.00	0.00	0	0	**43**
36	0.80	1366	15427	0.00	0	0.00	0.00	0	0	**46**
37	0.90	1148	11467	0.00	0	0.00	0.00	0	0	**47**
38	0.86	1247	13037	0.00	0	0.00	0.00	0	0	**50**
39	0.44	1141	23308	0.00	0	0.00	0.00	0	0	**57**
40	0.32	972	27124	0.00	0	0.00	0.00	0	0	**61**
41	0.29	922	29062	0.00	0	0.00	0.00	0	0	**64**
42	0.23	998	38636	0.00	0	0.00	0.00	0	0	**71**
43	0.24	1158	44290	0.00	0	0.00	0.00	0	0	**76**
44	0.23	1131	43348	0.00	0	0.00	0.00	0	0	**78**
45	0.26	892	31006	0.00	0	0.00	0.00	0	0	**73**
46	0.24	1523	57483	0.00	0	0.00	0.00	0	0	**89**
47	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**95**
48	0.30	945	28092	0.00	0	0.00	0.00	0	0	**80**
49	0.24	1718	60000	0.00	0	0.00	0.00	0	0	**100**
50	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
51	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
52	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
53	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
54	0.24	1718	60000	0.00	0	0.00	0.00	0	0	**0**
55	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
56	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
57	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
58	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
59	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
60	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
61	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
62	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
63	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
64	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
65	0.24	1884	60000	0.00	0	0.00	0.00	0	0	**0**
66	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
67	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
68	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
69	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
70	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
71	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
72	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
73	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
74	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
75	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
76	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
77	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
78	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
79	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
80	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
81	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
82	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**
83	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**

Depth to Top of Layer (ft)	API Method Su/σ'v	α	Unit Ultimate - Cohesive Side Friction (psf)	Unit Ultimate - Cohesive End Bearing (psf)	Unit Ultimate - Cohesionless Side Friction (psf)	Unit Ultimate - Cohesionless End Bearing (psf)	Total Capacity (kips)	β-Esrig and Kirby (1979) Method OCR	β	Unit Ultimate Side Friction (psf)	Unit Ultimate End Bearing (psf)	Unit Ultimate - Cohesionless Side Friction (psf)	Unit Ultimate - Cohesionless End Bearing (psf)	Total Capacity (kips)	Average Capacity (kips)
0	0.00	0.00	0	0	0	0	**0**	15.00	2.05	1968	0	0	0	**0**	
16	0.76	0.00	0	13500	0	0	**0**	3.79	0.67	1317	13500	0	0	**0**	
17	0.71	0.00	0	13500	0	0	**0**	3.57	0.64	1346	13500	0	0	**0**	
18	0.68	0.00	0	13500	0	0	**0**	3.38	0.62	1375	13500	0	0	**0**	
19	0.64	0.00	0	13500	0	0	**0**	3.21	0.60	1404	13500	0	0	**0**	
20	0.61	0.00	0	13500	0	0	**0**	3.05	0.58	1433	13500	0	0	**0**	**9**
21	0.58	0.66	984	13500	0	0	**0**	2.91	0.57	1461	13500	0	0	**0**	**12**
22	0.56	0.67	1006	13500	0	0	**0**	2.78	0.55	1489	13500	0	0	**0**	**14**
23	0.53	0.69	1028	13500	0	0	**0**	2.66	0.54	1517	13500	0	0	**0**	**17**
24	0.51	0.70	1050	13500	0	0	**0**	2.55	0.52	1543	13500	0	0	**0**	**20**
25	0.49	0.71	1071	13500	0	0	**0**	2.45	0.51	1569	13500	0	0	**0**	**22**
26	0.47	0.73	1092	13500	0	0	**0**	2.36	0.50	1595	13500	0	0	**0**	**25**
27	0.45	0.74	1112	13500	0	0	**0**	2.27	0.49	1619	13500	0	0	**0**	**27**
28	0.44	0.75	1132	13500	0	0	**0**	2.19	0.48	1643	13500	0	0	**0**	**30**
29	0.42	0.77	1152	13500	0	0	**0**	2.12	0.47	1667	13500	0	0	**0**	**32**
30	0.21	1.08	847	7057	0	0	**0**	1.00	0.31	1135	7057	0	0	**0**	**31**
31	0.16	1.25	754	5412	0	0	**0**	1.00	0.31	1172	5412	0	0	**0**	**31**
32	0.15	1.27	766	5412	0	0	**0**	1.00	0.31	1209	5412	0	0	**0**	**32**
33	0.20	1.13	888	7057	0	0	**0**	1.00	0.31	1246	7057	0	0	**0**	**34**
34	0.29	0.93	1108	10683	0	0	**0**	1.00	0.31	1283	10683	0	0	**0**	**38**
35	0.40	0.79	1351	15427	0	0	**0**	2.01	0.46	1945	15427	0	0	**0**	**43**
36	0.39	0.80	1370	15427	0	0	**0**	1.96	0.45	1967	15427	0	0	**0**	**46**
37	0.28	0.94	1197	11467	0	0	**0**	1.00	0.31	1395	11467	0	0	**0**	**47**
38	0.31	0.89	1293	13037	0	0	**0**	1.00	0.31	1432	13037	0	0	**0**	**50**
39	0.55	0.68	1752	23308	0	0	**0**	2.73	0.55	2589	23308	0	0	**0**	**57**
40	0.62	0.63	1914	27124	0	0	**0**	3.10	0.59	2859	27124	0	0	**0**	**61**
41	0.65	0.62	2005	29062	0	0	**0**	3.24	0.60	3008	29062	0	0	**0**	**64**
42	0.85	0.54	2332	38636	0	0	**0**	4.23	0.72	3638	38636	0	0	**0**	**71**
43	0.96	0.51	2511	44290	0	0	**0**	4.80	0.78	4023	44290	0	0	**0**	**76**
44	0.93	0.52	2498	43348	0	0	**0**	4.65	0.77	3974	43348	0	0	**0**	**78**
45	0.66	0.62	2125	31006	0	0	**0**	3.29	0.61	3192	31006	0	0	**0**	**73**
46	1.21	0.48	3048	57483	0	0	**0**	6.03	0.93	4935	57483	0	0	**0**	**89**
47	1.49	0.45	3618	60000	0	0	**0**	7.47	1.11	5920	60000	0	0	**0**	**95**
48	0.58	0.66	2055	28092	0	0	**0**	2.88	0.56	3051	28092	0	0	**0**	**80**
49	1.32	0.47	3370	60000	0	0	**0**	6.60	1.00	5474	60000	0	0	**0**	**100**
50	1.45	0.46	3647	60000	0	0	**0**	7.23	1.08	5954	60000	0	0	**0**	
51	1.43	0.46	3657	60000	0	0	**0**	7.16	1.07	5966	60000	0	0	**0**	
52	1.42	0.46	3666	60000	0	0	**0**	7.09	1.06	5977	60000	0	0	**0**	
53	1.40	0.46	3675	60000	0	0	**0**	7.01	1.05	5989	60000	0	0	**0**	
54	1.25	0.47	3413	60000	0	0	**0**	6.27	0.96	5534	60000	0	0	**0**	
55	1.38	0.46	3694	60000	0	0	**0**	6.88	1.03	6012	60000	0	0	**0**	
56	1.36	0.46	3703	60000	0	0	**0**	6.81	1.03	6024	60000	0	0	**0**	
57	1.35	0.46	3712	60000	0	0	**0**	6.74	1.02	6036	60000	0	0	**0**	
58	1.34	0.47	3721	60000	0	0	**0**	6.68	1.01	6048	60000	0	0	**0**	
59	1.32	0.47	3730	60000	0	0	**0**	6.61	1.00	6059	60000	0	0	**0**	
60	1.31	0.47	3739	60000	0	0	**0**	6.55	0.99	6071	60000	0	0	**0**	
61	1.30	0.47	3747	60000	0	0	**0**	6.49	0.99	6083	60000	0	0	**0**	
62	1.29	0.47	3756	60000	0	0	**0**	6.43	0.98	6095	60000	0	0	**0**	
63	1.27	0.47	3765	60000	0	0	**0**	6.37	0.97	6107	60000	0	0	**0**	
64	1.26	0.47	3774	60000	0	0	**0**	6.31	0.97	6120	60000	0	0	**0**	
65	1.25	0.47	3784	60000	0	0	**0**	6.24	0.96	6134	60000	0	0	**0**	
66	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2008	0	0	0	**0**	
67	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2029	0	0	0	**0**	
68	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2050	0	0	0	**0**	
69	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2070	0	0	0	**0**	
70	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2091	0	0	0	**0**	
71	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2112	0	0	0	**0**	
72	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2133	0	0	0	**0**	
73	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2154	0	0	0	**0**	
74	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2175	0	0	0	**0**	
75	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2196	0	0	0	**0**	
76	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2217	0	0	0	**0**	
77	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2238	0	0	0	**0**	
78	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2259	0	0	0	**0**	
79	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2280	0	0	0	**0**	
80	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2301	0	0	0	**0**	
81	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2322	0	0	0	**0**	
82	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2343	0	0	0	**0**	
83	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2364	0	0	0	**0**	

84	85	84.5	242	0	1	Y	130.0	0	0	0	10345.00	2652.00	7693.00	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2385	0	0	0	**0**
85	86	85.5	241	0	1	Y	130.0	0	0	0	10475.00	2714.40	7760.60	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2406	0	0	0	**0**
86	87	86.5	240	0	1	Y	130.0	0	0	0	10605.00	2776.80	7828.20	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2427	0	0	0	**0**
87	88	87.5	239	0	1	Y	130.0	0	0	0	10735.00	2839.20	7895.80	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2448	0	0	0	**0**
88	89	88.5	238	0	1	Y	130.0	0	0	0	10865.00	2901.60	7963.40	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2469	0	0	0	**0**
89	90	89.5	237	0	1	Y	130.0	0	0	0	10995.00	2964.00	8031.00	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2490	0	0	0	**0**
90	91	90.5	236	0	1	Y	130.0	0	0	0	11125.00	3026.40	8098.60	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2511	0	0	0	**0**
91	92	91.5	235	0	1	Y	130.0	0	0	0	11255.00	3088.80	8166.20	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2532	0	0	0	**0**
92	93	92.5	234	0	1	Y	130.0	0	0	0	11385.00	3151.20	8233.80	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2552	0	0	0	**0**
93	94	93.5	233	0	1	Y	130.0	0	0	0	11515.00	3213.60	8301.40	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2573	0	0	0	**0**
94	95	94.5	232	0	1	Y	130.0	0	0	0	11645.00	3276.00	8369.00	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2594	0	0	0	**0**
95	96	95.5	231	0	1	Y	130.0	0	0	0	11775.00	3338.40	8436.60	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2615	0	0	0	**0**
96	97	96.5	230	0	1	Y	130.0	0	0	0	11905.00	3400.80	8504.20	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2636	0	0	0	**0**
97	98	97.5	229	0	1	Y	130.0	0	0	0	12035.00	3463.20	8571.80	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2657	0	0	0	**0**
98	99	98.5	228	0	1	Y	130.0	0	0	0	12165.00	3525.60	8639.40	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2678	0	0	0	**0**
99	100	99.5	227	0	1	Y	130.0	0	0	0	12295.00	3588.00	8707.00	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2699	0	0	0	**0**
100	101	100.5	226	0	1	Y	130.0	0	0	0	12425.00	3650.40	8774.60	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2720	0	0	0	**0**
101	102	101.5	225	0	1	Y	130.0	0	0	0	12555.00	3712.80	8842.20	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2741	0	0	0	**0**
102	103	102.5	224	0	1	Y	130.0	0	0	0	12685.00	3775.20	8909.80	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2762	0	0	0	**0**
103	104	103.5	223	0	1	Y	130.0	0	0	0	12815.00	3837.60	8977.40	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2783	0	0	0	**0**
104	105	104.5	222	0	1	Y	130.0	0	0	0	12945.00	3900.00	9045.00	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2804	0	0	0	**0**
105	106	105.5	221	0	1	Y	130.0	0	0	0	13075.00	3962.40	9112.60	1.00	0	0	0.00	0	0.00	0.00	0	0	**0**	0.00	#DIV/0!	#DIV/0!	0	0	0	**0**	1.00	0.31	2825	0	0	0	**0**

Notes:

1. α-API revised Method (1987) for cohesive soil
2. β–Esrig and Kirby (1979) for cohesive soil and Meyerhof for cohesionless soil
3. Soil Plugging Occur in Clay at 10 to 20 D, and for sand between 20 to 30 D
4. Other Methods such as USACE and Schmertman Methods will also be considered

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

SW 581 - CIDH piles

TOTAL LOAD = 90.0 TONS

NUMBER OF LAYERS = 2

WATER TABLE DEPTH = 41.2 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 1.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY =*****

SOIL INFORMATION

LAYER NO 1----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04
DEPTH, FT	= 0.300E+02

LAYER NO 2----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04

DEPTH, FT = 0.300E+02

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K = 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.000E+00
INTERNAL FRICTION ANGLE, DEG. = 0.300E+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 = 0.400E+04
DEPTH, FT = 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	1.333	FT.
DIAMETER OF BASE	=	1.333	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	13.000	FT.
IGNORED BOTTOM PORTION	=	0.000	FT.
AREA OF ONE PERCENT STEEL	=	2.011	SQ.IN.
ELASTIC MODULUS, Ec	=	0.360E+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)
14.0	0.72	1.83	0.00	1.83	1.83	1.83	2.53
15.0	0.78	3.79	0.00	3.79	3.79	3.79	4.88
16.0	0.83	5.88	0.00	5.88	5.88	5.88	7.10
17.0	0.88	8.10	0.00	8.10	8.10	8.10	9.21
18.0	0.93	10.45	0.00	10.45	10.45	10.45	11.23
19.0	0.98	12.93	0.00	12.93	12.93	12.93	13.16
20.0	1.03	15.54	0.00	15.54	15.54	15.54	15.03
21.0	1.09	18.29	0.00	18.29	18.29	18.29	16.84
22.0	1.14	21.16	0.00	21.16	21.16	21.16	18.60
23.0	1.19	24.17	0.00	24.17	24.17	24.17	20.31
24.0	1.24	27.30	0.00	27.30	27.30	27.30	21.99
25.0	1.29	30.57	0.00	30.57	30.57	30.57	23.64
26.0	1.34	33.96	0.00	33.96	33.96	33.96	25.26
27.0	1.40	37.49	0.00	37.49	37.49	37.49	26.85
28.0	1.45	41.15	0.00	41.15	41.15	41.15	28.41
29.0	1.50	44.94	0.00	44.94	44.94	44.94	29.96

30.0	1.55	48.85	0.00	48.85	48.85	48.85	31.49
31.0	1.60	52.90	0.00	52.90	52.90	52.90	33.00
32.0	1.66	57.08	0.00	57.08	57.08	57.08	34.49
33.0	1.71	61.39	0.00	61.39	61.39	61.39	35.97
34.0	1.76	65.84	0.00	65.84	65.84	65.84	37.44
35.0	1.81	70.41	0.00	70.41	70.41	70.41	38.89
36.0	1.86	75.11	0.00	75.11	75.11	75.11	40.34
37.0	1.91	79.94	0.00	79.94	79.94	79.94	41.78
38.0	1.97	84.91	0.00	84.91	84.91	84.91	43.20
39.0	2.02	90.00	0.00	90.00	90.00	90.00	44.62

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2761E+00	0.3110E-03	0.1527E-11	0.1000E-03
0.2761E+01	0.3110E-02	0.1527E-10	0.1000E-02
0.6986E+01	0.7811E-02	0.3818E-10	0.2500E-02
0.1409E+02	0.1571E-01	0.7637E-10	0.5000E-02
0.2106E+02	0.2358E-01	0.1146E-09	0.7500E-02
0.2764E+02	0.3130E-01	0.1527E-09	0.1000E-01
0.5551E+02	0.6975E-01	0.3818E-09	0.2500E-01
0.7592E+02	0.1133E+00	0.7637E-09	0.5000E-01
0.8546E+02	0.1470E+00	0.1146E-08	0.7500E-01
0.9048E+02	0.1769E+00	0.1519E-08	0.1000E+00
0.9330E+02	0.3297E+00	0.3454E-08	0.2500E+00
0.9311E+02	0.5795E+00	0.5228E-08	0.5000E+00
0.9293E+02	0.8294E+00	0.6792E-08	0.7500E+00
0.9275E+02	0.1079E+01	0.7872E-08	0.1000E+01
0.9233E+02	0.1679E+01	0.1019E-07	0.1600E+01

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Sound Wall 599 - Ultimate Resistance

TOTAL LOAD = 130.0 TONS

NUMBER OF LAYERS = 2

WATER TABLE DEPTH = 34.2 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 1.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY =*****

SOIL INFORMATION

LAYER NO 1----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04
DEPTH, FT	= 0.335E+02

LAYER NO 2----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.550E+00
END BEARING COEFFICIENT-Nc	= 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.670E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03

MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.700E+04
DEPTH, FT = 0.335E+02

AT THE BOTTOM

STRENGTH REDUCTION FACTOR-ALPHA = 0.550E+00
END BEARING COEFFICIENT-Nc = 0.900E+01
UNDRAINED SHEAR STRENGTH, LB/SQ FT = 0.670E+04
INTERNAL FRICTION ANGLE, DEG. = 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST = 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT = 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT = 0.700E+04
DEPTH, FT = 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM = 1.333 FT.
DIAMETER OF BASE = 1.333 FT.
END OF STEM TO BASE = 0.000 FT.
ANGLE OF BELL = 0.000 DEG.
IGNORED TOP PORTION = 13.490 FT.
IGNORED BOTTOM PORTION = 0.000 FT.
AREA OF ONE PERCENT STEEL = 2.011 SQ.IN.
ELASTIC MODULUS, Ec = 0.360E+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)
14.0	0.72	1.89	0.00	1.89	1.89	1.89	2.61
15.0	0.78	3.92	0.00	3.92	3.92	3.92	5.05
16.0	0.83	6.07	0.00	6.07	6.07	6.07	7.34
17.0	0.88	8.35	0.00	8.35	8.35	8.35	9.50
18.0	0.93	10.77	0.00	10.77	10.77	10.77	11.57
19.0	0.98	13.32	0.00	13.32	13.32	13.32	13.55
20.0	1.03	15.99	0.00	15.99	15.99	15.99	15.46
21.0	1.09	18.80	0.00	18.80	18.80	18.80	17.31
22.0	1.14	21.74	0.00	21.74	21.74	21.74	19.10
23.0	1.19	24.81	0.00	24.81	24.81	24.81	20.85
24.0	1.24	28.00	0.00	28.00	28.00	28.00	22.56
25.0	1.29	31.33	0.00	31.33	31.33	31.33	24.23
26.0	1.34	34.79	0.00	34.79	34.79	34.79	25.88
27.0	1.40	38.39	0.00	38.39	38.39	38.39	27.49

28.0	1.45	42.11	0.00	42.11	42.11	42.11	29.08
29.0	1.50	45.96	0.00	45.96	45.96	45.96	30.64
30.0	1.55	49.94	0.00	49.94	49.94	49.94	32.19
31.0	1.60	54.06	0.00	54.06	54.06	54.06	33.71
32.0	1.66	58.30	0.00	58.30	58.30	58.30	35.23
33.0	1.71	62.67	0.00	62.67	62.67	62.67	36.72
34.0	1.76	70.39	0.00	70.39	70.39	70.39	40.03
35.0	1.81	78.11	0.00	78.11	78.11	78.11	43.15
36.0	1.86	85.83	0.00	85.83	85.83	85.83	46.10
37.0	1.91	93.55	0.00	93.55	93.55	93.55	48.89
38.0	1.97	101.27	0.00	101.27	101.27	101.27	51.53
39.0	2.02	108.99	0.00	108.99	108.99	108.99	54.03
40.0	2.07	116.71	0.00	116.71	116.71	116.71	56.41
41.0	2.12	124.43	0.00	124.43	124.43	124.43	58.68
42.0	2.17	132.14	0.00	132.14	132.14	132.14	60.83

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.6171E+00	0.6276E-03	0.3447E-11	0.1000E-03
0.6234E+01	0.6301E-02	0.3447E-10	0.1000E-02
0.1591E+02	0.1601E-01	0.8619E-10	0.2500E-02
0.3150E+02	0.3208E-01	0.1724E-09	0.5000E-02
0.4572E+02	0.4754E-01	0.2586E-09	0.7500E-02
0.5844E+02	0.6221E-01	0.3447E-09	0.1000E-01
0.9852E+02	0.1180E+00	0.8619E-09	0.2500E-01
0.1261E+03	0.1728E+00	0.1724E-08	0.5000E-01
0.1323E+03	0.2040E+00	0.2586E-08	0.7500E-01
0.1359E+03	0.2328E+00	0.3046E-08	0.1000E+00
0.1341E+03	0.3803E+00	0.4960E-08	0.2500E+00
0.1299E+03	0.6250E+00	0.6328E-08	0.5000E+00
0.1297E+03	0.8749E+00	0.6729E-08	0.7500E+00
0.1296E+03	0.1125E+01	0.6816E-08	0.1000E+01
0.1292E+03	0.1725E+01	0.6919E-08	0.1600E+01

Bastanchury-16inch-Abut2-SB-sw603.sfo
VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Soundwall 603 - Ultimate Resistance - Wall LOL Station 10+00 to 10+08

TOTAL LOAD = 130.0 TONS

NUMBER OF LAYERS = 1

WATER TABLE DEPTH = 35.4 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 1.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY =*****

SOIL INFORMATION

LAYER NO 1----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04
DEPTH, FT	= 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	1.333	FT.
DIAMETER OF BASE	=	1.333	FT.
END OF STEM TO BASE	=	0.000	FT.
ANGLE OF BELL	=	0.000	DEG.
IGNORED TOP PORTION	=	13.490	FT.

IGNORED BOTTOM PORTION = 0.000 FT.
AREA OF ONE PERCENT STEEL = 2.011 SQ.IN.
ELASTIC MODULUS, Ec = 0.360E+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)
14.0	0.72	1.89	0.00	1.89	1.89	1.89	2.61
15.0	0.78	3.92	0.00	3.92	3.92	3.92	5.05
16.0	0.83	6.07	0.00	6.07	6.07	6.07	7.34
17.0	0.88	8.35	0.00	8.35	8.35	8.35	9.50
18.0	0.93	10.77	0.00	10.77	10.77	10.77	11.57
19.0	0.98	13.32	0.00	13.32	13.32	13.32	13.55
20.0	1.03	15.99	0.00	15.99	15.99	15.99	15.46
21.0	1.09	18.80	0.00	18.80	18.80	18.80	17.31
22.0	1.14	21.74	0.00	21.74	21.74	21.74	19.10
23.0	1.19	24.81	0.00	24.81	24.81	24.81	20.85
24.0	1.24	28.00	0.00	28.00	28.00	28.00	22.56
25.0	1.29	31.33	0.00	31.33	31.33	31.33	24.23
26.0	1.34	34.79	0.00	34.79	34.79	34.79	25.88
27.0	1.40	38.39	0.00	38.39	38.39	38.39	27.49
28.0	1.45	42.11	0.00	42.11	42.11	42.11	29.08
29.0	1.50	45.96	0.00	45.96	45.96	45.96	30.64
30.0	1.55	49.94	0.00	49.94	49.94	49.94	32.19
31.0	1.60	54.06	0.00	54.06	54.06	54.06	33.71
32.0	1.66	58.30	0.00	58.30	58.30	58.30	35.23
33.0	1.71	62.67	0.00	62.67	62.67	62.67	36.72
34.0	1.76	67.18	0.00	67.18	67.18	67.18	38.20
35.0	1.81	71.75	0.00	71.75	71.75	71.75	39.64
36.0	1.86	76.38	0.00	76.38	76.38	76.38	41.02
37.0	1.91	81.07	0.00	81.07	81.07	81.07	42.37
38.0	1.97	85.83	0.00	85.83	85.83	85.83	43.67
39.0	2.02	90.65	0.00	90.65	90.65	90.65	44.94
40.0	2.07	95.53	0.00	95.53	95.53	95.53	46.18
41.0	2.12	100.47	0.00	100.47	100.47	100.47	47.38
42.0	2.17	105.48	0.00	105.48	105.48	105.48	48.56
43.0	2.22	110.55	0.00	110.55	110.55	110.55	49.71
44.0	2.28	115.68	0.00	115.68	115.68	115.68	50.83
45.0	2.33	120.88	0.00	120.88	120.88	120.88	51.94
46.0	2.38	126.13	0.00	126.13	126.13	126.13	53.02
47.0	2.43	131.45	0.00	131.45	131.45	131.45	54.08

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.4830E+00	0.5100E-03	0.1527E-10	0.1000E-03

0.4840E+01	0.5102E-02	0.1527E-09	0.1000E-02
0.1233E+02	0.1289E-01	0.3818E-09	0.2500E-02
0.2465E+02	0.2592E-01	0.7637E-09	0.5000E-02
0.3605E+02	0.3856E-01	0.1146E-08	0.7500E-02
0.4632E+02	0.5060E-01	0.1527E-08	0.1000E-01
0.8521E+02	0.1053E+00	0.3818E-08	0.2500E-01
0.1115E+03	0.1596E+00	0.7637E-08	0.5000E-01
0.1233E+03	0.1982E+00	0.1146E-07	0.7500E-01
0.1292E+03	0.2304E+00	0.1519E-07	0.1000E+00
0.1324E+03	0.3845E+00	0.3454E-07	0.2500E+00
0.1321E+03	0.6342E+00	0.5228E-07	0.5000E+00
0.1318E+03	0.8840E+00	0.6792E-07	0.7500E+00
0.1316E+03	0.1134E+01	0.7872E-07	0.1000E+01
0.1310E+03	0.1733E+01	0.1019E-06	0.1600E+01

RollingHills-16inch-Abut1-SB-sw603.sfo
VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Soundwall 603 - Ultimate Resistance - Wall LOL Station 33+82.46 to 33+90.46

TOTAL LOAD = 140.0 TONS

NUMBER OF LAYERS = 1

WATER TABLE DEPTH = 49.5 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 1.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY =*****

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	= 0.800E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.700E+04
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	= 0.800E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.700E+04
DEPTH, FT	= 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	1.333	FT.
DIAMETER OF BASE	=	1.333	FT.
END OF STEM TO BASE	=	0.000	FT.

RollingHills-16inch-Abut1-SB-sw603.sfo

```
ANGLE OF BELL              =    0.000  DEG.
IGNORED TOP PORTION        =   18.420  FT.
IGNORED BOTTOM PORTION     =    4.000  FT.
AREA OF ONE PERCENT STEEL  =    2.011  SQ.IN.
ELASTIC MODULUS, Ec        = 0.360E+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)
23.0	1.19	9.22	0.00	9.22	9.22	9.22	7.75
24.0	1.24	18.43	0.00	18.43	18.43	18.43	14.85
25.0	1.29	27.65	0.00	27.65	27.65	27.65	21.38
26.0	1.34	36.87	0.00	36.87	36.87	36.87	27.42
27.0	1.40	46.08	0.00	46.08	46.08	46.08	33.00
28.0	1.45	55.30	0.00	55.30	55.30	55.30	38.19
29.0	1.50	64.52	0.00	64.52	64.52	64.52	43.01
30.0	1.55	73.73	0.00	73.73	73.73	73.73	47.52
31.0	1.60	82.95	0.00	82.95	82.95	82.95	51.74
32.0	1.66	92.17	0.00	92.17	92.17	92.17	55.69
33.0	1.71	101.38	0.00	101.38	101.38	101.38	59.40
34.0	1.76	110.60	0.00	110.60	110.60	110.60	62.89
35.0	1.81	119.81	0.00	119.81	119.81	119.81	66.19
36.0	1.86	129.03	0.00	129.03	129.03	129.03	69.30
37.0	1.91	138.25	0.00	138.25	138.25	138.25	72.24
38.0	1.97	147.46	0.00	147.46	147.46	147.46	75.03

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.1192E+01	0.7584E-03	0.3447E-10	0.1000E-03
0.1298E+02	0.8018E-02	0.3447E-09	0.1000E-02
0.3293E+02	0.2037E-01	0.8619E-09	0.2500E-02
0.6135E+02	0.3989E-01	0.1724E-08	0.5000E-02
0.8369E+02	0.5699E-01	0.2586E-08	0.7500E-02
0.1014E+03	0.7191E-01	0.3447E-08	0.1000E-01
0.1488E+03	0.1235E+00	0.8619E-08	0.2500E-01
0.1749E+03	0.1713E+00	0.1724E-07	0.5000E-01
0.1779E+03	0.1989E+00	0.2586E-07	0.7500E-01
0.1798E+03	0.2258E+00	0.3046E-07	0.1000E+00
0.1673E+03	0.3680E+00	0.4960E-07	0.2500E+00
0.1586E+03	0.6108E+00	0.6328E-07	0.5000E+00
0.1586E+03	0.8608E+00	0.6729E-07	0.7500E+00
0.1586E+03	0.1111E+01	0.6816E-07	0.1000E+01
0.1586E+03	0.1711E+01	0.6919E-07	0.1600E+01

RollingHills-16inch-Abut2-SB-sw627.sfo
VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Soundwall 627 - Ultimate Resistance

TOTAL LOAD = 140.0 TONS

NUMBER OF LAYERS = 1

WATER TABLE DEPTH = 50.4 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 1.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY =*****

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	= 0.800E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.700E+04
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	= 0.800E+04
INTERNAL FRICTION ANGLE, DEG.	= 0.000E+00
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.700E+04
DEPTH, FT	= 0.100E+03

DRILLED SHAFT INFORMATION

DIAMETER OF STEM	=	1.333	FT.
DIAMETER OF BASE	=	1.333	FT.
END OF STEM TO BASE	=	0.000	FT.

RollingHills-16inch-Abut2-SB-sw627.sfo

```
ANGLE OF BELL              =    0.000  DEG.
IGNORED TOP PORTION        =   18.360  FT.
IGNORED BOTTOM PORTION     =    0.000  FT.
AREA OF ONE PERCENT STEEL  =    2.011  SQ.IN.
ELASTIC MODULUS, Ec        = 0.360E+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)
19.0	0.98	9.22	0.00	9.22	9.22	9.22	9.38
20.0	1.03	18.43	0.00	18.43	18.43	18.43	17.82
21.0	1.09	27.65	0.00	27.65	27.65	27.65	25.46
22.0	1.14	36.87	0.00	36.87	36.87	36.87	32.40
23.0	1.19	46.08	0.00	46.08	46.08	46.08	38.74
24.0	1.24	55.30	0.00	55.30	55.30	55.30	44.55
25.0	1.29	64.52	0.00	64.52	64.52	64.52	49.90
26.0	1.34	73.73	0.00	73.73	73.73	73.73	54.83
27.0	1.40	82.95	0.00	82.95	82.95	82.95	59.40
28.0	1.45	92.17	0.00	92.17	92.17	92.17	63.64
29.0	1.50	101.38	0.00	101.38	101.38	101.38	67.59
30.0	1.55	110.60	0.00	110.60	110.60	110.60	71.28
31.0	1.60	119.81	0.00	119.81	119.81	119.81	74.73
32.0	1.66	129.03	0.00	129.03	129.03	129.03	77.96
33.0	1.71	138.25	0.00	138.25	138.25	138.25	81.00
34.0	1.76	147.46	0.00	147.46	147.46	147.46	83.86

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.1613E+01	0.9621E-03	0.3447E-10	0.1000E-03
0.1776E+02	0.1029E-01	0.3447E-09	0.1000E-02
0.4430E+02	0.2601E-01	0.8619E-09	0.2500E-02
0.7953E+02	0.4980E-01	0.1724E-08	0.5000E-02
0.1061E+03	0.7003E-01	0.2586E-08	0.7500E-02
0.1262E+03	0.8705E-01	0.3447E-08	0.1000E-01
0.1788E+03	0.1439E+00	0.8619E-08	0.2500E-01
0.2068E+03	0.1943E+00	0.1724E-07	0.5000E-01
0.2100E+03	0.2221E+00	0.2586E-07	0.7500E-01
0.2117E+03	0.2491E+00	0.3046E-07	0.1000E+00
0.1966E+03	0.3895E+00	0.4960E-07	0.2500E+00
0.1871E+03	0.6314E+00	0.6328E-07	0.5000E+00
0.1871E+03	0.8814E+00	0.6729E-07	0.7500E+00
0.1871E+03	0.1131E+01	0.6816E-07	0.1000E+01
0.1871E+03	0.1731E+01	0.6919E-07	0.1600E+01

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Retaining Wall 670 - Ultimate Resistance

TOTAL LOAD = 90.0 TONS

NUMBER OF LAYERS = 3

WATER TABLE DEPTH = 22.0 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 1.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY =*****

SOIL INFORMATION

LAYER NO 1----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04
DEPTH, FT	= 0.220E+02

LAYER NO 2----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.900E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.300E+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	= 0.400E+04

```
  DEPTH, FT                                          = 0.220E+02


  AT THE BOTTOM

  LATERAL EARTH-PRESSURE COEFFICIENT-K               = 0.900E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                      = 0.300E+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           = 0.400E+04
  DEPTH, FT                                          = 0.310E+02


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.460E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.560E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
  DEPTH, FT                                          = 0.310E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                    = 0.460E+00
  END BEARING COEFFICIENT-Nc                         = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                 = 0.560E+04
  INTERNAL FRICTION ANGLE, DEG.                      = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST      = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                         = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT           = 0.400E+04
  DEPTH, FT                                          = 0.100E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    1.333  FT.
 DIAMETER OF BASE          =    1.333  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   23.000  FT.
 IGNORED BOTTOM PORTION    =    1.333  FT.
 AREA OF ONE PERCENT STEEL =    2.011  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.360E+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)
25.0	1.29	1.50	0.00	1.50	1.50	1.50	1.16
26.0	1.34	3.07	0.00	3.07	3.07	3.07	2.28
27.0	1.40	4.70	0.00	4.70	4.70	4.70	3.37
28.0	1.45	6.40	0.00	6.40	6.40	6.40	4.42
29.0	1.50	8.15	0.00	8.15	8.15	8.15	5.43
30.0	1.55	9.97	0.00	9.97	9.97	9.97	6.43
31.0	1.60	11.85	0.00	11.85	11.85	11.85	7.39
32.0	1.65	13.79	0.00	13.79	13.79	13.79	8.33
33.0	1.71	19.19	0.00	19.19	19.19	19.19	11.24
34.0	1.76	24.59	0.00	24.59	24.59	24.59	13.98
35.0	1.81	29.98	0.00	29.98	29.98	29.98	16.56
36.0	1.86	35.38	0.00	35.38	35.38	35.38	19.00
37.0	1.91	40.77	0.00	40.77	40.77	40.77	21.31
38.0	1.97	46.17	0.00	46.17	46.17	46.17	23.49
39.0	2.02	51.56	0.00	51.56	51.56	51.56	25.56
40.0	2.07	56.96	0.00	56.96	56.96	56.96	27.53
41.0	2.12	62.36	0.00	62.36	62.36	62.36	29.41
42.0	2.17	67.75	0.00	67.75	67.75	67.75	31.19
43.0	2.22	73.15	0.00	73.15	73.15	73.15	32.89
44.0	2.28	78.54	0.00	78.54	78.54	78.54	34.52
45.0	2.33	83.94	0.00	83.94	83.94	83.94	36.07
46.0	2.38	89.33	0.00	89.33	89.33	89.33	37.55
47.0	2.43	94.73	0.00	94.73	94.73	94.73	38.97

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2753E+00	0.3736E-03	0.3447E-10	0.1000E-03
0.2753E+01	0.3736E-02	0.3447E-09	0.1000E-02
0.7030E+01	0.9444E-02	0.8618E-09	0.2500E-02
0.1418E+02	0.1902E-01	0.1724E-08	0.5000E-02
0.2103E+02	0.2845E-01	0.2586E-08	0.7500E-02
0.2757E+02	0.3773E-01	0.3447E-08	0.1000E-01
0.4913E+02	0.7594E-01	0.8618E-08	0.2500E-01
0.6493E+02	0.1188E+00	0.1724E-07	0.5000E-01
0.6797E+02	0.1466E+00	0.2586E-07	0.7500E-01
0.6990E+02	0.1737E+00	0.3046E-07	0.1000E+00
0.6830E+02	0.3214E+00	0.4959E-07	0.2500E+00
0.6532E+02	0.5676E+00	0.6327E-07	0.5000E+00
0.6526E+02	0.8176E+00	0.6729E-07	0.7500E+00
0.6521E+02	0.1068E+01	0.6816E-07	0.1000E+01
0.6508E+02	0.1667E+01	0.6919E-07	0.1600E+01

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Retaining Wall 698 - Ultimate Resistance - Wall LOL Station 12+45 to 18+71

TOTAL LOAD = 90.0 TONS

NUMBER OF LAYERS = 3

WATER TABLE DEPTH = 68.0 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 1.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY =*****

SOIL INFORMATION

LAYER NO 1----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.700E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.260E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.400E+04
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.700E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.260E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03
MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT	= 0.400E+04
DEPTH, FT	= 0.570E+02

LAYER NO 2----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.700E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.260E+02
BLOWS PER FOOT FROM STANDARD PENETRATION TEST	= 0.000E+00
SOIL UNIT WEIGHT, LB/CU FT	= 0.130E+03

```
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.400E+04
  DEPTH, FT                                         = 0.570E+02


  AT THE BOTTOM

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.700E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.260E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.400E+04
  DEPTH, FT                                         = 0.680E+02


LAYER NO 3----SAND

  AT THE TOP

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.700E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.260E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.400E+04
  DEPTH, FT                                         = 0.680E+02


  AT THE BOTTOM

  LATERAL EARTH-PRESSURE COEFFICIENT-K              = 0.700E+00
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                = 0.000E+00
  INTERNAL FRICTION ANGLE, DEG.                     = 0.260E+02
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST     = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                        = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT          = 0.400E+04
  DEPTH, FT                                         = 0.100E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    1.333  FT.
 DIAMETER OF BASE          =    1.333  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   14.000  FT.
 IGNORED BOTTOM PORTION    =    1.333  FT.
 AREA OF ONE PERCENT STEEL =    2.011  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.360E+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);
```

RW 698 - 45tons - wall.sfo

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)
16.0	0.83	1.39	0.00	1.39	1.39	1.39	1.69
17.0	0.88	2.88	0.00	2.88	2.88	2.88	3.28
18.0	0.93	4.46	0.00	4.46	4.46	4.46	4.79
19.0	0.98	6.14	0.00	6.14	6.14	6.14	6.24
20.0	1.03	7.90	0.00	7.90	7.90	7.90	7.64
21.0	1.09	9.76	0.00	9.76	9.76	9.76	8.99
22.0	1.14	11.72	0.00	11.72	11.72	11.72	10.30
23.0	1.19	13.76	0.00	13.76	13.76	13.76	11.57
24.0	1.24	15.90	0.00	15.90	15.90	15.90	12.81
25.0	1.29	18.13	0.00	18.13	18.13	18.13	14.02
26.0	1.34	20.46	0.00	20.46	20.46	20.46	15.21
27.0	1.40	22.87	0.00	22.87	22.87	22.87	16.38
28.0	1.45	25.38	0.00	25.38	25.38	25.38	17.53
29.0	1.50	27.99	0.00	27.99	27.99	27.99	18.66
30.0	1.55	30.68	0.00	30.68	30.68	30.68	19.78
31.0	1.60	33.47	0.00	33.47	33.47	33.47	20.88
32.0	1.65	36.35	0.00	36.35	36.35	36.35	21.97
33.0	1.71	39.33	0.00	39.33	39.33	39.33	23.04
34.0	1.76	42.40	0.00	42.40	42.40	42.40	24.11
35.0	1.81	45.56	0.00	45.56	45.56	45.56	25.17
36.0	1.86	48.81	0.00	48.81	48.81	48.81	26.22
37.0	1.91	52.16	0.00	52.16	52.16	52.16	27.26
38.0	1.97	55.60	0.00	55.60	55.60	55.60	28.29
39.0	2.02	59.13	0.00	59.13	59.13	59.13	29.32
40.0	2.07	62.76	0.00	62.76	62.76	62.76	30.34
41.0	2.12	66.48	0.00	66.48	66.48	66.48	31.35
42.0	2.17	70.29	0.00	70.29	70.29	70.29	32.36
43.0	2.22	74.20	0.00	74.20	74.20	74.20	33.36
44.0	2.28	78.19	0.00	78.19	78.19	78.19	34.36
45.0	2.33	82.29	0.00	82.29	82.29	82.29	35.36
46.0	2.38	86.47	0.00	86.47	86.47	86.47	36.35
47.0	2.43	90.75	0.00	90.75	90.75	90.75	37.33

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.2737E+00	0.3447E-03	0.1527E-11	0.1000E-03
0.2737E+01	0.3447E-02	0.1527E-10	0.1000E-02
0.6911E+01	0.8650E-02	0.3818E-10	0.2500E-02
0.1394E+02	0.1740E-01	0.7637E-10	0.5000E-02
0.2076E+02	0.2609E-01	0.1145E-09	0.7500E-02
0.2716E+02	0.3458E-01	0.1527E-09	0.1000E-01
0.5377E+02	0.7616E-01	0.3818E-09	0.2500E-01
0.7302E+02	0.1219E+00	0.7637E-09	0.5000E-01
0.8193E+02	0.1566E+00	0.1145E-08	0.7500E-01
0.8659E+02	0.1870E+00	0.1519E-08	0.1000E+00
0.8919E+02	0.3402E+00	0.3454E-08	0.2500E+00
0.8900E+02	0.5900E+00	0.5228E-08	0.5000E+00
0.8883E+02	0.8398E+00	0.6792E-08	0.7500E+00
0.8866E+02	0.1090E+01	0.7872E-08	0.1000E+01
0.8826E+02	0.1689E+01	0.1019E-07	0.1600E+01

VERTICALLY LOADED DRILLED SHAFT ANALYSIS PROGRAM SHAFT
VERSION 5.0 (C) COPYRIGHT ENSOFT,INC. 1989,1995,1998,2001,2003

Retaining Wall 698 - Ultimate Resistance - Wall LOL Station 12+25 to 12+45

TOTAL LOAD = 90.0 TONS

NUMBER OF LAYERS = 3

WATER TABLE DEPTH = 68.0 FT.

FACTOR OF SAFETY APPLIED TO THE TOTAL ULTIMATE CAPACITY = 1.00

FACTOR OF SAFETY APPLIED TO THE ULTIMATE BASE CAPACITY =*****

SOIL INFORMATION

LAYER NO 1----SAND

AT THE TOP

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.700E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.260E+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	= 0.400E+04
DEPTH, FT	= 0.000E+00

AT THE BOTTOM

LATERAL EARTH-PRESSURE COEFFICIENT-K	= 0.700E+00
UNDRAINED SHEAR STRENGTH, LB/SQ FT	= 0.000E+00
INTERNAL FRICTION ANGLE, DEG.	= 0.260E+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	= 0.400E+04
DEPTH, FT	= 0.570E+02

LAYER NO 2----CLAY

AT THE TOP

STRENGTH REDUCTION FACTOR-ALPHA	= 0.460E+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                          = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.400E+04
  DEPTH, FT                                           = 0.570E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.460E+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                          = 0.120E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.400E+04
  DEPTH, FT                                           = 0.680E+02


LAYER NO 3----CLAY

  AT THE TOP

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.460E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                       = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.400E+04
  DEPTH, FT                                           = 0.680E+02


  AT THE BOTTOM

  STRENGTH REDUCTION FACTOR-ALPHA                     = 0.460E+00
  END BEARING COEFFICIENT-Nc                          = 0.900E+01
  UNDRAINED SHEAR STRENGTH, LB/SQ FT                  = 0.400E+04
  INTERNAL FRICTION ANGLE, DEG.                       = 0.000E+00
  BLOWS PER FOOT FROM STANDARD PENETRATION TEST       = 0.000E+00
  SOIL UNIT WEIGHT, LB/CU FT                          = 0.130E+03
  MAXIMUM LOAD TRANSFER FOR SOIL, LB/SQ FT            = 0.400E+04
  DEPTH, FT                                           = 0.100E+03



DRILLED SHAFT INFORMATION
-------------------------

 DIAMETER OF STEM          =    1.333  FT.
 DIAMETER OF BASE          =    1.333  FT.
 END OF STEM TO BASE       =    0.000  FT.
 ANGLE OF BELL             =    0.000  DEG.
 IGNORED TOP PORTION       =   26.000  FT.
 IGNORED BOTTOM PORTION    =    1.333  FT.
 AREA OF ONE PERCENT STEEL =    2.011  SQ.IN.
 ELASTIC MODULUS, Ec       = 0.360E+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)
28.0	1.45	2.32	0.00	2.32	2.32	2.32	1.60
29.0	1.50	4.72	0.00	4.72	4.72	4.72	3.15
30.0	1.55	7.21	0.00	7.21	7.21	7.21	4.65
31.0	1.60	9.78	0.00	9.78	9.78	9.78	6.10
32.0	1.65	12.44	0.00	12.44	12.44	12.44	7.52
33.0	1.71	15.19	0.00	15.19	15.19	15.19	8.90
34.0	1.76	18.02	0.00	18.02	18.02	18.02	10.25
35.0	1.81	20.94	0.00	20.94	20.94	20.94	11.57
36.0	1.86	23.95	0.00	23.95	23.95	23.95	12.86
37.0	1.91	27.03	0.00	27.03	27.03	27.03	14.13
38.0	1.97	30.21	0.00	30.21	30.21	30.21	15.37
39.0	2.02	33.47	0.00	33.47	33.47	33.47	16.60
40.0	2.07	36.82	0.00	36.82	36.82	36.82	17.80
41.0	2.12	40.25	0.00	40.25	40.25	40.25	18.98
42.0	2.17	43.77	0.00	43.77	43.77	43.77	20.15
43.0	2.22	47.38	0.00	47.38	47.38	47.38	21.30
44.0	2.28	51.07	0.00	51.07	51.07	51.07	22.44
45.0	2.33	54.84	0.00	54.84	54.84	54.84	23.56
46.0	2.38	58.70	0.00	58.70	58.70	58.70	24.68
47.0	2.43	62.65	0.00	62.65	62.65	62.65	25.78
48.0	2.48	66.69	0.00	66.69	66.69	66.69	26.86
49.0	2.53	70.81	0.00	70.81	70.81	70.81	27.94
50.0	2.59	75.01	0.00	75.01	75.01	75.01	29.01
51.0	2.64	79.30	0.00	79.30	79.30	79.30	30.07
52.0	2.69	83.68	0.00	83.68	83.68	83.68	31.12
53.0	2.74	88.14	0.00	88.14	88.14	88.14	32.16
54.0	2.79	92.69	0.00	92.69	92.69	92.69	33.19

TOP LOAD ton	TOP MOVEMENT IN.	TIP LOAD ton	TIP MOVEMENT IN.
0.3729E+00	0.4646E-03	0.3447E-11	0.1000E-03
0.3753E+01	0.4655E-02	0.3447E-10	0.1000E-02
0.9586E+01	0.1180E-01	0.8618E-10	0.2500E-02
0.1919E+02	0.2370E-01	0.1724E-09	0.5000E-02
0.2819E+02	0.3534E-01	0.2586E-09	0.7500E-02
0.3643E+02	0.4653E-01	0.3447E-09	0.1000E-01
0.6835E+02	0.9829E-01	0.8618E-09	0.2500E-01
0.9042E+02	0.1509E+00	0.1724E-08	0.5000E-01
0.1003E+03	0.1886E+00	0.2586E-08	0.7500E-01
0.1054E+03	0.2206E+00	0.3046E-08	0.1000E+00
0.1082E+03	0.3745E+00	0.4959E-08	0.2500E+00
0.1079E+03	0.6242E+00	0.6327E-08	0.5000E+00
0.1077E+03	0.8740E+00	0.6729E-08	0.7500E+00
0.1075E+03	0.1124E+01	0.6816E-08	0.1000E+01
0.1070E+03	0.1723E+01	0.6919E-08	0.1600E+01

Lateral Pile Analysis

==========

LPILE Plus for Windows, Version 5.0 (5.0.17)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

(c) 1985-2005 by Ensoft, Inc.
All Rights Reserved

==========

This program is licensed to:

Hisham Nofal
CH2MHill

Path to file locations: C:\MyFolder\Projects\SR-57\Final Reports\Retaining Walls\Pile Foundation\SW 581 3' diameter pipe\Lateral Pile analysis\
Name of input data file: RW581.lpd
Name of output file: RW581.lpo
Name of plot output file: RW581.lpp
Name of runtime file: RW581.lpr

Time and Date of Analysis

Date: April 14, 2009 Time: 15: 4: 0

Problem Title

SW 581- p-multiplier = 0.41

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 =         1000
- Deflection tolerance for convergence =   10.000E-12 in
- Maximum allowable deflection         =   1.0000E+01 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                                 =     240.00 in
Depth of ground surface below top of pile =     -96.00 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   16.00000000    1608.0000     201.0000      3600000.
  2     240.0000   16.00000000    1608.0000     201.0000      3600000.


--------------------------------------------------------------------------------
                      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    =      -96.000 in
Distance from top of pile to bottom of layer =        1.000 in
p-y subgrade modulus k for top of soil layer =      225.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      225.000 lbs/in**3

Layer  2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =        1.000 in
Distance from top of pile to bottom of layer =      264.000 in
p-y subgrade modulus k for top of soil layer =      225.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      225.000 lbs/in**3

Layer  3 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer    =      264.000 in
Distance from top of pile to bottom of layer =     1000.000 in
p-y subgrade modulus k for top of soil layer =      225.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      225.000 lbs/in**3


(Depth of lowest layer extends  760.00 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	-96.00	.06900
2	1.00	.06900
3	1.00	.06900
4	264.00	.06900
5	264.00	.06900
6	1000.00	.06900

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	-96.000	.00000	38.00	------	------
2	1.000	.00000	38.00	------	------
3	1.000	.00000	38.00	------	------
4	264.000	.00000	38.00	------	------
5	264.000	.00000	38.00	------	------
6	1000.000	.00000	38.00	------	------

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	1.0000	1.0000
2	1000.000	1.0000	1.0000

Loading Type

Cyclic loading criteria was used for computation of p-y curves

Number of cycles of loading = 1000.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

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 = .750 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 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

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	53844.0949	-.0071351	0.0000	-1536.4733
2.400	.232876	124801.	49834.8992	-.0071092	620.8994	-1804.5231
4.800	.215876	239208.	45492.7449	-.0070338	1190.0871	-1813.9388
7.200	.199114	343166.	41135.0624	-.0069130	1707.2933	-1817.4633
9.600	.182693	436656.	36776.1837	-.0067514	2172.4170	-1814.9356
12.000	.166707	519692.	32430.8045	-.0065531	2585.5306	-1806.2137
14.400	.151238	592324.	28113.9400	-.0063226	2946.8840	-1791.1734
16.800	.136358	654639.	23840.8824	-.0060641	3256.9082	-1769.7079
19.200	.122130	706760.	19627.1619	-.0057819	3516.2185	-1741.7258
21.600	.108605	748849.	15488.5131	-.0054802	3725.6166	-1707.1481
24.000	.095825	781105.	11440.8512	-.0051630	3886.0934	-1665.9034
26.400	.083823	803765.	7500.2620	-.0048345	3998.8309	-1617.9209
28.800	.072620	817106.	3683.0136	-.0044985	4065.2041	-1563.1194

31.200	.062230	821443.	5.6003	-.0041588	4086.7835	-1501.3917
33.600	.052658	817133.	-3515.1643	-.0038191	4065.3379	-1432.5788
36.000	.043898	804571.	-6861.9772	-.0034830	4002.8393	-1356.4319
38.400	.035939	784195.	-9873.4363	-.0031536	3901.4698	-1153.1174
40.800	.028761	757178.	-12383.1661	-.0028341	3767.0557	-938.3242
43.200	.022336	724756.	-14398.0731	-.0025269	3605.7524	-740.7651
45.600	.016632	688067.	-15959.6791	-.0022340	3423.2211	-560.5732
48.000	.011612	648150.	-17109.5672	-.0019570	3224.6257	-397.6668
50.400	.007238	605942.	-17888.8954	-.0016971	3014.6345	-251.7733
52.800	.003466	562283.	-18337.9680	-.0014549	2797.4282	-122.4539
55.200	.000254	517919.	-18495.8652	-.0012310	2576.7128	-9.1272
57.600	-.002442	473503.	-18400.1290	-.0010255	2355.7359	88.9074
60.000	-.004668	429599.	-18086.5030	-.0008382	2137.3068	172.4477
62.400	-.006466	386688.	-17588.7239	-.0006690	1923.8194	242.3682
64.800	-.007879	345173.	-16938.3621	-.0005173	1717.2775	299.5999
67.200	-.008949	305384.	-16164.7072	-.0003825	1519.3212	345.1126
69.600	-.009715	267582.	-15294.6945	-.0002637	1331.2547	379.8980
72.000	-.010215	231969.	-14352.8706	-.0001601	1154.0748	404.9552
74.400	-.010483	198688.	-13361.3924	-7.0853E-05	988.4996	421.2767
76.800	-.010555	167834.	-12340.0557	5.1257E-06	834.9967	429.8373
79.200	-.010459	139456.	-11306.3507	6.8826E-05	693.8117	431.5835
81.600	-.010224	113564.	-10275.5401	.0001213	564.9943	427.4253
84.000	-.009877	90133.5519	-9260.7551	.0001635	448.4256	418.2289
86.400	-.009439	69112.2388	-8273.1074	.0001965	343.8420	404.8109
88.800	-.008933	50422.6364	-7321.8131	.0002213	250.8589	387.9344
91.200	-.008377	33967.5360	-6414.3251	.0002388	168.9927	368.3056
93.600	-.007787	19633.8757	-5556.4721	.0002499	97.6810	346.5719
96.000	-.007178	7296.4697	-4752.6006	.0002555	36.3008	323.3210
98.400	-.006561	-3178.6071	-4005.7182	.0002563	15.8140	299.0809
100.800	-.005947	-11930.9778	-3317.6365	.0002532	59.3581	274.3206
103.200	-.005346	-19103.2621	-2689.1100	.0002468	95.0411	249.4515
105.600	-.004763	-24838.7057	-2119.9724	.0002377	123.5757	224.8298
108.000	-.004205	-29279.1297	-1609.2661	.0002264	145.6673	200.7588
110.400	-.003676	-32563.1830	-1155.3653	.0002136	162.0059	177.4918
112.800	-.003179	-34824.8833	-756.0924	.0001997	173.2581	155.2356
115.200	-.002718	-36192.4264	-408.8250	.0001849	180.0618	134.1538
117.600	-.002292	-36787.2433	-110.5958	.0001698	183.0211	114.3704
120.000	-.001903	-36723.2864	141.8171	.0001546	182.7029	95.9737
122.400	-.001550	-36106.5213	351.8089	.0001395	179.6344	79.0195
124.800	-.001233	-35034.6037	522.8751	.0001247	174.3015	63.5357
127.200	-.000951	-33596.7207	658.5475	.0001105	167.1479	49.5247
129.600	-.000703	-31873.5756	762.3385	9.6920E-05	158.5750	36.9678
132.000	-.000486	-29937.4958	837.6937	8.4106E-05	148.9428	25.8281
134.400	-.000299	-27852.6461	887.9516	7.2127E-05	138.5704	16.0535
136.800	-.000140	-25675.3279	916.3117	6.1031E-05	127.7379	7.5798
139.200	-6.09E-06	-23454.3500	925.8074	5.0846E-05	116.6883	.3332456
141.600	.000104	-21231.4526	919.2868	4.1583E-05	105.6291	-5.7670
144.000	.000194	-19041.7733	899.3983	3.3234E-05	94.7352	-10.8067
146.400	.000264	-16914.3409	868.5808	2.5781E-05	84.1509	-14.8745
148.800	.000317	-14872.5855	829.0593	1.9191E-05	73.9930	-18.0601
151.200	.000356	-12934.8562	782.8436	1.3427E-05	64.3525	-20.4530
153.600	.000382	-11114.9363	731.7306	8.4416E-06	55.2982	-22.1412
156.000	.000396	-9422.5495	677.3096	4.1843E-06	46.8784	-23.2096
158.400	.000402	-7863.8502	620.9699	6.0085E-07	39.1236	-23.7401
160.800	.000399	-6441.8939	563.9101	-2.3647E-06	32.0492	-23.8098
163.200	.000390	-5157.0818	507.1490	-4.7691E-06	25.6571	-23.4911
165.600	.000376	-4007.5786	451.5380	-6.6689E-06	19.9382	-22.8514
168.000	.000358	-2989.6994	397.7736	-8.1194E-06	14.8741	-21.9523
170.400	.000337	-2098.2655	346.4108	-9.1742E-06	10.4391	-20.8500
172.800	.000314	-1326.9275	297.8770	-9.8842E-06	6.6016	-19.5949
175.200	.000290	-668.4558	252.4850	-1.0298E-05	3.3257	-18.2319
177.600	.000265	-114.9996	210.4463	-1.0460E-05	.5721376	-16.8003
180.000	.000240	341.6866	171.8846	-1.0413E-05	1.6999	-15.3344

182.400	.000215	710.0465	136.8473	-1.0195E-05	3.5326	-13.8633
184.800	.000191	998.5537	105.3178	-9.8410E-06	4.9679	-12.4113
187.200	.000168	1215.5719	77.2262	-9.3821E-06	6.0476	-10.9984
189.600	.000146	1369.2393	52.4595	-8.8462E-06	6.8121	-9.6405
192.000	.000125	1467.3777	30.8713	-8.2582E-06	7.3004	-8.3497
194.400	.000106	1517.4218	12.2900	-7.6395E-06	7.5494	-7.1348
196.800	8.86E-05	1526.3695	-3.4737	-7.0085E-06	7.5939	-6.0016
199.200	7.26E-05	1500.7482	-16.6191	-6.3810E-06	7.4664	-4.9530
201.600	5.80E-05	1446.5977	-27.3505	-5.7700E-06	7.1970	-3.9898
204.000	4.49E-05	1369.4657	-35.8713	-5.1862E-06	6.8133	-3.1108
206.400	3.31E-05	1274.4156	-42.3795	-4.6382E-06	6.3404	-2.3128
208.800	2.26E-05	1166.0440	-47.0644	-4.1323E-06	5.8012	-1.5913
211.200	1.33E-05	1048.5064	-50.1031	-3.6732E-06	5.2164	-.9409056
213.600	4.96E-06	925.5492	-51.6582	-3.2640E-06	4.6047	-.3549976
216.000	-2.41E-06	800.5472	-51.8759	-2.9062E-06	3.9828	.1735185
218.400	-8.99E-06	676.5446	-50.8851	-2.6000E-06	3.3659	.6521789
220.800	-1.49E-05	556.2987	-48.7960	-2.3444E-06	2.7677	1.0887
223.200	-2.02E-05	442.3237	-45.7006	-2.1374E-06	2.2006	1.4909
225.600	-2.51E-05	336.9360	-41.6722	-1.9759E-06	1.6763	1.8661
228.000	-2.97E-05	242.2971	-36.7669	-1.8558E-06	1.2055	2.2216
230.400	-3.41E-05	160.4546	-31.0243	-1.7723E-06	.7982817	2.5639
232.800	-3.82E-05	93.3802	-24.4692	-1.7197E-06	.4645781	2.8988
235.200	-4.23E-05	43.0026	-17.1134	-1.6914E-06	.2139433	3.2310
237.600	-4.63E-05	11.2358	-8.9589	-1.6802E-06	.0558994	3.5644
240.000	-5.04E-05	0.0000	0.0000	-1.6778E-06	0.0000	3.9013

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      =     -.00713509
Maximum bending moment           =   821443.48186 lbs-in
Maximum shear force              =    53844.09490 lbs
Depth of maximum bending moment  =    31.20000000 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 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	85041.0367	-.0132316	0.0000	-2250.4385
2.400	.468244	197617.	79191.0677	-.0131906	983.1703	-2624.5356
4.800	.436685	380117.	72895.2887	-.0130709	1891.1300	-2621.9469
7.200	.405504	547515.	66612.6274	-.0128786	2723.9533	-2613.6041

9.600	.374868	699858.	60356.2480	-.0126200	3481.8793	-2600.0454
12.000	.344928	837225.	54137.9631	-.0123014	4165.2965	-2581.8587
14.400	.315821	959720.	47968.1217	-.0119289	4774.7262	-2559.6758
16.800	.287669	1067472.	41855.5131	-.0115086	5310.8039	-2534.1647
19.200	.260580	1160626.	35807.4884	-.0110468	5774.2608	-2505.8559
21.600	.234645	1239348.	29835.3479	-.0105493	6165.9081	-2470.9279
24.000	.209943	1303836.	23957.3100	-.0100221	6486.7467	-2427.4370
26.400	.186539	1354343.	18194.0624	-.0094710	6738.0230	-2375.2693
28.800	.164482	1391168.	12566.5604	-.0089019	6921.2318	-2314.3156
31.200	.143810	1414662.	7096.0266	-.0083203	7038.1199	-2244.4625
33.600	.124545	1425229.	1803.9778	-.0077316	7090.6892	-2165.5782
36.000	.106698	1423321.	-3287.7060	-.0071411	7081.2000	-2077.4917
38.400	.090268	1409448.	-8156.6496	-.0065538	7012.1768	-1979.9614
40.800	.075240	1384169.	-12779.7541	-.0059747	6886.4143	-1872.6257
43.200	.061589	1348105.	-17132.8124	-.0054083	6706.9886	-1754.9230
45.600	.049280	1301932.	-21189.8682	-.0048590	6477.2726	-1625.9568
48.000	.038266	1246393.	-24713.5264	-.0043307	6200.9619	-1310.4250
50.400	.028492	1183307.	-27475.3698	-.0038271	5887.0988	-991.1112
52.800	.019896	1114512.	-29508.1042	-.0033507	5544.8337	-702.8342
55.200	.012409	1041668.	-30885.5609	-.0029038	5182.4276	-445.0464
57.600	.005958	966261.	-31679.9035	-.0024875	4807.2680	-216.9057
60.000	.000469	889604.	-31960.9733	-.0021028	4425.8926	-17.3192
62.400	-.004135	812848.	-31795.7385	-.0017499	4044.0209	155.0149
64.800	-.007931	736985.	-31247.8406	-.0014286	3666.5914	301.5666
67.200	-.010993	662859.	-30377.2365	-.0011384	3297.8038	423.9368
69.600	-.013395	591174.	-29239.9260	-.0008785	2941.1649	523.8219
72.000	-.015209	522507.	-27887.7624	-.0006476	2599.5369	602.9811
74.400	-.016504	457313.	-26368.3365	-.0004445	2275.1885	663.2071
76.800	-.017343	395939.	-24724.9284	-.0002676	1969.8453	706.2996
79.200	-.017788	338633.	-22996.5192	-.0001154	1684.7424	734.0414
81.600	-.017897	285556.	-21217.8560	1.4037E-05	1420.6747	748.1779
84.000	-.017721	236788.	-19419.5627	.0001223	1178.0473	750.3998
86.400	-.017310	192342.	-17628.2895	.0002113	956.9240	742.3278
88.800	-.016707	152172.	-15866.8955	.0002827	757.0733	725.5006
91.200	-.015953	116181.	-14154.6563	.0003383	578.0130	701.3654
93.600	-.015083	84229.3756	-12507.4927	.0003799	419.0516	671.2709
96.000	-.014129	56144.6533	-10938.2135	.0004090	279.3266	636.4617
98.400	-.013120	31725.9507	-9456.7681	.0004272	157.8406	598.0761
100.800	-.012079	10752.1665	-8070.5037	.0004360	53.4934	557.1442
103.200	-.011027	-7012.4670	-6784.4241	.0004368	34.8879	514.5888
105.600	-.009983	-21813.0693	-5601.4454	.0004308	108.5227	471.2268
108.000	-.008960	-33899.4050	-4522.6457	.0004192	168.6538	427.7729
110.400	-.007970	-43521.7688	-3547.5069	.0004032	216.5262	384.8428
112.800	-.007024	-50927.4383	-2674.1453	.0003836	253.3703	342.9586
115.200	-.006129	-56357.6663	-1899.5299	.0003614	280.3864	302.5543
117.600	-.005290	-60045.1819	-1219.6870	.0003372	298.7322	263.9815
120.000	-.004510	-62212.1638	-629.8895	.0003119	309.5133	227.5163
122.400	-.003793	-63068.6516	-124.8314	.0002859	313.7744	193.3654
124.800	-.003138	-62811.3548	301.2145	.0002598	312.4943	161.6729
127.200	-.002545	-61622.8219	654.2547	.0002340	306.5812	132.5272
129.600	-.002014	-59670.9322	940.4482	.0002089	296.8703	105.9673
132.000	-.001543	-57108.6707	1165.9963	.0001847	284.1227	81.9894
134.400	-.001128	-54074.1501	1337.0468	.0001616	269.0256	60.5527
136.800	-.000767	-50690.8460	1459.6128	.0001399	252.1933	41.5856
139.200	-.000456	-47068.0088	1539.5045	.0001197	234.1692	24.9909
141.600	-.000193	-43301.2243	1582.2746	.0001009	215.4290	10.6509
144.000	2.81E-05	-39473.0908	1593.1742	8.3759E-05	196.3835	-1.5679
146.400	.000209	-35653.9882	1577.1204	6.8185E-05	177.3830	-11.8103
148.800	.000355	-31902.9129	1538.6731	5.4181E-05	158.7210	-20.2291
151.200	.000470	-28268.3572	1482.0207	4.1707E-05	140.6386	-26.9813
153.600	.000556	-24789.2136	1410.9729	3.0709E-05	123.3294	-32.2252
156.000	.000617	-21495.6873	1328.9610	2.1114E-05	106.9437	-36.1180
158.400	.000657	-18410.2007	1239.0434	1.2842E-05	91.5930	-38.8133

160.800	.000679	-15548.2790	1143.9159	5.8021E-06	77.3546	-40.4596
163.200	.000685	-12919.4043	1045.9264	-9.9132E-08	64.2756	-41.1984
165.600	.000678	-10527.8325	947.0920	-4.9597E-06	52.3773	-41.1635
168.000	.000661	-8373.3626	849.1199	-8.8778E-06	41.6585	-40.4799
170.400	.000635	-6452.0570	753.4284	-1.1951E-05	32.0998	-39.2630
172.800	.000604	-4756.9062	661.1707	-1.4275E-05	23.6662	-37.6184
175.200	.000567	-3278.4376	573.2583	-1.5940E-05	16.3106	-35.6419
177.600	.000527	-2005.2663	490.3853	-1.7036E-05	9.9764	-33.4189
180.000	.000485	-924.5882	413.0521	-1.7643E-05	4.5999	-31.0253
182.400	.000442	-22.6160	341.5891	-1.7839E-05	.1125176	-28.5272
184.800	.000400	715.0396	276.1790	-1.7696E-05	3.5574	-25.9813
187.200	.000357	1303.0430	216.8784	-1.7277E-05	6.4828	-23.4358
189.600	.000317	1756.0558	163.6386	-1.6643E-05	8.7366	-20.9306
192.000	.000278	2088.5084	116.3246	-1.5846E-05	10.3906	-18.4977
194.400	.000241	2314.4139	74.7326	-1.4934E-05	11.5145	-16.1623
196.800	.000206	2447.2247	38.6064	-1.3947E-05	12.1752	-13.9429
199.200	.000174	2499.7246	7.6523	-1.2921E-05	12.4364	-11.8522
201.600	.000144	2483.9559	-18.4477	-1.1888E-05	12.3580	-9.8978
204.000	.000117	2411.1758	-40.0243	-1.0873E-05	11.9959	-8.0827
206.400	9.17E-05	2291.8394	-57.4104	-9.8983E-06	11.4022	-6.4058
208.800	6.90E-05	2135.6058	-70.9324	-8.9806E-06	10.6249	-4.8625
211.200	4.86E-05	1951.3640	-80.9022	-8.1333E-06	9.7083	-3.4457
213.600	3.00E-05	1747.2751	-87.6117	-7.3666E-06	8.6929	-2.1455
216.000	1.32E-05	1530.8278	-91.3271	-6.6871E-06	7.6161	-.9506279
218.400	-2.09E-06	1308.9049	-92.2856	-6.0984E-06	6.5120	.1518827
220.800	-1.61E-05	1087.8568	-90.6926	-5.6016E-06	5.4122	1.1757
223.200	-2.90E-05	873.5806	-86.7200	-5.1950E-06	4.3462	2.1348
225.600	-4.10E-05	671.6009	-80.5061	-4.8747E-06	3.3413	3.0434
228.000	-5.24E-05	487.1512	-72.1560	-4.6345E-06	2.4236	3.9150
230.400	-6.33E-05	325.2520	-61.7431	-4.4660E-06	1.6182	4.7624
232.800	-7.38E-05	190.7845	-49.3117	-4.3591E-06	.9491766	5.5971
235.200	-8.42E-05	88.5560	-34.8809	-4.3012E-06	.4405771	6.4286
237.600	-9.45E-05	23.3562	-18.4492	-4.2780E-06	.1161998	7.2645
240.000	-.000105	0.0000	0.0000	-4.2731E-06	0.0000	8.1098

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      =     -.01323161
Maximum bending moment           =       1425229. lbs-in
Maximum shear force              =    85041.03671 lbs
Depth of maximum bending moment  =    33.60000000 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 3

```
Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head   =         .750000 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	.750000	0.0000	111307.	-.0189981	0.0000	-2535.7054
2.400	.704405	259833.	104566.	-.0189442	1292.7017	-3081.2558
4.800	.659068	501918.	97014.2287	-.0187863	2497.1048	-3212.1053
7.200	.614230	725501.	89144.9080	-.0185319	3609.4594	-3345.6620
9.600	.570115	929814.	81092.2814	-.0181887	4625.9384	-3364.8601
12.000	.526924	1114744.	73066.5821	-.0177649	5545.9915	-3323.2226
14.400	.484843	1280533.	65148.5609	-.0172684	6370.8120	-3275.1284
16.800	.444036	1427457.	57352.6687	-.0167070	7101.7780	-3221.4484
19.200	.404649	1555826.	49691.2135	-.0160886	7740.4280	-3163.0975
21.600	.366811	1665975.	42174.2665	-.0154207	8288.4339	-3101.0250
24.000	.330630	1758262.	34809.5907	-.0147109	8747.5746	-3036.2049
26.400	.296199	1833061.	27602.5936	-.0139664	9119.7077	-2969.6260
28.800	.263591	1890755.	20556.3636	-.0131945	9406.7410	-2902.2324
31.200	.232865	1931732.	13679.2685	-.0124021	9610.6059	-2828.6802
33.600	.204061	1956415.	6991.1581	-.0115961	9733.4101	-2744.7451
36.000	.177204	1965289.	517.1369	-.0107831	9777.5590	-2650.2726
38.400	.152302	1958898.	-5717.2709	-.0099697	9745.7597	-2545.0673
40.800	.129349	1937846.	-11685.9838	-.0091619	9641.0271	-2428.8601
43.200	.108325	1902805.	-17362.1257	-.0083657	9466.6914	-2301.2581
45.600	.089194	1854508.	-22717.6315	-.0075868	9226.4092	-2161.6634
48.000	.071908	1793760.	-27722.5950	-.0068306	8924.1808	-2009.1394
50.400	.056407	1721440.	-32344.1708	-.0061019	8564.3771	-1842.1737
52.800	.042619	1638508.	-36361.4027	-.0054054	8151.7827	-1505.5196
55.200	.030461	1546905.	-39479.0213	-.0047451	7696.0451	-1092.4959
57.600	.019843	1449009.	-41656.8688	-.0041240	7209.0001	-722.3770
60.000	.010666	1346952.	-42996.5902	-.0035444	6701.2542	-394.0575
62.400	.002830	1242625.	-43596.7389	-.0030076	6182.2159	-106.0665
64.800	-.003770	1137688.	-43551.9721	-.0025142	5660.1380	143.3721
67.200	-.009238	1033576.	-42952.3872	-.0020641	5142.1688	356.2819
69.600	-.013678	931516.	-41882.9926	-.0016567	4634.4094	534.8803
72.000	-.017191	832538.	-40423.3039	-.0012910	4141.9779	681.5270
74.400	-.019875	737484.	-38647.0575	-.0009656	3669.0767	798.6783
76.800	-.021825	647032.	-36622.0309	-.0006786	3219.0631	888.8439
79.200	-.023132	561699.	-34409.9592	-.0004280	2794.5208	954.5491
81.600	-.023880	481864.	-32066.5396	-.0002117	2397.3327	998.3005
84.000	-.024148	407779.	-29641.5114	-2.7256E-05	2028.7527	1022.5564
86.400	-.024011	339585.	-27178.8022	.0001277	1689.4757	1029.7013
88.800	-.023535	277321.	-24716.7308	.0002556	1379.7066	1022.0248
91.200	-.022784	220944.	-22288.2575	.0003588	1099.2254	1001.7030
93.600	-.021813	170337.	-19921.2712	.0004400	847.4497	970.7856
96.000	-.020672	125322.	-17638.9068	.0005012	623.4936	931.1847
98.400	-.019407	85670.6466	-15459.8840	.0005450	426.2221	884.6675
100.800	-.018056	51114.7674	-13398.8607	.0005733	254.3023	832.8519
103.200	-.016655	21356.1151	-11466.7934	.0005884	106.2493	777.2042
105.600	-.015232	-3925.8409	-9671.3005	.0005920	19.5315	719.0399
108.000	-.013813	-25066.1271	-8017.0219	.0005860	124.7071	659.5256
110.400	-.012420	-42407.5460	-6505.9713	.0005720	210.9828	599.6833
112.800	-.011068	-56294.7894	-5137.8763	.0005515	280.0736	540.3959
115.200	-.009772	-67069.3525	-3910.5047	.0005259	333.6784	482.4139
117.600	-.008543	-75065.2118	-2819.9724	.0004965	373.4588	426.3630
120.000	-.007389	-80605.2201	-1861.0334	.0004642	401.0210	372.7528
122.400	-.006315	-83998.1721	-1027.3476	.0004301	417.9014	321.9853
124.800	-.005325	-85536.4887	-311.7280	.0003949	425.5547	274.3643
127.200	-.004420	-85494.4667	293.6352	.0003595	425.3456	230.1050
129.600	-.003599	-84127.0396	796.9730	.0003243	418.5425	189.3431
132.000	-.002863	-81668.9963	1206.7575	.0002900	406.3134	152.1440
134.400	-.002208	-78334.6038	1531.5446	.0002568	389.7244	118.5120
136.800	-.001630	-74317.5821	1779.8377	.0002251	369.7392	88.3989

139.200	-.001127	-69791.3828	1959.9709	.0001953	347.2208	61.7121
141.600	-.000693	-64909.7219	2080.0120	.0001673	322.9339	38.3222
144.000	-.000324	-59807.3252	2147.6833	.0001415	297.5489	18.0705
146.400	-1.38E-05	-54600.8421	2170.2985	.0001178	271.6460	.7754736
148.800	.000242	-49389.8923	2154.7153	9.6220E-05	245.7209	-13.7615
151.200	.000448	-44258.2089	2107.3010	7.6808E-05	220.1901	-25.7504
153.600	.000610	-39274.8477	2033.9112	5.9491E-05	195.3973	-35.4077
156.000	.000734	-34495.4349	1939.8791	4.4199E-05	171.6191	-42.9524
158.400	.000823	-29963.4279	1830.0137	3.0837E-05	149.0718	-48.6022
160.800	.000882	-25711.3694	1708.6067	1.9296E-05	127.9173	-52.5703
163.200	.000915	-21762.1157	1579.4468	9.4546E-06	108.2692	-55.0630
165.600	.000927	-18130.0250	1445.8382	1.1851E-06	90.1991	-56.2774
168.000	.000921	-14822.0922	1310.6256	-5.6458E-06	73.7418	-56.3998
170.400	.000900	-11839.0223	1176.2206	-1.1173E-05	58.9006	-55.6043
172.800	.000867	-9176.2332	1044.6331	-1.5529E-05	45.6529	-54.0520
175.200	.000825	-6824.7834	917.5023	-1.8846E-05	33.9541	-51.8904
177.600	.000777	-4772.2221	796.1303	-2.1250E-05	23.7424	-49.2530
180.000	.000723	-3003.3580	681.5154	-2.2862E-05	14.9421	-46.2594
182.400	.000667	-1500.9482	574.3854	-2.3796E-05	7.4674	-43.0155
184.800	.000609	-246.3079	475.2304	-2.4158E-05	1.2254	-39.6137
187.200	.000551	780.1576	384.3341	-2.4047E-05	3.8814	-36.1332
189.600	.000494	1598.4956	301.8045	-2.3554E-05	7.9527	-32.6414
192.000	.000438	2228.8192	227.6025	-2.2761E-05	11.0887	-29.1936
194.400	.000385	2690.9877	161.5686	-2.1741E-05	13.3880	-25.8346
196.800	.000334	3004.3486	103.4480	-2.0560E-05	14.9470	-22.5992
199.200	.000286	3187.5380	52.9134	-1.9277E-05	15.8584	-19.5130
201.600	.000241	3258.3327	9.5859	-1.7940E-05	16.2106	-16.5933
204.000	.000200	3233.5503	-26.9462	-1.6595E-05	16.0873	-13.8501
206.400	.000162	3128.9911	-57.1108	-1.5276E-05	15.5671	-11.2871
208.800	.000126	2959.4183	-81.3378	-1.4014E-05	14.7235	-8.9020
211.200	9.42E-05	2738.5697	-100.0459	-1.2832E-05	13.6247	-6.6881
213.600	6.48E-05	2479.1978	-113.6326	-1.1751E-05	12.3343	-4.6342
216.000	3.78E-05	2193.1330	-122.4652	-1.0782E-05	10.9111	-2.7263
218.400	1.31E-05	1891.3650	-126.8738	-9.9355E-06	9.4098	-.9475868
220.800	-9.85E-06	1584.1389	-127.1466	-9.2150E-06	7.8813	.7202301
223.200	-3.12E-05	1281.0613	-123.5263	-8.6211E-06	6.3734	2.2967
225.600	-5.12E-05	991.2125	-116.2085	-8.1500E-06	4.9314	3.8016
228.000	-7.03E-05	723.2606	-105.3414	-7.7946E-06	3.5983	5.2544
230.400	-8.86E-05	485.5740	-91.0278	-7.5440E-06	2.4158	6.6736
232.800	-.000107	286.3273	-73.3282	-7.3840E-06	1.4245	8.0760
235.200	-.000124	133.5986	-52.2658	-7.2970E-06	.6646694	9.4760
237.600	-.000142	35.4514	-27.8330	-7.2619E-06	.1763750	10.8847
240.000	-.000159	0.0000	0.0000	-7.2546E-06	0.0000	12.3095

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =      .75000000 in
Computed slope at pile head      =     -.01899809
Maximum bending moment           =       1965289. lbs-in
Maximum shear force              =   111306.61540 lbs
Depth of maximum bending moment  =    36.00000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             17
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 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	129988.	-.0244683	0.0000	-2535.7054
2.400	.941276	304670.	123248.	-.0244052	1515.7688	-3081.2558
4.800	.882855	591591.	115696.	-.0242194	2943.2390	-3212.1053
7.200	.825023	860011.	107827.	-.0239185	4278.6608	-3345.6620
9.600	.768047	1109160.	99633.6744	-.0235103	5518.2069	-3481.9260
12.000	.712174	1338252.	91110.2864	-.0230029	6657.9724	-3620.8973
14.400	.657633	1546489.	82250.1186	-.0224049	7693.9749	-3762.5759
16.800	.604630	1733053.	73046.6735	-.0217251	8622.1544	-3906.9617
19.200	.553352	1897113.	63748.7555	-.0209726	9438.3731	-3841.3033
21.600	.503962	2039047.	54639.6007	-.0201566	10144.5127	-3749.6590
24.000	.456601	2159383.	45755.7193	-.0192863	10743.1994	-3653.5755
26.400	.411388	2258675.	37106.3022	-.0183704	11237.1866	-3554.2721
28.800	.368423	2337493.	28697.5995	-.0174177	11629.3200	-3452.9801
31.200	.327783	2396423.	20532.9059	-.0164363	11922.5024	-3350.9312
33.600	.289528	2436051.	12612.5756	-.0154346	12119.6581	-3249.3441
36.000	.253697	2456963.	4935.2386	-.0144203	12223.6982	-3148.4367
38.400	.220311	2459740.	-2489.0732	-.0134011	12237.5145	-3038.4898
40.800	.189372	2445016.	-9635.1034	-.0123843	12164.2577	-2916.5354
43.200	.160866	2413492.	-16473.6651	-.0113772	12007.4225	-2782.2660
45.600	.134762	2365942.	-22974.6648	-.0103864	11770.8567	-2635.2337
48.000	.111011	2303214.	-29106.6584	-.0094185	11458.7738	-2474.7610
50.400	.089553	2226230.	-34836.1219	-.0084796	11075.7724	-2299.7919
52.800	.070310	2136000.	-40126.2284	-.0075753	10626.8664	-2108.6302
55.200	.053192	2033624.	-44934.7113	-.0067109	10117.5341	-1898.4389
57.600	.038097	1920314.	-48877.1483	-.0058913	9553.7987	-1386.9253
60.000	.024913	1799014.	-51645.9676	-.0051203	8950.3186	-920.4241
62.400	.013520	1672413.	-53358.6187	-.0044007	8320.4621	-506.7852
64.800	.003790	1542893.	-54139.7030	-.0037341	7676.0829	-144.1184
67.200	-.004404	1412542.	-54108.8243	-.0031215	7027.5737	169.8506
69.600	-.011193	1283170.	-53379.7554	-.0025627	6383.9319	437.7068
72.000	-.016705	1156319.	-52059.7753	-.0020570	5752.8333	662.2766
74.400	-.021067	1033283.	-50249.1668	-.0016031	5140.7134	846.5638
76.800	-.024400	915123.	-48040.8620	-.0011992	4552.8532	993.6902
79.200	-.026823	802687.	-45520.2234	-.0008431	3993.4689	1106.8419
81.600	-.028447	696626.	-42764.9483	-.0005323	3465.8031	1189.2207
84.000	-.029378	597415.	-39845.0815	-.0002640	2972.2164	1244.0016
86.400	-.029714	505370.	-36823.1255	-3.5434E-05	2514.2787	1274.2951
88.800	-.029548	420664.	-33754.2329	.0001565	2092.8582	1283.1154
91.200	-.028963	343350.	-30686.4702	.0003149	1708.2075	1273.3535
93.600	-.028036	273369.	-27661.1398	.0004428	1360.0470	1247.7551
96.000	-.026838	210576.	-24713.1497	.0005431	1047.6430	1208.9033
98.400	-.025429	154746.	-21871.4190	.0006188	769.8822	1159.2056
100.800	-.023867	105593.	-19159.3103	.0006728	525.3404	1100.8849
103.200	-.022200	62781.6305	-16595.0794	.0007077	312.3464	1035.9742
105.600	-.020471	25937.0456	-14192.3336	.0007261	129.0400	966.3140
108.000	-.018715	-5341.5706	-11960.4925	.0007303	26.5750	893.5536
110.400	-.016965	-31473.3182	-9905.2434	.0007227	156.5837	819.1539
112.800	-.015246	-52886.7391	-8028.9869	.0007052	263.1181	744.3932
115.200	-.013580	-70012.4554	-6331.2666	.0006797	348.3207	670.3738

117.600	-.011983	-83276.8187	-4809.1801	.0006480	414.3125	598.0316
120.000	-.010470	-93096.5201	-3457.7682	.0006114	463.1668	528.1451
122.400	-.009049	-99874.1061	-2270.3781	.0005714	496.8861	461.3467
124.800	-.007727	-103994.	-1239.0013	.0005291	517.3848	398.1340
127.200	-.006509	-105821.	-354.5827	.0004856	526.4742	338.8815
129.600	-.005396	-105696.	392.6980	.0004418	525.8524	283.8524
132.000	-.004388	-103936.	1013.1735	.0003983	517.0963	233.2106
134.400	-.003484	-100833.	1517.4653	.0003559	501.6572	187.0326
136.800	-.002680	-96652.5286	1916.2864	.0003150	480.8584	145.3183
139.200	-.001972	-91634.9245	2220.2716	.0002759	455.8951	108.0027
141.600	-.001355	-85995.2249	2439.8332	.0002391	427.8369	74.9653
144.000	-.000824	-79923.7252	2585.0401	.0002047	397.6305	46.0404
146.400	-.000373	-73587.0326	2665.5200	.0001729	366.1046	21.0261
148.800	5.41E-06	-67129.2294	2690.3821	.0001437	333.9763	-.3077086
151.200	.000317	-60673.1986	2668.1587	.0001172	301.8567	-18.2117
153.600	.000568	-54322.0674	2606.7642	9.3381E-05	270.2590	-32.9503
156.000	.000765	-48160.7303	2513.4690	7.2137E-05	239.6056	-44.7957
158.400	.000914	-42257.4165	2394.8870	5.3394E-05	210.2359	-54.0225
160.800	.001021	-36665.2725	2256.9759	3.7033E-05	182.4143	-60.9034
163.200	.001092	-31423.9321	2105.0459	2.2919E-05	156.3380	-65.7049
165.600	.001131	-26561.0521	1943.7784	1.0899E-05	132.1445	-68.6847
168.000	.001144	-22093.7959	1777.2508	8.1252E-07	109.9194	-70.0883
170.400	.001135	-18030.2482	1608.9678	-7.5051E-06	89.7027	-70.1476
172.800	.001108	-14370.7506	1441.8958	-1.4222E-05	71.4963	-69.0790
175.200	.001067	-11109.1482	1278.5022	-1.9504E-05	55.2694	-67.0823
177.600	.001015	-8233.9401	1120.7951	-2.3513E-05	40.9649	-64.3402
180.000	.000954	-5729.3317	970.3656	-2.6408E-05	28.5041	-61.0177
182.400	.000888	-3576.1853	828.4297	-2.8337E-05	17.7920	-57.2622
184.800	.000818	-1752.8690	695.8707	-2.9442E-05	8.7207	-53.2037
187.200	.000747	-236.0061	573.2795	-2.9854E-05	1.1742	-48.9556
189.600	.000675	998.8727	460.9953	-2.9696E-05	4.9695	-44.6146
192.000	.000604	1976.7713	359.1429	-2.9079E-05	9.8347	-40.2624
194.400	.000535	2722.7584	267.6689	-2.8105E-05	13.5461	-35.9659
196.800	.000469	3261.5819	186.3755	-2.6864E-05	16.2268	-31.7786
199.200	.000406	3617.3608	114.9515	-2.5438E-05	17.9968	-27.7414
201.600	.000347	3813.3492	53.0010	-2.3898E-05	18.9719	-23.8840
204.000	.000292	3871.7656	.0692667	-2.2305E-05	19.2625	-20.2258
206.400	.000240	3813.6817	-44.3338	-2.0712E-05	18.9735	-16.7768
208.800	.000192	3658.9632	-80.7133	-1.9163E-05	18.2038	-13.5394
211.200	.000148	3426.2577	-109.5711	-1.7694E-05	17.0461	-10.5087
213.600	.000107	3133.0219	-131.3905	-1.6334E-05	15.5872	-7.6741
216.000	6.97E-05	2795.5833	-146.6235	-1.5105E-05	13.9084	-5.0201
218.400	3.48E-05	2429.2289	-155.6804	-1.4022E-05	12.0857	-2.5273
220.800	2.37E-06	2048.3174	-158.9215	-1.3094E-05	10.1906	-.1736150
223.200	-2.80E-05	1666.4058	-156.6519	-1.2324E-05	8.2906	2.0650
225.600	-5.68E-05	1296.3884	-149.1179	-1.1710E-05	6.4497	4.2133
228.000	-8.42E-05	950.6399	-136.5062	-1.1244E-05	4.7296	6.2964
230.400	-.000111	641.1584	-118.9453	-1.0914E-05	3.1898	8.3378
232.800	-.000137	379.7027	-96.5085	-1.0702E-05	1.8891	10.3595
235.200	-.000162	177.9178	-69.2207	-1.0587E-05	.8851632	12.3803
237.600	-.000187	47.4436	-37.0662	-1.0540E-05	.2360376	14.4150
240.000	-.000213	0.0000	0.0000	-1.0530E-05	0.0000	16.4735

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

Pile-head deflection = 1.00000000 in
Computed slope at pile head = -.02446832
Maximum bending moment = 2459740. lbs-in

```
Maximum shear force              =   129988.48740 lbs
Depth of maximum bending moment  =    38.40000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             19
Number of zero deflection points =              3
```

Summary of Pile-Head 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	Boundary Condition 1	Boundary 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	821443.	53844.0949
4	y= .500000	M= 0.000	0.0000	.5000000	1425229.	85041.0367
4	y= .750000	M= 0.000	0.0000	.7500000	1965289.	111307.
4	y= 1.000000	M= 0.000	0.0000	1.0000000	2459740.	129988.

The analysis ended normally.

```
==============================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.39)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

                        (c) 1985-2007 by Ensoft, Inc.
                             All Rights Reserved

==============================================================================


This program is licensed to:

Hisham Nofal
CH2MHILL

Path to file locations:      C:\MyFolder\Projects\SR-57\Foundation Reports\Draft Foundation
Reports\Rolling Hills Drive UC\Foundation Design\Lateral Pile Analysis\Southbound Widening\
Name of input data file:     ROLHILL-UC0-SW603.lpd
Name of output file:         ROLHILL-UC0-SW603.lpo
Name of plot output file:    ROLHILL-UC0-SW603.lpp
Name of runtime file:        ROLHILL-UC0-SW603.lpr


------------------------------------------------------------------------------
                          Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  August 17, 2009     Time:  10:56:52


------------------------------------------------------------------------------
                                Problem Title
------------------------------------------------------------------------------
Soundwall 603 and 627 Lateral Capacity


------------------------------------------------------------------------------
                                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
- Additional p-y curves computed at specified depths

Solution Control Parameters:
- Number of pile increments            =          100
- Maximum number of iterations allowed =         1000
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+01 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 = 192.00 in

Depth of ground surface below top of pile = -160.32 in

Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	16.00000000	1608.3300	201.0500	3600000.
2	192.0000	16.00000000	1608.3300	201.0500	3600000.

Soil and Rock Layering Information

The soil profile is modelled using 3 layers

Layer 1 is stiff clay without free water using initial selected k, 2004
Distance from top of pile to top of layer =
Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -160.320 in
Distance from top of pile to bottom of layer = 12.000 in
p-y subgrade modulus k for top of soil layer = 800.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 800.000 lbs/in**3

Layer 2 is stiff clay without free water using initial selected k, 2004
Distance from top of pile to top of layer =
Layer 2 is stiff clay without free water
Distance from top of pile to top of layer = 12.000 in
Distance from top of pile to bottom of layer = 444.960 in
p-y subgrade modulus k for top of soil layer = 800.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 800.000 lbs/in**3

Layer 3 is stiff clay without free water using initial selected k, 2004
Distance from top of pile to top of layer =
Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 444.960 in
Distance from top of pile to bottom of layer = 644.280 in
p-y subgrade modulus k for top of soil layer = 800.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 800.000 lbs/in**3

(Depth of lowest layer extends 452.28 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-160.32	.07500
2	12.00	.07500
3	12.00	.07500
4	444.96	.07500
5	444.96	.03900

6	644.28	.03900

Shear Strength of Soils

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	-160.320	55.00000	.00	.02000	.0
2	12.000	55.00000	.00	.02000	.0
3	12.000	55.00000	.00	.02000	.0
4	444.960	55.00000	.00	.02000	.0
5	444.960	55.00000	.00	.02000	.0
6	644.280	55.00000	.00	.02000	.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	1.0000	1.0000
2	1000.000	1.0000	1.0000

Loading Type

Cyclic loading criteria was used for computation of p-y curves.

Number of cycles of loading = 1000.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

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     =            .750 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 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



--------------------------------------------------------------------------------
                    Output of p-y Curves at Specified Depths
--------------------------------------------------------------------------------



p-y curves are generated and printed for verification at  5 depths.

Depth      Depth Below Pile Head      Depth Below Ground Surface
 No.                 in                          in
-----      ---------------------      --------------------------
  1                24.000                     184.320
  2                48.000                     208.320
  3                72.000                     232.320
  4                96.000                     256.320
  5               120.000                     280.320

Depth of ground surface below top of pile =    -160.32 in


p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

Soil Layer Number           =          2
Depth below pile head       =       24.000 in
Depth below ground surface  =      184.320 in
Equivalent Depth            =      184.163 in
Diameter                    =       16.000 in
Undrained cohesion, c       =     55.00000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =         800. pci
Epsilon-50                  =       .02000
Pct                         =     7925.492 lbs/in
Pcd                         =     7920.000 lbs/in
Pu                          =     7920.000 lbs/in
y50                         =         .800 in
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.

        y, in            p, lbs/in
----------------    -----------------
         0.0000           0.0000
       .0001280          18.8583
       .0006400          94.2917
       .0012800         188.5834
       .0064000         915.5418
       .0128000        1088.7688
```

.0640000	1628.0891
.1280000	1936.1351
.3200000	2434.5611
.6400000	2895.1974
.9600000	3204.0626
1.2800	3442.9893
3.2000	4329.3298
6.4000	5148.4698
12.8000	6122.5970
28.8000	7498.6193
44.8000	7920.0000

p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

```
Soil Layer Number           =          2
Depth below pile head       =       48.000 in
Depth below ground surface  =      208.320 in
Equivalent Depth            =      208.163 in
Diameter                    =       16.000 in
Undrained cohesion, c       =     55.00000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =         800. pci
Epsilon-50                  =       .02000
Pct                         =     8614.292 lbs/in
Pcd                         =     7920.000 lbs/in
Pu                          =     7920.000 lbs/in
y50                         =         .800 in
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.
```

y, in	p, lbs/in
0.0000	0.0000
.0001280	21.3159
.0006400	106.5797
.0012800	213.1594
.0064000	915.5418
.0128000	1088.7688
.0640000	1628.0891
.1280000	1936.1351
.3200000	2434.5611
.6400000	2895.1974
.9600000	3204.0626
1.2800	3442.9893
3.2000	4329.3298
6.4000	5148.4698
12.8000	6122.5970
28.8000	7498.6193
44.8000	7920.0000

p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

```
Soil Layer Number           =          2
Depth below pile head       =       72.000 in
Depth below ground surface  =      232.320 in
Equivalent Depth            =      232.163 in
Diameter                    =       16.000 in
Undrained cohesion, c       =     55.00000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =         800. pci
Epsilon-50                  =       .02000
Pct                         =     9303.092 lbs/in
Pcd                         =     7920.000 lbs/in
Pu                          =     7920.000 lbs/in
y50                         =         .800 in
```

```
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.
```

y, in	p, lbs/in
0.0000	0.0000
.0001280	23.7735
.0006400	118.8677
.0012800	237.7354
.0064000	915.5418
.0128000	1088.7688
.0640000	1628.0891
.1280000	1936.1351
.3200000	2434.5611
.6400000	2895.1974
.9600000	3204.0626
1.2800	3442.9893
3.2000	4329.3298
6.4000	5148.4698
12.8000	6122.5970
28.8000	7498.6193
44.8000	7920.0000

p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

```
Soil Layer Number           =          2
Depth below pile head       =       96.000 in
Depth below ground surface  =      256.320 in
Equivalent Depth            =      256.163 in
Diameter                    =       16.000 in
Undrained cohesion, c       =     55.00000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =         800. pci
Epsilon-50                  =       .02000
Pct                         =     9991.892 lbs/in
Pcd                         =     7920.000 lbs/in
Pu                          =     7920.000 lbs/in
y50                         =         .800 in
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.
```

y, in	p, lbs/in
0.0000	0.0000
.0001280	26.2311
.0006400	131.1557
.0012800	262.3114
.0064000	915.5418
.0128000	1088.7688
.0640000	1628.0891
.1280000	1936.1351
.3200000	2434.5611
.6400000	2895.1974
.9600000	3204.0626
1.2800	3442.9893
3.2000	4329.3298
6.4000	5148.4698
12.8000	6122.5970
28.8000	7498.6193
44.8000	7920.0000

p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

```
Soil Layer Number           =          2
```

```
Depth below pile head       =      120.000 in
Depth below ground surface  =      280.320 in
Equivalent Depth            =      280.163 in
Diameter                    =       16.000 in
Undrained cohesion, c       =     55.00000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =         800. pci
Epsilon-50                  =       .02000
Pct                         =    10680.692 lbs/in
Pcd                         =     7920.000 lbs/in
Pu                          =     7920.000 lbs/in
y50                         =         .800 in
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.
```

y, in	p, lbs/in
0.0000	0.0000
.0001280	28.6887
.0006400	143.4437
.0012800	286.8874
.0064000	915.5418
.0128000	1088.7688
.0640000	1628.0891
.1280000	1936.1351
.3200000	2434.5611
.6400000	2895.1974
.9600000	3204.0626
1.2800	3442.9893
3.2000	4329.3298
6.4000	5148.4698
12.8000	6122.5970
28.8000	7498.6193
44.8000	7920.0000

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	Es*h F/L lbs/in
0.000	.250000	0.0000	59782.1094	-.0073807	0.0000	-2092.6788	8035.8867
1.920	.235829	110924.	55778.1902	-.0073623	551.7496	-2078.0703	16918.5856
3.840	.221729	214188.	51803.9668	-.0073084	1065.3945	-2061.7456	17853.1193
5.760	.207765	309852.	47862.7398	-.0072215	1541.2342	-2043.6992	18886.2574
7.680	.193998	397981.	43957.8230	-.0071041	1979.5996	-2023.9225	20030.7441
9.600	.180485	478650.	40092.5499	-.0069588	2380.8532	-2002.4038	21301.5640
11.520	.167277	551937.	36270.2793	-.0067879	2745.3896	-1979.1281	22716.4176
13.440	.154420	617928.	32495.5074	-.0065939	3073.6357	-1952.9260	24282.0120
15.360	.141956	676719.	28771.6419	-.0063793	3366.0719	-1926.1006	26051.1352
17.280	.129923	728411.	25101.0328	-.0061463	3623.1901	-1897.4506	28040.4634
19.200	.118354	773107.	21487.2142	-.0058973	3845.5157	-1866.9437	30286.4973
21.120	.107277	810922.	17933.7885	-.0056347	4033.6079	-1834.5414	32833.7707
23.040	.096717	841973.	14444.4390	-.0053607	4188.0610	-1800.1976	35737.0970
24.960	.086692	866388.	11029.9819	-.0050774	4309.5048	-1756.5286	38902.2988
26.880	.077220	884328.	7705.5118	-.0047871	4398.7398	-1706.4610	42429.6914
28.800	.068310	895977.	4478.5366	-.0044919	4456.6843	-1654.9715	46516.6354

30.720	.059971	901526.	1351.8518	-.0041939	4484.2824	-1601.9918	51288.8983
32.640	.052205	901168.	-1671.5946	-.0038950	4482.5055	-1547.4315	56911.3000
34.560	.045014	895107.	-4588.6533	-.0035972	4452.3540	-1491.1713	63603.9583
36.480	.038392	883548.	-7395.9074	-.0033023	4394.8596	-1433.0517	71667.4510
38.400	.032333	866707.	-10089.5797	-.0030121	4311.0880	-1372.8569	81523.2610
40.320	.026826	844804.	-12665.3994	-.0027283	4202.1430	-1310.2887	93781.7495
42.240	.021856	818071.	-15118.4040	-.0024526	4069.1718	-1244.9244	109363.
44.160	.017408	786749.	-17442.6293	-.0021865	3913.3731	-1176.1436	129724.
46.080	.013460	751092.	-19630.5998	-.0019315	3736.0079	-1102.9924	157336.
48.000	.009991	711368.	-21672.4254	-.0016891	3538.4177	-1023.9094	196777.
49.920	.006974	667870.	-23554.0311	-.0014604	3322.0525	-936.0965	257715.
51.840	.004383	620920.	-25166.2706	-.0012467	3088.5225	-743.3197	325637.
53.760	.002187	571231.	-26239.1233	-.0010490	2841.3627	-374.2352	328586.
55.680	.000354	520162.	-26657.1463	-.0008681	2587.3406	-61.2055	331536.
57.600	-.001147	468868.	-26524.1359	-.0007041	2332.1963	199.7579	334485.
59.520	-.002349	418310.	-25936.0145	-.0005570	2080.7149	412.8686	337434.
61.440	-.003285	369273.	-24980.5015	-.0004264	1836.8040	582.4575	340383.
63.360	-.003987	322384.	-23736.9770	-.0003117	1603.5733	712.8804	343332.
65.280	-.004482	278123.	-22276.5114	-.0002122	1383.4145	808.4380	346281.
67.200	-.004801	236843.	-20682.9342	-.0001268	1178.0796	851.5382	340524.
69.120	-.004969	198701.	-19040.8703	-5.4559E-05	988.3589	858.9450	331873.
71.040	-.005011	163726.	-17389.9420	5.5327E-06	814.3883	860.7719	329824.
72.960	-.004948	131924.	-15739.8296	5.4552E-05	656.2013	858.0951	332968.
74.880	-.004801	103285.	-14098.4398	9.3551E-05	513.7488	851.6860	340581.
76.800	-.004589	77785.5221	-12472.3830	.0001236	386.9132	842.1231	352351.
78.720	-.004327	55390.7482	-10870.1401	.0001457	275.5193	826.8799	366925.
80.640	-.004030	36044.1842	-9331.1304	.0001608	179.2875	776.2553	369874.
82.560	-.003709	19559.2077	-7894.4744	.0001700	97.2895	720.2613	372823.
84.480	-.003377	5729.4024	-6568.6111	.0001742	28.4986	660.8463	375772.
86.400	-.003040	-5664.2591	-5358.4966	.0001742	28.1746	599.6897	378722.
88.320	-.002708	-14847.2245	-4266.1063	.0001708	73.8516	538.2168	381671.
90.240	-.002384	-22046.1074	-3290.9074	.0001647	109.6596	477.6154	384620.
92.160	-.002075	-27484.3091	-2430.2966	.0001565	136.7098	418.8542	387569.
94.080	-.001783	-31378.4464	-1680.0024	.0001467	156.0796	362.7023	390518.
96.000	-.001511	-33935.5182	-1034.4499	.0001359	168.7988	309.7482	393467.
97.920	-.001261	-35350.7341	-487.0882	.0001244	175.8382	260.4203	396416.
99.840	-.001034	-35805.9368	-30.6795	.0001126	178.1024	215.0054	399365.
101.760	-.000829	-35468.5435	342.4470	.0001008	176.4242	173.6681	402314.
103.680	-.000647	-34490.9402	640.1777	8.9215E-05	171.5615	136.4680	405264.
105.600	-.000486	-33010.2612	870.4287	7.8023E-05	164.1965	103.3769	408213.
107.520	-.000347	-31148.4938	1040.9928	6.7385E-05	154.9358	74.2940	411162.
109.440	-.000227	-29012.8489	1159.4133	5.7410E-05	144.3129	49.0606	414111.
111.360	-.000126	-26696.3468	1232.8853	4.8173E-05	132.7904	27.4727	417060.
113.280	-4.25E-05	-24278.5692	1268.1803	3.9722E-05	120.7641	9.2928	420009.
115.200	2.61E-05	-21826.5346	1271.5910	3.2077E-05	108.5674	-5.7400	422958.
117.120	8.07E-05	-19395.6598	1248.8960	2.5243E-05	96.4760	-17.9006	425907.
119.040	.000123	-17030.7738	1205.3395	1.9203E-05	84.7128	-27.4708	428857.
120.960	.000154	-14767.1563	1145.6244	1.3931E-05	73.4534	-34.7323	431806.
122.880	.000176	-12631.5760	1073.9183	9.3879E-06	62.8308	-39.9615	434755.
124.800	.000190	-10643.3099	993.8673	5.5288E-06	52.9409	-43.4250	437704.
126.720	.000198	-8815.1255	908.6182	2.3025E-06	43.8473	-45.3762	440653.
128.640	.000199	-7154.2161	820.8461	-3.4524E-07	35.5858	-46.0530	443602.
130.560	.000196	-5663.0764	732.7870	-2.4704E-06	28.1687	-45.6753	446551.
132.480	.000190	-4340.3139	646.2721	-4.1290E-06	21.5892	-44.4444	449500.
134.400	.000181	-3181.3914	562.7649	-5.3761E-06	15.8246	-42.5423	452450.
136.320	.000169	-2179.2966	483.3985	-6.2649E-06	10.8400	-40.1311	455399.
138.240	.000156	-1325.1410	409.0131	-6.8460E-06	6.5914	-37.3538	458348.
140.160	.000143	-608.6864	340.1920	-7.1666E-06	3.0277	-34.3348	461297.
142.080	.000129	-18.8036	277.2975	-7.2707E-06	.0935310	-31.1804	464246.
144.000	.000115	456.1360	220.5034	-7.1981E-06	2.2689	-27.9802	467195.
145.920	.000101	827.9295	169.8266	-6.9852E-06	4.1182	-24.8082	470144.
147.840	8.82E-05	1108.2701	125.1556	-6.6642E-06	5.5127	-21.7241	473093.
149.760	7.57E-05	1308.5271	86.2770	-6.2635E-06	6.5087	-18.7745	476042.
151.680	6.41E-05	1439.5738	52.8987	-5.8079E-06	7.1606	-15.9946	478992.
153.600	5.34E-05	1511.6581	24.6712	-5.3185E-06	7.5191	-13.4091	481941.
155.520	4.37E-05	1534.3112	1.2061	-4.8135E-06	7.6318	-11.0337	484890.
157.440	3.49E-05	1516.2895	-17.9080	-4.3077E-06	7.5422	-8.8767	487839.
159.360	2.71E-05	1465.5446	-33.0917	-3.8133E-06	7.2898	-6.9396	490788.
161.280	2.03E-05	1389.2175	-44.7635	-3.3400E-06	6.9101	-5.2185	493737.
163.200	1.43E-05	1293.6528	-53.3303	-2.8951E-06	6.4348	-3.7052	496686.

165.120	9.18E-06	1184.4292	-59.1796	-2.4843E-06	5.8915	-2.3878	499635.
167.040	4.78E-06	1066.4032	-62.6739	-2.1111E-06	5.3044	-1.2521	502585.
168.960	1.07E-06	943.7614	-64.1463	-1.7778E-06	4.6944	-.2816030	505534.
170.880	-2.04E-06	820.0815	-63.8971	-1.4853E-06	4.0792	.5411556	508483.
172.800	-4.63E-06	698.3965	-62.1926	-1.2336E-06	3.4739	1.2344	511432.
174.720	-6.78E-06	581.2621	-59.2637	-1.0214E-06	2.8913	1.8165	514381.
176.640	-8.56E-06	470.8238	-55.3067	-8.4694E-07	2.3419	2.3054	517330.
178.560	-1.00E-05	368.8842	-50.4837	-7.0772E-07	1.8349	2.7186	520279.
180.480	-1.13E-05	276.9665	-44.9244	-6.0063E-07	1.3777	3.0723	523228.
182.400	-1.23E-05	196.3744	-38.7288	-5.2215E-07	.9767868	3.3815	526178.
184.320	-1.33E-05	128.2479	-31.9694	-4.6833E-07	.6379184	3.6595	529127.
186.240	-1.41E-05	73.6118	-24.6953	-4.3486E-07	.3661527	3.9178	532076.
188.160	-1.49E-05	33.4181	-16.9352	-4.1711E-07	.1662252	4.1656	535025.
190.080	-1.57E-05	8.5806	-8.7026	-4.1015E-07	.0426806	4.4100	537974.
192.000	-1.65E-05	0.0000	0.0000	-4.0873E-07	0.0000	4.6553	270462.

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      =     -.00738067
Maximum bending moment           =   901525.73538 lbs-in
Maximum shear force              =    59782.10936 lbs
Depth of maximum bending moment  =    30.72000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             10
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	Es*h F/L lbs/in
0.000	.500000	0.0000	81293.3891	-.0129778	0.0000	-2488.6286	4778.1668
1.920	.475083	151496.	76527.6093	-.0129527	753.5581	-2475.7254	10005.4019
3.840	.450262	293866.	71788.1753	-.0128788	1461.7200	-2461.1851	10494.9526
5.760	.425628	427163.	67078.2368	-.0127593	2124.7523	-2445.0009	11029.3558
7.680	.401266	551446.	62400.9589	-.0125970	2742.9518	-2427.1636	11613.6265
9.600	.377255	666783.	57759.5259	-.0123950	3316.6454	-2407.6624	12253.5367
11.520	.353669	773243.	53157.1453	-.0121563	3846.1909	-2386.4840	12955.7526
13.440	.330575	870906.	48598.3886	-.0118837	4331.9765	-2362.2208	13719.9163
15.360	.308036	959861.	44086.4997	-.0115801	4774.4472	-2337.6634	14570.7543
17.280	.286108	1040198.	39623.4227	-.0112485	5174.0533	-2311.3751	15511.0935
19.200	.264842	1112015.	35212.5037	-.0108917	5531.2767	-2283.3321	16553.2880
21.120	.244284	1175414.	30857.1383	-.0105124	5846.6317	-2253.5069	17711.9337
23.040	.224474	1230506.	26560.7785	-.0101135	6120.6653	-2221.8679	19004.3781
24.960	.205448	1277408.	22335.6705	-.0096977	6353.9574	-2179.2863	20366.3996
26.880	.187235	1316275.	18199.4289	-.0092676	6547.2890	-2129.2987	21834.9004
28.800	.169860	1347293.	14160.3383	-.0088260	6701.5767	-2078.0874	23489.5096
30.720	.153343	1370651.	10220.7780	-.0083754	6817.7594	-2025.6214	25362.7097
32.640	.137699	1386541.	6383.1954	-.0079182	6896.7992	-1971.8605	27494.6280
34.560	.122937	1395162.	2650.1262	-.0074570	6939.6820	-1916.7533	29935.3722
36.480	.109064	1396718.	-975.7821	-.0069941	6947.4181	-1860.2345	32748.2750
38.400	.096080	1391415.	-4491.7393	-.0065318	6921.0440	-1802.2208	36014.4946

40.320	.083982	1379469.	-7894.7724	-.0060724	6861.6234	-1742.6054	39839.6878
42.240	.072762	1361099.	-11181.6741	-.0056180	6770.2494	-1681.2505	44363.9441
44.160	.062409	1336532.	-14348.9313	-.0051707	6648.0472	-1617.9758	49777.0327
46.080	.052906	1306000.	-17392.6283	-.0047326	6496.1768	-1552.5419	56342.6521
48.000	.044236	1269744.	-20308.3072	-.0043055	6315.8383	-1484.6236	64438.6697
49.920	.036373	1228016.	-23090.7631	-.0038914	6108.2769	-1413.7680	74627.4105
51.840	.029293	1181075.	-25733.7301	-.0034919	5874.7918	-1339.3226	87786.4553
53.760	.022964	1129198.	-28229.3730	-.0031089	5616.7483	-1260.3054	105372.
55.680	.017355	1072675.	-30567.4096	-.0027438	5335.5951	-1175.1494	130011.
57.600	.012428	1011819.	-32733.4482	-.0023982	5032.8937	-1081.1408	167026.
59.520	.008146	946978.	-34705.3772	-.0020734	4710.3679	-972.9519	229336.
61.440	.004466	878551.	-36399.4986	-.0017707	4370.0016	-791.7579	340383.
63.360	.001346	807204.	-37390.6407	-.0014912	4015.1172	-240.6818	343332.
65.280	-.001260	734971.	-37403.4981	-.0012355	3655.8195	227.2887	346281.
67.200	-.003398	663575.	-36591.8766	-.0010036	3300.6895	618.1505	349230.
69.120	-.005114	594458.	-35168.1552	-.0007951	2956.8943	864.8927	324701.
71.040	-.006451	528529.	-33457.7632	-.0006089	2628.9582	916.7656	272835.
72.960	-.007452	465980.	-31665.1823	-.0004440	2317.8323	950.5061	244889.
74.880	-.008156	406935.	-29819.3323	-.0002992	2024.1355	972.2543	228869.
76.800	-.008601	351474.	-27940.0956	-.0001735	1748.2665	985.2840	219937.
78.720	-.008823	299645.	-26042.3079	-6.5533E-05	1490.4641	991.5781	215792.
80.640	-.008853	251471.	-24137.6476	2.5844E-05	1250.8439	992.4430	215237.
82.560	-.008723	206956.	-22235.6604	.0001019	1029.4216	988.7937	217634.
84.480	-.008462	166086.	-20344.3696	.0001637	826.1303	981.3009	222658.
86.400	-.008095	128834.	-18470.6647	.0002126	640.8328	970.4751	230190.
88.320	-.007645	95158.9250	-16620.5610	.0002497	473.3303	956.7162	240260.
90.240	-.007136	65010.8672	-14799.3815	.0002763	323.3708	940.3457	253020.
92.160	-.006584	38329.3000	-13011.8875	.0002934	190.6539	921.6272	268742.
94.080	-.006009	15045.2193	-11262.3763	.0003023	74.8365	900.7803	287824.
96.000	-.005424	-4918.2248	-9554.7566	.0003040	24.4638	877.9901	310810.
97.920	-.004842	-21645.0462	-7892.6101	.0002996	107.6647	853.4125	338428.
99.840	-.004273	-35225.8477	-6279.2445	.0002901	175.2170	827.1767	371643.
101.760	-.003728	-45757.3451	-4735.3286	.0002767	227.6018	781.0690	402314.
103.680	-.003211	-53409.5096	-3334.8793	.0002603	265.6644	677.7323	405264.
105.600	-.002728	-58563.2818	-2127.4198	.0002417	291.2998	580.0381	408213.
107.520	-.002283	-61578.8015	-1101.2912	.0002218	306.2993	488.8458	411162.
109.440	-.001877	-62792.2401	-243.4475	.0002012	312.3351	404.7414	414111.
111.360	-.001510	-62513.6401	460.0545	.0001804	310.9493	328.0732	417060.
113.280	-.001184	-61025.6309	1023.6322	.0001599	303.5478	258.9868	420009.
115.200	-.000896	-58582.8926	1461.8181	.0001401	291.3974	197.4569	422958.
117.120	-.000646	-55412.2493	1788.9614	.0001212	275.6263	143.3174	425907.
119.040	-.000431	-51713.2808	2018.9839	.0001034	257.2272	96.2894	428857.
120.960	-.000249	-47659.3511	2165.1872	8.6923E-05	237.0625	56.0057	431806.
122.880	-9.73E-05	-43398.9620	2240.1050	7.1825E-05	215.8709	22.0337	434755.
124.800	2.68E-05	-39057.3480	2255.3963	5.8153E-05	194.2753	-6.1053	437704.
126.720	.000126	-34738.2404	2221.7737	4.5918E-05	172.7916	-28.9182	440653.
128.640	.000203	-30525.7368	2148.9634	3.5097E-05	151.8382	-46.9259	443602.
130.560	.000261	-26486.2208	2045.6904	2.5644E-05	131.7452	-60.6502	446551.
132.480	.000302	-22670.2856	1919.6867	1.7494E-05	112.7643	-70.6037	449500.
134.400	.000328	-19114.6240	1777.7172	1.0565E-05	95.0781	-77.2812	452450.
136.320	.000342	-15843.8518	1625.6201	4.7693E-06	78.8090	-81.1532	455399.
138.240	.000346	-12872.2426	1468.3589	8.0320E-09	64.0279	-82.6606	458348.
140.160	.000342	-10205.3536	1310.0815	-3.8183E-06	50.7625	-82.2117	461297.
142.080	.000332	-7841.5297	1154.1864	-6.8105E-06	39.0046	-80.1791	464246.
144.000	.000316	-5773.2778	1003.3913	-9.0679E-06	28.7169	-76.8991	467195.
145.920	.000297	-3988.5070	859.8037	-1.0686E-05	19.8392	-72.6713	470144.
147.840	.000275	-2471.6315	724.9911	-1.1758E-05	12.2942	-67.7586	473093.
149.760	.000252	-1204.5411	600.0497	-1.2367E-05	5.9915	-62.3888	476042.
151.680	.000228	-167.4408	485.6708	-1.2595E-05	.8328677	-56.7559	478992.
153.600	.000203	660.4348	382.2040	-1.2513E-05	3.2851	-51.0221	481941.
155.520	.000179	1300.2225	289.7155	-1.2188E-05	6.4674	-45.3200	484890.
157.440	.000156	1772.9425	208.0433	-1.1678E-05	8.8188	-39.7552	487839.
159.360	.000135	2099.1088	136.8464	-1.1036E-05	10.4412	-34.4083	490788.
161.280	.000114	2298.4326	75.6501	-1.0307E-05	11.4326	-29.3379	493737.
163.200	9.50E-05	2389.6052	23.8861	-9.5298E-06	11.8861	-24.5830	496686.
165.120	7.75E-05	2390.1551	-19.0725	-8.7373E-06	11.8889	-20.1655	499635.
167.040	6.15E-05	2316.3669	-53.8801	-7.9569E-06	11.5218	-16.0925	502585.
168.960	4.69E-05	2183.2554	-81.1931	-7.2109E-06	10.8597	-12.3585	505534.
170.880	3.38E-05	2004.5854	-101.6475	-6.5165E-06	9.9710	-8.9481	508483.
172.800	2.19E-05	1792.9291	-115.8414	-5.8869E-06	8.9182	-5.8372	511432.

174.720	1.12E-05	1559.7544	-124.3210	-5.3310E-06	7.7584	-2.9957	514381.
176.640	1.44E-06	1315.5365	-127.5701	-4.8543E-06	6.5436	-.3887640	517330.
178.560	-7.46E-06	1069.8854	-126.0030	-4.4588E-06	5.3217	2.0211	520279.
180.480	-1.57E-05	831.6850	-119.9609	-4.1435E-06	4.1369	4.2727	523228.
182.400	-2.34E-05	609.2354	-109.7109	-3.9046E-06	3.0304	6.4044	526178.
184.320	-3.07E-05	410.3951	-95.4479	-3.7355E-06	2.0413	8.4529	529127.
186.240	-3.77E-05	242.7155	-77.2998	-3.6272E-06	1.2073	10.4514	532076.
188.160	-4.46E-05	113.5638	-55.3353	-3.5681E-06	.5648781	12.4284	535025.
190.080	-5.14E-05	30.2281	-29.5739	-3.5443E-06	.1503578	14.4063	537974.
192.000	-5.82E-05	0.0000	0.0000	-3.5393E-06	0.0000	16.3998	270462.

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      =     -.01297780
Maximum bending moment           =       1396718. lbs-in
Maximum shear force              =    81293.38910 lbs
Depth of maximum bending moment  =    36.48000000 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 3

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .750000 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	Es*h F/L lbs/in
0.000	.750000	0.0000	97251.6641	-.0180526	0.0000	-2754.1202	3525.2739
1.920	.715339	181647.	91974.9608	-.0180225	903.5300	-2742.4457	7360.8402
3.840	.680794	353184.	86722.2033	-.0179338	1756.7730	-2729.1767	7696.9283
5.760	.646473	514660.	81496.4603	-.0177899	2559.9725	-2714.3056	8061.3828
7.680	.612480	666130.	76300.8168	-.0175942	3313.4009	-2697.8230	8457.1227
9.600	.578911	807655.	71138.3772	-.0173498	4017.3606	-2679.7182	8887.4709
11.520	.545857	939302.	66012.2684	-.0170601	4672.1836	-2659.9784	9356.2213
13.440	.513401	1061142.	60927.1352	-.0167285	5278.2317	-2637.0353	9861.9064
15.360	.481620	1173262.	55886.1364	-.0163580	5835.9258	-2614.0051	10420.8577
17.280	.450586	1275745.	50890.9717	-.0159519	6345.6881	-2589.2914	11033.2806
19.200	.420364	1368683.	45944.8936	-.0155135	6807.9718	-2562.8733	11705.8418
21.120	.391014	1452173.	41051.1972	-.0150458	7223.2612	-2534.7272	12446.2963
23.040	.362588	1526320.	36213.2257	-.0145519	7592.0725	-2504.8265	13263.7088
24.960	.335135	1591232.	31444.2413	-.0140350	7914.9540	-2462.8656	14109.8604
26.880	.308694	1647066.	26763.6182	-.0134981	8192.6751	-2412.7834	15006.9203
28.800	.283302	1694005.	22180.2476	-.0129442	8426.1541	-2361.5610	16004.8293
30.720	.258988	1732238.	17696.3380	-.0123761	8616.3302	-2309.1781	17119.0042
32.640	.235778	1761958.	13314.1428	-.0117967	8764.1640	-2255.6085	18368.0148
34.560	.213689	1783364.	9035.9726	-.0112089	8870.6377	-2200.8188	19774.4100
36.480	.192736	1796657.	4864.2103	-.0106153	8936.7561	-2144.7670	21365.8173
38.400	.172926	1802043.	801.3294	-.0100186	8963.5469	-2087.4006	23176.4272
40.320	.154264	1799734.	-3150.0831	-.0094215	8952.0619	-2028.6541	25249.0293
42.240	.136748	1789946.	-6987.2984	-.0088263	8903.3785	-1968.4452	27637.8601
44.160	.120371	1772902.	-10707.4091	-.0082355	8818.6006	-1906.6701	30412.6673
46.080	.105123	1748830.	-14307.2817	-.0076516	8698.8610	-1843.1971	33664.6515
48.000	.090989	1717963.	-17783.4930	-.0070768	8545.3236	-1777.8564	37515.3965

49.920	.077948	1680541.	-21132.2446	-.0065133	8359.1864	-1710.4265	42130.7269
51.840	.065978	1636815.	-24349.2420	-.0059633	8141.6859	-1640.6125	47743.0412
53.760	.055049	1587040.	-27429.5227	-.0054288	7894.1023	-1568.0131	54688.9633
55.680	.045131	1531485.	-30367.1984	-.0049117	7617.7667	-1492.0658	63476.4004
57.600	.036188	1470430.	-33155.0558	-.0044140	7314.0719	-1411.9523	74912.3953
59.520	.028181	1404170.	-35783.8979	-.0039374	6984.4867	-1326.4249	90369.0669
61.440	.021069	1333020.	-38241.3791	-.0034835	6630.5795	-1233.4513	112405.
63.360	.014805	1257323.	-40509.7146	-.0030540	6254.0550	-1129.3982	146470.
65.280	.009341	1177463.	-42560.4049	-.0026503	5856.8213	-1006.7375	206925.
67.200	.004627	1093891.	-44334.8881	-.0022737	5441.1275	-841.6824	349230.
69.120	.000610	1007217.	-45250.3249	-.0019254	5010.0002	-111.8976	352179.
71.040	-.002766	920130.	-44866.5956	-.0016058	4576.8211	511.6157	355129.
72.960	-.005556	834929.	-43527.6645	-.0013148	4153.0232	883.1043	305160.
74.880	-.007815	752984.	-41756.4449	-.0010515	3745.4184	961.9162	236326.
76.800	-.009594	674584.	-39860.8848	-.0008148	3355.4518	1012.6256	202647.
78.720	-.010944	599918.	-37884.0702	-.0006035	2984.0533	1046.5563	183607.
80.640	-.011912	529109.	-35853.1399	-.0004163	2631.8450	1068.9960	172306.
82.560	-.012543	462242.	-33787.3215	-.0002520	2299.2383	1082.8981	165767.
84.480	-.012879	399366.	-31701.2402	-.0001091	1986.4883	1090.1032	162509.
86.400	-.012962	340509.	-29606.5678	1.3569E-05	1693.7270	1091.8471	161735.
88.320	-.012827	285677.	-27512.9489	.0001174	1420.9863	1089.0059	163004.
90.240	-.012511	234859.	-25428.5656	.0002037	1168.2143	1082.2267	166086.
92.160	-.012045	188031.	-23360.5046	.0002738	935.2865	1072.0034	170880.
94.080	-.011459	145155.	-21315.0077	.0003291	722.0156	1058.7226	177387.
96.000	-.010781	106182.	-19297.6482	.0003707	528.1580	1042.6936	185687.
97.920	-.010036	71051.9555	-17313.4608	.0004001	353.4198	1024.1683	195939.
99.840	-.009245	39697.8577	-15367.0393	.0004185	197.4613	1003.3541	208377.
101.760	-.008429	12042.5245	-13462.6124	.0004271	59.9008	980.4239	223330.
103.680	-.007605	-11998.5740	-11604.1042	.0004271	59.6821	955.5222	241235.
105.600	-.006789	-32517.2356	-9795.1848	.0004197	161.7441	928.7689	262669.
107.520	-.005993	-49612.0836	-8039.3152	.0004061	246.7756	900.2619	288398.
109.440	-.005230	-63388.2059	-6339.7900	.0003873	315.2995	870.0768	319441.
111.360	-.004506	-73956.8771	-4699.7830	.0003646	367.8692	838.2638	357175.
113.280	-.003830	-81435.3725	-3122.4020	.0003388	405.0680	804.8414	403504.
115.200	-.003205	-85946.9006	-1671.9368	.0003110	427.5088	706.0598	422958.
117.120	-.002635	-87855.6099	-432.9257	.0002822	437.0029	584.5767	425907.
119.040	-.002121	-87609.3355	583.1516	.0002531	435.7779	473.8372	428857.
120.960	-.001663	-85616.3078	1397.1363	.0002244	425.8644	374.0636	431806.
122.880	-.001260	-82244.3319	2030.0542	.0001966	409.0918	285.2259	434755.
124.800	-.000908	-77820.8995	2502.6732	.0001700	387.0892	207.0856	437704.
126.720	-.000607	-72634.0668	2835.1436	.0001451	361.2894	139.2377	440653.
128.640	-.000351	-66933.9482	3046.7135	.0001220	332.9364	81.1476	443602.
130.560	-.000138	-60934.6870	3155.5121	.0001008	303.0954	32.1843	446551.
132.480	3.57E-05	-54816.7818	3178.3928	8.1561E-05	272.6644	-8.3501	449500.
134.400	.000175	-48729.6585	3130.8297	6.4392E-05	242.3864	-41.1948	452450.
136.320	.000283	-42794.3957	3026.8590	4.9217E-05	212.8638	-67.1080	455399.
138.240	.000364	-37106.5200	2879.0601	3.5969E-05	184.5717	-86.8491	458348.
140.160	.000421	-31738.8048	2698.5691	2.4555E-05	157.8721	-101.1624	461297.
142.080	.000458	-26744.0146	2495.1183	1.4858E-05	133.0275	-110.7655	464246.
144.000	.000478	-22157.5504	2277.0979	6.7500E-06	110.2140	-116.3391	467195.
145.920	.000484	-17999.9586	2051.6335	9.1703E-08	89.5337	-118.5197	470144.
147.840	.000478	-14279.2777	1824.6758	-5.2603E-06	71.0266	-117.8946	473093.
149.760	.000464	-10993.2035	1601.0986	-9.4506E-06	54.6813	-114.9983	476042.
151.680	.000442	-8131.0590	1384.8017	-1.2621E-05	40.4447	-110.3109	478992.
153.600	.000415	-5675.5649	1178.8159	-1.4911E-05	28.2308	-104.2576	481941.
155.520	.000385	-3604.4059	985.4077	-1.6449E-05	17.9287	-97.2093	484890.
157.440	.000352	-1891.5992	806.1818	-1.7361E-05	9.4090	-89.4844	487839.
159.360	.000318	-508.6677	642.1798	-1.7759E-05	2.5302	-81.3511	490788.
161.280	.000284	574.3713	493.9738	-1.7748E-05	2.8570	-73.0302	493737.
163.200	.000250	1388.1917	361.7540	-1.7422E-05	6.9050	-64.6987	496686.
165.120	.000217	1963.5067	245.4098	-1.6866E-05	9.7667	-56.4931	499635.
167.040	.000185	2330.5655	144.6036	-1.6155E-05	11.5925	-48.5134	502585.
168.960	.000155	2518.7846	58.8371	-1.5350E-05	12.5287	-40.8267	505534.
170.880	.000126	2556.5000	-12.4895	-1.4509E-05	12.7163	-33.4718	508483.
172.800	9.93E-05	2470.8250	-70.0263	-1.3675E-05	12.2901	-26.4624	511432.
174.720	7.39E-05	2287.5991	-114.4298	-1.2886E-05	11.3788	-19.7913	514381.
176.640	4.99E-05	2031.4146	-146.3265	-1.2170E-05	10.1045	-13.4344	517330.
178.560	2.71E-05	1725.7054	-166.2836	-1.1547E-05	8.5838	-7.3543	520279.
180.480	5.52E-06	1392.8854	-174.7873	-1.1030E-05	6.9284	-1.5037	523228.
182.400	-1.52E-05	1054.5221	-172.2275	-1.0625E-05	5.2453	4.1702	526178.

184.320	-3.53E-05	731.5318	-158.8902	-1.0328E-05	3.6387	9.7228	529127.
186.240	-5.49E-05	444.3836	-134.9567	-1.0133E-05	2.2104	15.2079	532076.
188.160	-7.42E-05	213.2980	-100.5096	-1.0024E-05	1.0610	20.6745	535025.
190.080	-9.34E-05	58.4267	-55.5463	-9.9794E-06	.2906204	26.1623	537974.
192.000	-.000113	0.0000	0.0000	-9.9697E-06	0.0000	31.6985	270462.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =      .75000000 in
Computed slope at pile head      =     -.01805262
Maximum bending moment           =       1802043. lbs-in
Maximum shear force              =    97251.66414 lbs
Depth of maximum bending moment  =    38.40000000 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 4

```
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	Es*h F/L lbs/in
0.000	1.000000	0.0000	110419.	-.0228122	0.0000	-2959.4948	2841.1150
1.920	.956201	206550.	104748.	-.0227780	1027.4034	-2948.8138	5921.0618
3.840	.912533	402230.	99097.5393	-.0226770	2000.7358	-2936.5673	6178.6389
5.760	.869121	587085.	93472.5973	-.0225130	2920.2217	-2922.7473	6456.7267
7.680	.826083	761165.	87875.7094	-.0222895	3786.1145	-2907.3443	6757.3157
9.600	.783529	924528.	82309.9252	-.0220100	4598.6967	-2890.3476	7082.6558
11.520	.741564	1077235.	76778.3165	-.0216781	5358.2800	-2871.7449	7435.2957
13.440	.700285	1219356.	71285.5922	-.0212973	6065.2054	-2849.8429	7813.5267
15.360	.659783	1350972.	65834.8531	-.0208711	6719.8746	-2828.0102	8229.6478
17.280	.620140	1472162.	60427.6184	-.0204030	7322.6878	-2804.5259	8683.0189
19.200	.581435	1583014.	55067.0776	-.0198965	7874.0758	-2779.3708	9177.9666
21.120	.543738	1683620.	49756.4588	-.0193549	8374.4997	-2752.5237	9719.4740
23.040	.507112	1774079.	44499.0335	-.0187816	8824.4519	-2723.9609	10313.3038
24.960	.471617	1854496.	39308.8657	-.0181799	9224.4561	-2682.4640	10920.5875
26.880	.437302	1925025.	34206.7097	-.0175533	9575.2731	-2632.2818	11557.1993
28.800	.404212	1985850.	29201.9475	-.0169048	9877.8233	-2581.0121	12259.7602
30.720	.372387	2037160.	24296.6814	-.0162378	10133.0466	-2528.6400	13037.4823
32.640	.341859	2079149.	19493.0466	-.0155553	10341.9035	-2475.1463	13901.2921
34.560	.312655	2112014.	14793.2202	-.0148604	10505.3747	-2420.5062	14864.2355
36.480	.284795	2135955.	10199.4325	-.0141561	10624.4622	-2364.6892	15942.0044
38.400	.258295	2151179.	5713.9802	-.0134452	10700.1895	-2307.6569	17153.6256
40.320	.233165	2157897.	1339.2419	-.0127308	10733.6024	-2249.3622	18522.3786
42.240	.209409	2156322.	-2922.3024	-.0120155	10725.7698	-2189.7465	20077.0315
44.160	.187026	2146675.	-7068.0473	-.0113020	10677.7848	-2128.7377	21853.5374
46.080	.166009	2129181.	-11095.2315	-.0105931	10590.7662	-2066.2459	23897.4020
48.000	.146348	2104070.	-15000.8996	-.0098912	10465.8597	-2002.1584	26267.0624
49.920	.128027	2071577.	-18781.8513	-.0091988	10304.2406	-1936.3329	29038.8209
51.840	.111025	2031947.	-22434.5741	-.0085185	10107.1159	-1868.5868	32314.2538
53.760	.095316	1985429.	-25955.1529	-.0078524	9875.7277	-1798.6828	36231.6960
55.680	.080872	1932279.	-29339.1424	-.0072028	9611.3580	-1726.3063	40984.7282
57.600	.067658	1872766.	-32581.3857	-.0065719	9315.3337	-1651.0305	46853.3005

59.520	.055636	1807167.	-35675.7439	-.0059618	8989.0353	-1572.2593	54259.0681
61.440	.044764	1735771.	-38614.6768	-.0053743	8633.9071	-1489.1292	63870.6580
63.360	.034998	1658887.	-41388.5558	-.0048115	8251.4735	-1400.3281	76821.9789
65.280	.026288	1576839.	-43984.4516	-.0042750	7843.3626	-1303.7300	95219.8966
67.200	.018582	1489986.	-46383.7659	-.0037665	7411.3459	-1195.5557	123530.
69.120	.011825	1398726.	-48556.8191	-.0032875	6957.4068	-1068.0413	173418.
71.040	.005958	1303528.	-50446.4888	-.0028395	6483.8836	-900.3647	290147.
72.960	.000921	1205011.	-51475.7598	-.0024236	5993.8508	-171.7926	358078.
74.880	-.003349	1105861.	-51036.2280	-.0020404	5500.6679	629.6382	361027.
76.800	-.006914	1009032.	-49536.6213	-.0016898	5019.0304	932.4521	258936.
78.720	-.009837	915641.	-47663.5253	-.0013707	4554.4908	1018.6895	198824.
80.640	-.012177	826004.	-45653.9075	-.0010819	4108.6304	1074.6624	169441.
82.560	-.013992	740330.	-43554.0255	-.0008222	3682.4757	1112.7147	152692.
84.480	-.015335	658757.	-41392.8057	-.0005902	3276.7243	1138.5560	142555.
86.400	-.016258	581381.	-39190.6490	-.0003846	2891.8500	1155.3571	136442.
88.320	-.016811	508265.	-36963.0239	-.0002039	2528.1610	1165.0857	133062.
90.240	-.017041	439443.	-34722.2456	-4.6788E-05	2185.8356	1169.0583	131716.
92.160	-.016991	374931.	-32478.4727	8.8238E-05	1864.9467	1168.2051	132008.
94.080	-.016702	314726.	-30240.3135	.0002026	1565.4787	1163.2108	133716.
96.000	-.016213	258808.	-28015.2185	.0002977	1287.3399	1154.5964	136730.
97.920	-.015559	207147.	-25809.7489	.0003749	1030.3724	1142.7678	141017.
99.840	-.014773	159699.	-23629.7655	.0004358	794.3593	1128.0483	146605.
101.760	-.013886	116409.	-21480.5676	.0004815	579.0307	1110.6996	153576.
103.680	-.012924	77213.6060	-19366.9976	.0005136	384.0685	1090.9358	162067.
105.600	-.011913	42039.7835	-17293.5224	.0005334	209.1102	1068.9342	172271.
107.520	-.010876	10806.4799	-15264.2977	.0005422	53.7526	1044.8416	184453.
109.440	-.009832	-16575.1197	-13283.2212	.0005412	82.4464	1018.7797	198958.
111.360	-.008798	-40201.0896	-11353.9785	.0005318	199.9644	990.8481	216243.
113.280	-.007789	-60174.3970	-9480.0837	.0005152	299.3137	961.1256	236907.
115.200	-.006819	-76604.6111	-7664.9197	.0004925	381.0393	929.6702	261748.
117.120	-.005898	-89607.6888	-5911.7798	.0004649	445.7179	896.5172	291836.
119.040	-.005034	-99305.8454	-4223.9166	.0004336	493.9576	861.6736	328642.
120.960	-.004233	-105828.	-2604.6055	.0003996	526.3971	825.1088	374237.
122.880	-.003500	-109308.	-1057.2335	.0003639	543.7070	786.7370	431626.
124.800	-.002836	-109887.	318.6327	.0003276	546.5908	646.4569	437704.
126.720	-.002242	-108084.	1433.1431	.0002914	537.6209	514.4913	440653.
128.640	-.001717	-104384.	2307.7911	.0002562	519.2170	396.6004	443602.
130.560	-.001258	-99222.0628	2969.3787	.0002225	493.5408	292.5533	446551.
132.480	-.000862	-92981.6214	3444.0413	.0001906	462.5002	201.8869	449500.
134.400	-.000526	-85996.9442	3756.8504	.0001609	427.7577	123.9559	452450.
136.320	-.000244	-78555.3160	3931.5073	.0001336	390.7423	57.9784	455399.
138.240	-1.29E-05	-70899.9560	3990.1193	.0001088	352.6637	3.0757	458348.
140.160	.000174	-63233.2578	3953.0468	8.6608E-05	314.5288	-41.6929	461297.
142.080	.000320	-55720.2562	3838.8141	6.6885E-05	277.1583	-77.2995	464246.
144.000	.000430	-48492.2115	3664.0728	4.9606E-05	241.2053	-104.7227	467195.
145.920	.000510	-41650.2168	3443.6101	3.4660E-05	207.1725	-124.9259	470144.
147.840	.000563	-35268.7487	3190.3949	2.1907E-05	175.4304	-138.8400	473093.
149.760	.000594	-29399.1004	2915.6521	1.1185E-05	146.2342	-147.3504	476042.
151.680	.000606	-24072.6446	2628.9613	2.3190E-06	119.7398	-151.2858	478992.
153.600	.000603	-19303.8888	2338.3721	-4.8730E-06	96.0195	-151.4113	481941.
155.520	.000588	-15093.2958	2050.5311	-1.0576E-05	75.0756	-148.4230	484890.
157.440	.000563	-11429.8493	1770.8174	-1.4974E-05	56.8533	-142.9454	487839.
159.360	.000530	-8293.3568	1503.4805	-1.8244E-05	41.2520	-135.5305	490788.
161.280	.000493	-5656.4841	1251.7793	-2.0557E-05	28.1359	-126.6583	493737.
163.200	.000451	-3486.5244	1018.1182	-2.2073E-05	17.3423	-116.7387	496686.
165.120	.000408	-1746.9101	804.1791	-2.2941E-05	8.6893	-106.1146	499635.
167.040	.000363	-398.4767	611.0459	-2.3296E-05	1.9821	-95.0658	502585.
168.960	.000318	599.5062	439.3221	-2.3263E-05	2.9820	-83.8132	505534.
170.880	.000274	1288.5202	289.2385	-2.2950E-05	6.4092	-72.5239	508483.
172.800	.000230	1710.1822	160.7518	-2.2453E-05	8.5066	-61.3164	511432.
174.720	.000188	1905.8073	53.6321	-2.1853E-05	9.4797	-50.2666	514381.
176.640	.000146	1916.1295	-32.4603	-2.1219E-05	9.5310	-39.4130	517330.
178.560	.000106	1781.1597	-97.9092	-2.0606E-05	8.8597	-28.7629	520279.
180.480	6.71E-05	1540.1583	-143.0882	-2.0056E-05	7.6609	-18.2986	523228.
182.400	2.91E-05	1231.7010	-168.3187	-1.9596E-05	6.1266	-7.9832	526178.
184.320	-8.10E-06	893.8145	-173.8390	-1.9244E-05	4.4459	2.2329	529127.
186.240	-4.48E-05	564.1592	-159.7861	-1.9002E-05	2.8062	12.4056	532076.
188.160	-8.11E-05	280.2359	-126.1895	-1.8862E-05	1.3939	22.5909	535025.
190.080	-.000117	79.5915	-72.9781	-1.8802E-05	.3958966	32.8377	537974.
192.000	-.000153	0.0000	0.0000	-1.8789E-05	0.0000	43.1812	270462.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.02281222
Maximum bending moment           =       2157897. lbs-in
Maximum shear force              =   110419.48141 lbs
Depth of maximum bending moment  =    40.32000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             17
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	901526.	59782.1094
4	y= .500000	M= 0.000	0.0000	.5000000	1396718.	81293.3891
4	y= .750000	M= 0.000	0.0000	.7500000	1802043.	97251.6641
4	y= 1.000000	M= 0.000	0.0000	1.0000000	2157897.	110419.

The analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.17)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

(c) 1985-2005 by Ensoft, Inc.
All Rights Reserved

==========

This program is licensed to:

Hisham Nofal
CH2MHill

Path to file locations: C:\MyFolder\Projects\SR-57\Final Reports\Retaining Walls\Pile Foundation\Sign Structure 630\Lateral Pile Analysis\
Name of input data file: RW 630.lpd
Name of output file: RW 630.lpo
Name of plot output file: RW 630.lpp
Name of runtime file: RW 630.lpr

Time and Date of Analysis

Date: April 14, 2009 Time: 15: 5:32

Problem Title

RW 630

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
- Additional p-y curves computed at specified depths

Solution Control Parameters:
- Number of pile increments = 100

```
- Maximum number of iterations allowed =         1000
- Deflection tolerance for convergence =   10.000E-12 in
- Maximum allowable deflection         =   1.0000E+01 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                                 =     180.00 in
Depth of ground surface below top of pile =    -240.00 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      3600000.
  2     180.0000   12.00000000    1728.0000     144.0000      3600000.


--------------------------------------------------------------------------------
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------

The soil profile is modelled using  4 layers

Layer  1 is stiff clay without free water using initial selected k, 2004
Distance from top of pile to top of layer    =
Layer  1 is stiff clay without free water
Distance from top of pile to top of layer    =     -240.000 in
Distance from top of pile to bottom of layer =      192.000 in
p-y subgrade modulus k for top of soil layer =      200.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      200.000 lbs/in**3

Layer  2 is stiff clay without free water using initial selected k, 2004
Distance from top of pile to top of layer    =
Layer  2 is stiff clay without free water
Distance from top of pile to top of layer    =      192.000 in
Distance from top of pile to bottom of layer =      300.000 in
p-y subgrade modulus k for top of soil layer =      120.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      441.000 lbs/in**3

Layer  3 is stiff clay without free water using initial selected k, 2004
Distance from top of pile to top of layer    =
Layer  3 is stiff clay without free water
Distance from top of pile to top of layer    =      300.000 in
Distance from top of pile to bottom of layer =      540.000 in
p-y subgrade modulus k for top of soil layer =      441.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      800.000 lbs/in**3

Layer  4 is stiff clay without free water using initial selected k, 2004
Distance from top of pile to top of layer    =
Layer  4 is stiff clay without free water
Distance from top of pile to top of layer    =      540.000 in
Distance from top of pile to bottom of layer =     1000.000 in
```

p-y subgrade modulus k for top of soil layer = 800.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 800.000 lbs/in**3

(Depth of lowest layer extends 820.00 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	-240.00	.07500
2	192.00	.07500
3	192.00	.06900
4	300.00	.06900
5	300.00	.03300
6	540.00	.03300
7	540.00	.03900
8	1000.00	.03900

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	-240.000	10.42000	.00	.02000	.0
2	192.000	10.42000	.00	.02000	.0
3	192.000	8.33000	.00	.02000	.0
4	300.000	22.93000	.00	.02000	.0
5	300.000	22.99000	.00	.02000	.0
6	540.000	55.00000	.00	.02000	.0
7	540.000	55.56000	.00	.02000	.0
8	1000.000	55.56000	.00	.02000	.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	1.0000	1.0000
2	1000.000	1.0000	1.0000

Loading Type

Cyclic loading criteria was used for computation of p-y curves

Number of cycles of loading = 1000.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

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 = .750 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 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

Output of p-y Curves at Specified Depths

---

p-y curves are generated and printed for verification at 5 depths.

Depth No.	Depth Below Pile Head in	Depth Below Ground Surface in
1	24.000	264.000
2	48.000	288.000
3	72.000	312.000
4	96.000	336.000
5	120.000	360.000

Depth of ground surface below top of pile = -240.00 in

p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

```
Soil Layer Number           =          1
Depth below ground surface  =      264.000 in
Diameter                    =       12.000 in
Undrained cohesion, c       =     10.42000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =      200.000 pci
Epsilon-50                  =       .02000
Pct                         =     1988.160 lbs/in
Pcd                         =     1125.360 lbs/in
y50                         =         .600 in
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.
```

y, in	p, lbs/in
0.0000	0.0000
9.6000E-05	5.0688
.0004800	25.3440
.0009600	50.6880
.0048000	130.0902
.0096000	154.7042
.0480000	231.3367
.0960000	275.1072
.2400000	345.9290
.4800000	411.3812
.7200000	455.2682
.9600000	489.2175
2.4000	615.1584
4.8000	731.5508
9.6000	869.9654
21.6000	1065.4856
33.6000	1125.3600

p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

```
Soil Layer Number           =          1
Depth below ground surface  =      288.000 in
Diameter                    =       12.000 in
Undrained cohesion, c       =     10.42000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =      200.000 pci
Epsilon-50                  =       .02000
Pct                         =     2134.800 lbs/in
Pcd                         =     1125.360 lbs/in
y50                         =         .600 in
```

```
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.
```

y, in	p, lbs/in
0.0000	0.0000
9.6000E-05	5.5296
.0004800	27.6480
.0009600	55.2960
.0048000	130.0902
.0096000	154.7042
.0480000	231.3367
.0960000	275.1072
.2400000	345.9290
.4800000	411.3812
.7200000	455.2682
.9600000	489.2175
2.4000	615.1584
4.8000	731.5508
9.6000	869.9654
21.6000	1065.4856
33.6000	1125.3600

p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

```
Soil Layer Number           =          1
Depth below ground surface  =      312.000 in
Diameter                    =       12.000 in
Undrained cohesion, c       =     10.42000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =      200.000 pci
Epsilon-50                  =       .02000
Pct                         =     2281.440 lbs/in
Pcd                         =     1125.360 lbs/in
y50                         =         .600 in
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.
```

y, in	p, lbs/in
0.0000	0.0000
9.6000E-05	5.9904
.0004800	29.9520
.0009600	59.9040
.0048000	130.0902
.0096000	154.7042
.0480000	231.3367
.0960000	275.1072
.2400000	345.9290
.4800000	411.3812
.7200000	455.2682
.9600000	489.2175
2.4000	615.1584
4.8000	731.5508
9.6000	869.9654
21.6000	1065.4856
33.6000	1125.3600

p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

```
Soil Layer Number           =          1
Depth below ground surface  =      336.000 in
Diameter                    =       12.000 in
Undrained cohesion, c       =     10.42000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =      200.000 pci
Epsilon-50                  =       .02000
Pct                         =     2428.080 lbs/in
Pcd                         =     1125.360 lbs/in
y50                         =         .600 in
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.
```

y, in	p, lbs/in
0.0000	0.0000
9.6000E-05	6.4512
.0004800	32.2560
.0009600	64.5120
.0048000	130.0902
.0096000	154.7042
.0480000	231.3367
.0960000	275.1072
.2400000	345.9290
.4800000	411.3812
.7200000	455.2682
.9600000	489.2175
2.4000	615.1584
4.8000	731.5508
9.6000	869.9654
21.6000	1065.4856
33.6000	1125.3600

p-y Curve Computed Using Cyclic Criteria for Stiff Clay without Free Water
With Option of Defining Initial k

```
Soil Layer Number           =          1
Depth below ground surface  =      360.000 in
Diameter                    =       12.000 in
Undrained cohesion, c       =     10.42000 lbs/in**2
Average Eff. Unit Weight    =       .07500 lbs/in**3
k                           =      200.000 pci
Epsilon-50                  =       .02000
Pct                         =     2574.720 lbs/in
Pcd                         =     1125.360 lbs/in
y50                         =         .600 in
p-multiplier                =      1.00000
y-multiplier                =      1.00000
Number of Cycles of Loading =        1000.
```

y, in	p, lbs/in
0.0000	0.0000
9.6000E-05	6.9120
.0004800	34.5600
.0009600	69.1200
.0048000	130.0902
.0096000	154.7042

.0480000	231.3367
.0960000	275.1072
.2400000	345.9290
.4800000	411.3812
.7200000	455.2682
.9600000	489.2175
2.4000	615.1584
4.8000	731.5508
9.6000	869.9654
21.6000	1065.4856
33.6000	1125.3600

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	15327.1088	-.0045548	0.0000	-349.4774
1.800	.241801	27022.6423	14700.6604	-.0045508	93.8286	-346.5763
3.600	.233617	52922.3774	14079.4967	-.0045393	183.7583	-343.6056
5.400	.225460	77708.8303	13463.7420	-.0045204	269.8223	-340.5662
7.200	.217344	101392.	12853.5194	-.0044945	352.0550	-337.4589
9.000	.209280	123982.	12248.9505	-.0044619	430.4913	-334.2844
10.800	.201281	145488.	11650.1555	-.0044229	505.1669	-331.0433
12.600	.193358	165922.	11057.2539	-.0043778	576.1183	-327.7363
14.400	.185521	185294.	10470.3639	-.0043270	643.3826	-324.3637
16.200	.177780	203615.	9889.6030	-.0042707	706.9978	-320.9262
18.000	.170146	220897.	9315.0879	-.0042093	767.0026	-317.4239
19.800	.162627	237150.	8746.9348	-.0041431	823.4364	-313.8573
21.600	.155231	252386.	8185.2594	-.0040722	876.3393	-310.2265
23.400	.147967	266617.	7630.1771	-.0039971	925.7522	-306.5316
25.200	.140841	279854.	7081.8032	-.0039181	971.7165	-302.7727
27.000	.133862	292111.	6540.2529	-.0038353	1014.2747	-298.9498
28.800	.127034	303399.	6005.6417	-.0037492	1053.4697	-295.0627
30.600	.120365	313731.	5478.0851	-.0036599	1089.3452	-291.1112
32.400	.113859	323120.	4957.6995	-.0035678	1121.9457	-287.0950
34.200	.107521	331579.	4444.6018	-.0034730	1151.3165	-283.0136
36.000	.101356	339121.	3938.9099	-.0033760	1177.5033	-278.8664
37.800	.095367	345759.	3440.7427	-.0032769	1200.5528	-274.6527
39.600	.089559	351508.	2950.2208	-.0031760	1220.5126	-270.3717
41.400	.083933	356380.	2467.4663	-.0030736	1237.4306	-266.0222
43.200	.078494	360390.	1992.6035	-.0029699	1251.3559	-261.6031
45.000	.073242	363553.	1525.7591	-.0028652	1262.3381	-257.1128
46.800	.068179	365883.	1067.0628	-.0027597	1270.4279	-252.5497
48.600	.063307	367395.	616.6476	-.0026536	1275.6764	-247.9117
50.400	.058626	368103.	174.6503	-.0025472	1278.1360	-243.1964
52.200	.054137	368024.	-258.7873	-.0024407	1277.8596	-238.4010
54.000	.049840	367172.	-683.5182	-.0023343	1274.9011	-233.5223
55.800	.045734	365563.	-1099.3889	-.0022283	1269.3156	-228.5563
57.600	.041818	363214.	-1506.2384	-.0021228	1261.1588	-223.4987

59.400	.038091	360140.	-1903.8967	-.0020182	1250.4876	-218.3439
61.200	.034552	356360.	-2292.1832	-.0019145	1237.3601	-213.0855
63.000	.031199	351889.	-2670.9045	-.0018121	1221.8353	-207.7159
64.800	.028029	346744.	-3039.8518	-.0017110	1203.9737	-202.2256
66.600	.025040	340945.	-3398.7978	-.0016115	1183.8372	-196.6033
68.400	.022228	334509.	-3747.4920	-.0015138	1161.4888	-190.8347
70.200	.019590	327454.	-4085.6553	-.0014180	1136.9935	-184.9023
72.000	.017123	319800.	-4412.9726	-.0013244	1110.4181	-178.7836
73.800	.014822	311567.	-4729.0825	-.0012330	1081.8313	-172.4496
75.600	.012684	302776.	-5033.5631	-.0011441	1051.3046	-165.8621
77.400	.010703	293447.	-5325.9114	-.0010579	1018.9118	-158.9693
79.200	.008875	283602.	-5605.5128	-.0009744	984.7307	-151.6989
81.000	.007195	273267.	-5871.5928	-.0008938	948.8429	-143.9456
82.800	.005658	262465.	-6123.1372	-.0008163	911.3358	-135.5483
84.600	.004257	251223.	-6358.7478	-.0007420	872.3037	-126.2412
86.400	.002986	239573.	-6576.3487	-.0006710	831.8514	-115.5376
88.200	.001841	227549.	-6772.4714	-.0006034	790.0993	-102.3765
90.000	.000814	215192.	-6912.9702	-.0005394	747.1955	-53.7334
91.800	-.000101	202662.	-6955.3173	-.0004789	703.6872	6.6811
93.600	-.000910	190153.	-6894.6638	-.0004221	660.2540	60.7117
95.400	-.001620	177841.	-6750.7816	-.0003688	617.5039	99.1573
97.200	-.002238	165850.	-6564.7944	-.0003191	575.8693	107.4951
99.000	-.002769	154208.	-6366.0118	-.0002728	535.4440	113.3745
100.800	-.003220	142933.	-6158.0158	-.0002298	496.2941	117.7322
102.600	-.003596	132039.	-5943.1280	-.0001900	458.4688	121.0321
104.400	-.003904	121537.	-5723.0115	-.0001534	422.0050	123.5417
106.200	-.004148	111436.	-5498.9358	-.0001197	386.9311	125.4313
108.000	-.004335	101741.	-5271.9125	-8.8810E-05	353.2683	126.8168
109.800	-.004468	92457.2797	-5042.7743	-6.0714E-05	321.0322	127.7812
111.600	-.004553	83587.2915	-4812.2238	-3.5245E-05	290.2337	128.3861
113.400	-.004595	75133.2741	-4580.8654	-1.2282E-05	260.8794	128.6788
115.200	-.004598	67096.1761	-4349.2276	8.2955E-06	232.9728	128.6966
117.000	-.004565	59476.0550	-4117.7783	2.6608E-05	206.5141	128.4692
118.800	-.004502	52272.1741	-3886.9372	4.2775E-05	181.5006	128.0210
120.600	-.004411	45483.0811	-3657.0836	5.6918E-05	157.9274	127.3719
122.400	-.004297	39106.6731	-3428.5641	6.9156E-05	135.7871	126.5387
124.200	-.004162	33140.2503	-3201.6975	7.9608E-05	115.0703	125.5354
126.000	-.004010	27580.5622	-2976.7792	8.8393E-05	95.7658	124.3738
127.800	-.003844	22423.8453	-2754.0851	9.5627E-05	77.8606	123.0640
129.600	-.003666	17665.8557	-2533.8748	.0001014	61.3398	121.6142
131.400	-.003479	13301.8960	-2316.3939	.0001059	46.1871	120.0313
133.200	-.003285	9326.8378	-2101.8769	.0001092	32.3849	118.3209
135.000	-.003086	5735.1390	-1890.5499	.0001114	19.9137	116.4870
136.800	-.002884	2520.8583	-1682.6322	.0001126	8.7530	114.5326
138.600	-.002681	-322.3368	-1478.3398	.0001129	1.1192	112.4589
140.400	-.002478	-2801.1650	-1277.8877	.0001124	9.7263	110.2656
142.200	-.002276	-4922.7326	-1081.4935	.0001113	17.0928	107.9503
144.000	-.002077	-6694.5414	-889.3809	.0001096	23.2449	105.5082
145.800	-.001881	-8124.5037	-701.7853	.0001075	28.2101	102.9314
147.600	-.001690	-9220.9684	-518.9600	.0001050	32.0173	100.2079
149.400	-.001503	-9992.7596	-341.1848	.0001022	34.6971	97.3200
151.200	-.001322	-10449.2339	-168.7786	9.9232E-05	36.2821	94.2424
153.000	-.001146	-10600.3626	-2.8813	9.6187E-05	36.8068	90.0879
154.800	-.000976	-10459.6066	147.5407	9.3140E-05	36.3181	77.0476
156.600	-.000811	-10069.2161	274.7687	9.0170E-05	34.9626	64.3168
158.400	-.000651	-9470.4392	379.3504	8.7343E-05	32.8835	51.8851
160.200	-.000496	-8703.5546	461.8069	8.4714E-05	30.2207	39.7332
162.000	-.000346	-7807.9344	522.6177	8.2325E-05	27.1109	27.8344
163.800	-.000200	-6822.1309	562.2088	8.0208E-05	23.6880	16.1558
165.600	-5.74E-05	-5783.9827	580.9432	7.8385E-05	20.0833	4.6602
167.400	8.21E-05	-4730.7355	579.1140	7.6863E-05	16.4262	-6.6926
169.200	.000219	-3699.1723	556.9408	7.5644E-05	12.8443	-17.9442
171.000	.000354	-2725.7485	514.5684	7.4714E-05	9.4644	-29.1363

172.800	.000488	-1846.7262	452.0682	7.4053E-05	6.4122	-40.3084
174.600	.000621	-1098.3030	369.4433	7.3627E-05	3.8136	-51.4971
176.400	.000753	-516.7304	266.6355	7.3393E-05	1.7942	-62.7338
178.200	.000885	-138.4153	143.5362	7.3298E-05	.4806086	-74.0432
180.000	.001017	0.0000	0.0000	7.3278E-05	0.0000	-85.4415

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      =     -.00455475
Maximum bending moment           =   368103.15799 lbs-in
Maximum shear force              =    15327.10878 lbs
Depth of maximum bending moment  =    50.40000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             46
Number of zero deflection points =              2
```

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	20758.1652	-.0080050	0.0000	-415.6011
1.800	.485591	36691.4237	20012.8077	-.0079997	127.4008	-412.5739
3.600	.471201	72046.1078	19272.9566	-.0079840	250.1601	-409.4828
5.400	.456849	106074.	18538.7265	-.0079582	368.3127	-406.3284
7.200	.442551	138786.	17810.2307	-.0079228	481.8942	-403.1114
9.000	.428326	170191.	17087.5813	-.0078781	590.9406	-399.8323
10.800	.414190	200301.	16370.8897	-.0078245	695.4889	-396.4917
12.600	.400158	229126.	15660.2661	-.0077624	795.5767	-393.0901
14.400	.386246	256678.	14955.8199	-.0076921	891.2423	-389.6279
16.200	.372467	282967.	14257.6599	-.0076140	982.5245	-386.1055
18.000	.358835	308005.	13565.8939	-.0075285	1069.4630	-382.5233
19.800	.345364	331804.	12880.6296	-.0074360	1152.0982	-378.8815
21.600	.332066	354376.	12201.9738	-.0073367	1230.4709	-375.1804
23.400	.318952	375731.	11530.0333	-.0072311	1304.6228	-371.4202
25.200	.306034	395884.	10864.9143	-.0071194	1374.5963	-367.6009
27.000	.293322	414845.	10206.7232	-.0070021	1440.4343	-363.7226
28.800	.280826	432628.	9555.5659	-.0068795	1502.1803	-359.7855
30.600	.268556	449245.	8911.5487	-.0067519	1559.8788	-355.7892
32.400	.256519	464710.	8274.7779	-.0066197	1613.5747	-351.7339
34.200	.244725	479034.	7645.3601	-.0064832	1663.3136	-347.6192
36.000	.233180	492233.	7023.4026	-.0063426	1709.1417	-343.4448
37.800	.221891	504319.	6409.0128	-.0061985	1751.1061	-339.2105
39.600	.210865	515305.	5802.2992	-.0060510	1789.2544	-334.9157
41.400	.200108	525207.	5203.3711	-.0059004	1823.6348	-330.5600

43.200	.189624	534037.	4612.3389	-.0057472	1854.2965	-326.1426
45.000	.179418	541811.	4029.3141	-.0055915	1881.2891	-321.6627
46.800	.169495	548543.	3454.4100	-.0054338	1904.6629	-317.1196
48.600	.159857	554247.	2887.7415	-.0052742	1924.4692	-312.5121
50.400	.150507	558939.	2329.4256	-.0051132	1940.7597	-307.8389
52.200	.141449	562633.	1779.5817	-.0049509	1953.5870	-303.0988
54.000	.132684	565345.	1238.3317	-.0047877	1963.0045	-298.2901
55.800	.124213	567091.	705.8008	-.0046239	1969.0662	-293.4109
57.600	.116038	567886.	182.1178	-.0044597	1971.8270	-288.4591
59.400	.108159	567747.	-332.5845	-.0042954	1971.3426	-283.4323
61.200	.100575	566689.	-838.1685	-.0041313	1967.6697	-278.3276
63.000	.093286	564729.	-1334.4910	-.0039676	1960.8655	-273.1419
64.800	.086291	561885.	-1821.4028	-.0038046	1950.9885	-267.8713
66.600	.079590	558172.	-2298.7472	-.0036425	1938.0980	-262.5114
68.400	.073178	553609.	-2766.3590	-.0034817	1922.2542	-257.0572
70.200	.067056	548213.	-3224.0630	-.0033223	1903.5185	-251.5028
72.000	.061218	542003.	-3671.6724	-.0031645	1881.9534	-245.8410
73.800	.055663	534995.	-4108.9865	-.0030087	1857.6226	-240.0635
75.600	.050387	527210.	-4535.7880	-.0028551	1830.5911	-234.1603
77.400	.045385	518666.	-4951.8397	-.0027037	1800.9252	-228.1194
79.200	.040653	509384.	-5356.8806	-.0025550	1768.6931	-221.9260
81.000	.036187	499382.	-5750.6198	-.0024091	1733.9642	-215.5620
82.800	.031981	488681.	-6132.7299	-.0022661	1696.8103	-209.0048
84.600	.028029	477304.	-6502.8372	-.0021264	1657.3051	-202.2255
86.400	.024326	465271.	-6860.5086	-.0019900	1615.5249	-195.1871
88.200	.020865	452606.	-7205.2333	-.0018572	1571.5488	-187.8404
90.000	.017640	439332.	-7536.3964	-.0017282	1525.4594	-180.1186
91.800	.014644	425475.	-7853.2384	-.0016030	1477.3438	-171.9281
93.600	.011869	411061.	-8154.7920	-.0014820	1427.2940	-163.1315
95.400	.009308	396118.	-8439.7748	-.0013652	1375.4089	-153.5160
97.200	.006954	380677.	-8706.3905	-.0012528	1321.7968	-142.7237
99.000	.004798	364775.	-8951.9122	-.0011450	1266.5790	-130.0781
100.800	.002832	348451.	-9171.5970	-.0010418	1209.8979	-114.0161
102.600	.001048	331757.	-9338.8217	-.0009434	1151.9341	-71.7892
104.400	-.000564	314831.	-9368.4677	-.0008499	1093.1626	38.8492
106.200	-.002012	298031.	-9239.2992	-.0007612	1034.8282	104.6715
108.000	-.003304	281569.	-9038.4485	-.0006773	977.6714	118.4960
109.800	-.004450	265492.	-8816.9152	-.0005982	921.8476	127.6521
111.600	-.005458	249828.	-8581.1272	-.0005236	867.4599	134.3345
113.400	-.006335	234600.	-8334.7337	-.0004535	814.5835	139.4360
115.200	-.007091	219823.	-8080.1651	-.0003878	763.2758	143.4180
117.000	-.007731	205511.	-7819.1903	-.0003263	713.5815	146.5540
118.800	-.008265	191674.	-7553.1732	-.0002688	665.5359	149.0205
120.600	-.008699	178320.	-7283.2096	-.0002153	619.1668	150.9391
122.400	-.009040	165455.	-7010.2069	-.0001655	574.4958	152.3973
124.200	-.009295	153083.	-6734.9351	-.0001195	531.5392	153.4603
126.000	-.009470	141209.	-6458.0605	-7.6877E-05	490.3091	154.1782
127.800	-.009572	129834.	-6180.1691	-3.7663E-05	450.8134	154.5901
129.600	-.009606	118960.	-5901.7836	-1.6687E-06	413.0570	154.7271
131.400	-.009578	108588.	-5623.3763	3.1252E-05	377.0412	154.6143
133.200	-.009493	98716.2498	-5345.3786	6.1244E-05	342.7648	154.2720
135.000	-.009357	89344.4890	-5068.1887	8.8452E-05	310.2239	153.7167
136.800	-.009175	80470.7703	-4792.1781	.0001130	279.4124	152.9618
138.600	-.008950	72092.6478	-4517.6965	.0001351	250.3217	152.0178
140.400	-.008688	64207.0629	-4245.0767	.0001548	222.9412	150.8931
142.200	-.008393	56810.3717	-3974.6383	.0001723	197.2582	149.5940
144.000	-.008068	49898.3651	-3706.6917	.0001878	173.2582	148.1244
145.800	-.007717	43466.2816	-3441.5418	.0002013	150.9246	146.4866
147.600	-.007344	37508.8148	-3179.4913	.0002130	130.2389	144.6806
149.400	-.006950	32020.1130	-2920.8451	.0002230	111.1809	142.7041
151.200	-.006541	26993.7726	-2665.9142	.0002316	93.7284	140.5524
153.000	-.006117	22422.8218	-2415.0212	.0002387	77.8570	138.2177
154.800	-.005681	18299.6964	-2168.5055	.0002446	63.5406	135.6886

156.600	-.005236	14616.2021	-1926.7314	.0002494	50.7507	132.9492
158.400	-.004783	11363.4632	-1690.0974	.0002531	39.4565	129.9775
160.200	-.004325	8531.8513	-1459.0487	.0002560	29.6245	126.7433
162.000	-.003862	6110.8879	-1234.0949	.0002581	21.2184	123.2053
163.800	-.003395	4089.1097	-1015.8353	.0002596	14.1983	119.3053
165.600	-.002927	2453.8806	-804.9972	.0002606	8.5204	114.9594
167.400	-.002457	1191.1199	-602.4964	.0002611	4.1358	110.0415
169.200	-.001987	284.8936	-409.5434	.0002613	.9892140	104.3507
171.000	-.001517	-283.2365	-227.8452	.0002613	.9834601	97.5363
172.800	-.001047	-535.3492	-62.3011	.0002612	1.8589	86.4017
174.600	-.000577	-507.5204	58.4868	.0002610	1.7622	47.8071
176.400	-.000107	-324.7966	109.5197	.0002609	1.1278	8.8961
178.200	.000363	-113.2493	90.2213	.0002608	.3932269	-30.3389
180.000	.000832	0.0000	0.0000	.0002608	0.0000	-69.9070

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      =     -.00800504
Maximum bending moment           =   567886.17011 lbs-in
Maximum shear force              =    20758.16524 lbs
Depth of maximum bending moment  =    57.60000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             50
Number of zero deflection points =              2
```

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   =         .750000 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	.750000	0.0000	24702.7528	-.0110997	0.0000	-459.9382
1.800	.730020	43719.8552	23877.6488	-.0110934	151.8051	-456.8440
3.600	.710064	85959.5358	23058.1689	-.0110746	298.4706	-453.6893
5.400	.690152	126729.	22244.4214	-.0110439	440.0322	-450.4746
7.200	.670306	166039.	21436.5137	-.0110015	576.5259	-447.2006
9.000	.650546	203901.	20634.5521	-.0109480	707.9886	-443.8679
10.800	.630893	240324.	19838.6418	-.0108837	834.4578	-440.4769
12.600	.611365	275320.	19048.8874	-.0108091	955.9716	-437.0280
14.400	.591980	308900.	18265.3925	-.0107246	1072.5689	-433.5218
16.200	.572756	341075.	17488.2601	-.0106306	1184.2890	-429.9586
18.000	.553710	371858.	16717.5925	-.0105274	1291.1721	-426.3387
19.800	.534858	401259.	15953.4914	-.0104156	1393.2589	-422.6625
21.600	.516214	429290.	15196.0580	-.0102954	1490.5908	-418.9302
23.400	.497794	455964.	14445.3930	-.0101673	1583.2096	-415.1420
25.200	.479612	481294.	13701.5971	-.0100317	1671.1582	-411.2980

27.000	.461680	505290.	12964.7702	-.0098890	1754.4796	-407.3985
28.800	.444011	527967.	12235.0124	-.0097395	1833.2178	-403.4435
30.600	.426618	549336.	11512.4236	-.0095836	1907.4173	-399.4330
32.400	.409510	569411.	10797.1037	-.0094218	1977.1231	-395.3670
34.200	.392699	588206.	10089.1526	-.0092543	2042.3811	-391.2454
36.000	.376195	605732.	9388.6705	-.0090816	2103.2375	-387.0681
37.800	.360006	622005.	8695.7578	-.0089040	2159.7394	-382.8349
39.600	.344141	637037.	8010.5154	-.0087218	2211.9345	-378.5455
41.400	.328607	650843.	7333.0447	-.0085355	2259.8709	-374.1997
43.200	.313413	663436.	6663.4477	-.0083453	2303.5975	-369.7970
45.000	.298564	674831.	6001.8273	-.0081517	2343.1640	-365.3369
46.800	.284067	685043.	5348.2871	-.0079550	2378.6204	-360.8189
48.600	.269926	694085.	4702.9321	-.0077554	2410.0176	-356.2422
50.400	.256147	701973.	4065.8686	-.0075535	2437.4070	-351.6062
52.200	.242734	708722.	3437.2042	-.0073494	2460.8409	-346.9098
54.000	.229689	714347.	2817.0483	-.0071435	2480.3721	-342.1522
55.800	.217017	718864.	2205.5125	-.0069361	2496.0540	-337.3320
57.600	.204719	722287.	1602.7104	-.0067276	2507.9410	-332.4480
59.400	.192797	724633.	1008.7584	-.0065183	2516.0879	-327.4986
61.200	.181253	725919.	423.7758	-.0063085	2520.5505	-322.4821
63.000	.170087	726159.	-152.1149	-.0060984	2521.3851	-317.3964
64.800	.159299	725371.	-718.7870	-.0058884	2518.6490	-312.2392
66.600	.148889	723571.	-1276.1095	-.0056787	2512.4003	-307.0081
68.400	.138856	720777.	-1823.9466	-.0054698	2502.6977	-301.6998
70.200	.129198	717005.	-2362.1564	-.0052618	2489.6009	-296.3111
72.000	.119913	712273.	-2890.5905	-.0050550	2473.1707	-290.8379
73.800	.111000	706599.	-3409.0927	-.0048497	2453.4686	-285.2757
75.600	.102454	700000.	-3917.4979	-.0046462	2430.5571	-279.6190
77.400	.094273	692496.	-4415.6307	-.0044447	2404.4998	-273.8618
79.200	.086453	684104.	-4903.3034	-.0042456	2375.3617	-267.9967
81.000	.078989	674844.	-5380.3140	-.0040490	2343.2085	-262.0151
82.800	.071877	664735.	-5846.4435	-.0038552	2308.1077	-255.9066
84.600	.065111	653797.	-6301.4526	-.0036644	2270.1280	-249.6590
86.400	.058685	642050.	-6745.0774	-.0034769	2229.3396	-243.2574
88.200	.052594	629515.	-7177.0241	-.0032930	2185.8145	-236.6834
90.000	.046830	616213.	-7596.9620	-.0031127	2139.6268	-229.9143
91.800	.041388	602166.	-8004.5144	-.0029365	2090.8525	-222.9218
93.600	.036259	587396.	-8399.2464	-.0027644	2039.5704	-215.6693
95.400	.031436	571928.	-8780.6470	-.0025966	1985.8619	-208.1093
97.200	.026911	555786.	-9148.1059	-.0024335	1929.8123	-200.1783
99.000	.022676	538995.	-9500.8765	-.0022751	1871.5106	-191.7890
100.800	.018721	521583.	-9838.0213	-.0021217	1811.0513	-182.8163
102.600	.015038	503578.	-10158.3214	-.0019733	1748.5353	-173.0727
104.400	.011617	485013.	-10460.1185	-.0018303	1684.0723	-162.2575
106.200	.008448	465922.	-10741.0063	-.0016927	1617.7839	-149.8400
108.000	.005523	446345.	-10997.1220	-.0015608	1549.8097	-134.7330
109.800	.002830	426332.	-11220.9729	-.0014345	1480.3198	-113.9902
111.600	.000359	405950.	-11346.2572	-.0013141	1409.5476	-25.2146
113.400	-.001901	385486.	-11276.0692	-.0011996	1338.4916	103.2012
115.200	-.003960	365356.	-11071.6047	-.0010910	1268.5967	123.9816
117.000	-.005829	345628.	-10837.1170	-.0009881	1200.0966	136.5603
118.800	-.007517	326342.	-10583.2372	-.0008909	1133.1327	145.5283
120.600	-.009036	307528.	-10315.1206	-.0007992	1067.8061	152.3791
122.400	-.010394	289208.	-10035.9513	-.0007128	1004.1937	157.8090
124.200	-.011602	271399.	-9747.9376	-.0006317	942.3567	162.2062
126.000	-.012668	254115.	-9452.7215	-.0005557	882.3445	165.8117
127.800	-.013603	237369.	-9151.5825	-.0004846	824.1977	168.7872
129.600	-.014413	221170.	-8845.5517	-.0004183	767.9497	171.2470
131.400	-.015108	205525.	-8535.4811	-.0003565	713.6283	173.2759
133.200	-.015697	190442.	-8222.0881	-.0002992	661.2562	174.9385
135.000	-.016186	175925.	-7905.9866	-.0002462	610.8522	176.2854
136.800	-.016583	161980.	-7587.7077	-.0001974	562.4314	177.3578
138.600	-.016896	148610.	-7267.7157	-.0001524	516.0058	178.1889

140.400	-.017132	135816.	-6946.4193	-.0001113	471.5849	178.8070
142.200	-.017297	123603.	-6624.1807	-7.3739E-05	429.1756	179.2358
144.000	-.017397	111969.	-6301.3224	-3.9658E-05	388.7827	179.4957
145.800	-.017439	100918.	-5978.1321	-8.8581E-06	350.4091	179.6045
147.600	-.017429	90448.1323	-5654.8679	1.8828E-05	314.0560	179.5779
149.400	-.017372	80560.2863	-5331.7610	4.3569E-05	279.7232	179.4298
151.200	-.017272	71253.7926	-5009.0190	6.5533E-05	247.4090	179.1725
153.000	-.017136	62527.8180	-4686.8280	8.4888E-05	217.1105	178.8174
154.800	-.016967	54381.2118	-4365.3551	.0001018	188.8237	178.3747
156.600	-.016769	46812.5397	-4044.7496	.0001164	162.5435	177.8536
158.400	-.016547	39820.1132	-3725.1451	.0001290	138.2643	177.2626
160.200	-.016305	33402.0175	-3406.6602	.0001396	115.9792	176.6095
162.000	-.016045	27556.1364	-3089.4005	.0001484	95.6810	175.9014
163.800	-.015771	22280.1758	-2773.4589	.0001556	77.3617	175.1448
165.600	-.015485	17571.6843	-2458.9175	.0001614	61.0128	174.3456
167.400	-.015190	13428.0727	-2145.8482	.0001658	46.6253	173.5092
169.200	-.014888	9846.6307	-1834.3138	.0001692	34.1897	172.6402
171.000	-.014581	6824.5430	-1524.3691	.0001716	23.6963	171.7428
172.800	-.014270	4358.9018	-1216.0623	.0001732	15.1351	170.8204
174.600	-.013957	2446.7188	-909.4355	.0001742	8.4956	169.8760
176.400	-.013643	1084.9340	-604.5267	.0001747	3.7671	168.9116
178.200	-.013328	270.4227	-301.3705	.0001749	.9389676	167.9286
180.000	-.013013	0.0000	0.0000	.0001750	0.0000	166.9276

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =      .75000000 in
Computed slope at pile head      =     -.01109972
Maximum bending moment           =   726158.91082 lbs-in
Maximum shear force              =    24702.75280 lbs
Depth of maximum bending moment  =    63.00000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             71
Number of zero deflection points =              1
```

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

```
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	27649.6672	-.0139052	0.0000	-494.2357
1.800	.974971	48968.7390	26762.8527	-.0138981	170.0303	-491.1137
3.600	.949967	96346.2697	25881.7096	-.0138771	334.5357	-487.9342
5.400	.925013	142143.	25006.3407	-.0138426	493.5517	-484.6979
7.200	.900134	186369.	24136.8477	-.0137950	647.1149	-481.4054
9.000	.875351	229036.	23273.3315	-.0137349	795.2623	-478.0571

10.800	.850688	270153.	22415.8920	-.0136627	938.0316	-474.6535
12.600	.826165	309733.	21564.6280	-.0135788	1075.4610	-471.1953
14.400	.801804	347786.	20719.6379	-.0134837	1207.5894	-467.6826
16.200	.777624	384323.	19881.0191	-.0133778	1334.4564	-464.1161
18.000	.753644	419357.	19048.8683	-.0132615	1456.1022	-460.4959
19.800	.729883	452899.	18223.2818	-.0131353	1572.5673	-456.8225
21.600	.706357	484961.	17404.3552	-.0129996	1683.8932	-453.0960
23.400	.683084	515555.	16592.1835	-.0128549	1790.1217	-449.3169
25.200	.660080	544693.	15786.8617	-.0127015	1891.2955	-445.4852
27.000	.637359	572388.	14988.4840	-.0125399	1987.4575	-441.6011
28.800	.614936	598652.	14197.1446	-.0123704	2078.6515	-437.6649
30.600	.592825	623497.	13412.9373	-.0121936	2164.9218	-433.6765
32.400	.571039	646938.	12635.9561	-.0120098	2246.3132	-429.6360
34.200	.549590	668987.	11866.2946	-.0118194	2322.8713	-425.5434
36.000	.528489	689657.	11104.0467	-.0116229	2394.6419	-421.3987
37.800	.507748	708961.	10349.3062	-.0114205	2461.6718	-417.2018
39.600	.487376	726914.	9602.1674	-.0112128	2524.0082	-412.9525
41.400	.467382	743529.	8862.7246	-.0110000	2581.6989	-408.6506
43.200	.447775	758820.	8131.0729	-.0107827	2634.7923	-404.2958
45.000	.428564	772801.	7407.3078	-.0105611	2683.3373	-399.8878
46.800	.409755	785486.	6691.5253	-.0103357	2727.3836	-395.4261
48.600	.391356	796891.	5983.8226	-.0101067	2766.9814	-390.9103
50.400	.373371	807028.	5284.2976	-.0098747	2802.1814	-386.3397
52.200	.355807	815914.	4593.0495	-.0096399	2833.0351	-381.7137
54.000	.338668	823563.	3910.1789	-.0094027	2859.5946	-377.0314
55.800	.321957	829991.	3235.7878	-.0091635	2881.9124	-372.2920
57.600	.305679	835212.	2569.9801	-.0089225	2900.0419	-367.4943
59.400	.289836	839243.	1912.8618	-.0086803	2914.0371	-362.6371
61.200	.274430	842098.	1264.5412	-.0084370	2923.9527	-357.7191
63.000	.259463	843795.	625.1294	-.0081931	2929.8439	-352.7385
64.800	.244935	844349.	-5.2597	-.0079489	2931.7668	-347.6937
66.600	.230847	843776.	-626.5082	-.0077047	2929.7781	-342.5824
68.400	.217198	842093.	-1238.4945	-.0074608	2923.9354	-337.4024
70.200	.203988	839318.	-1841.0924	-.0072175	2914.2970	-332.1508
72.000	.191215	835465.	-2434.1703	-.0069752	2900.9218	-326.8246
73.800	.178877	830555.	-3017.5904	-.0067342	2883.8698	-321.4201
75.600	.166972	824602.	-3591.2083	-.0064947	2863.2019	-315.9331
77.400	.155496	817626.	-4154.8711	-.0062571	2838.9797	-310.3589
79.200	.144447	809645.	-4708.4168	-.0060217	2811.2660	-304.6919
81.000	.133818	800676.	-5251.6725	-.0057887	2780.1245	-298.9256
82.800	.123607	790739.	-5784.4525	-.0055585	2745.6201	-293.0522
84.600	.113808	779852.	-6306.5562	-.0053312	2707.8189	-287.0630
86.400	.104415	768035.	-6817.7653	-.0051073	2666.7882	-280.9471
88.200	.095422	755308.	-7317.8403	-.0048869	2622.5968	-274.6918
90.000	.086822	741691.	-7806.5166	-.0046703	2575.3151	-268.2819
91.800	.078608	727204.	-8283.4990	-.0044578	2525.0153	-261.6985
93.600	.070774	711870.	-8748.4547	-.0042496	2471.7714	-254.9189
95.400	.063310	695710.	-9201.0046	-.0040460	2415.6597	-247.9144
97.200	.056208	678747.	-9640.7116	-.0038471	2356.7589	-240.6489
99.000	.049460	661003.	-10067.0641	-.0036533	2295.1508	-233.0761
100.800	.043056	642505.	-10479.4542	-.0034647	2230.9206	-225.1351
102.600	.036987	623277.	-10877.1452	-.0032816	2164.1576	-216.7438
104.400	.031243	603347.	-11259.2240	-.0031041	2094.9562	-207.7882
106.200	.025812	582744.	-11624.5259	-.0029325	2023.4173	-198.1028
108.000	.020685	561499.	-11971.5099	-.0027670	1949.6497	-187.4350
109.800	.015851	539647.	-12298.0322	-.0026077	1873.7734	-175.3676
111.600	.011298	517226.	-12600.8824	-.0024548	1795.9243	-161.1326
113.400	.007014	494284.	-12874.6284	-.0023084	1716.2624	-143.0296
115.200	.002988	470878.	-13107.3485	-.0021688	1634.9914	-115.5484
117.000	-.000794	447097.	-13160.3445	-.0020360	1552.4205	56.6639
118.800	-.004342	423500.	-12995.1650	-.0019100	1470.4871	126.8689
120.600	-.007670	400315.	-12749.3481	-.0017908	1389.9810	146.2610
122.400	-.010789	377603.	-12474.3553	-.0016783	1311.1202	159.2865

124.200	-.013712	355407.	-12178.7857	-.0015722	1234.0515	169.1242
126.000	-.016449	333759.	-11867.2755	-.0014725	1158.8854	176.9983
127.800	-.019013	312685.	-11542.8047	-.0013790	1085.7106	183.5248
129.600	-.021413	292205.	-11207.4759	-.0012915	1014.6004	189.0627
131.400	-.023662	272338.	-10862.8620	-.0012098	945.6171	193.8417
133.200	-.025769	253099.	-10510.1870	-.0011338	878.8146	198.0194
135.000	-.027744	234501.	-10150.4314	-.0010633	814.2398	201.7091
136.800	-.029597	216557.	-9784.3972	-.0009980	751.9342	204.9955
138.600	-.031337	199277.	-9412.7514	-.0009378	691.9348	207.9443
140.400	-.032973	182671.	-9036.0552	-.0008826	634.2748	210.6071
142.200	-.034514	166747.	-8654.7854	-.0008320	578.9841	213.0259
144.000	-.035968	151514.	-8269.3503	-.0007860	526.0900	215.2353
145.800	-.037343	136978.	-7880.1011	-.0007442	475.6173	217.2639
147.600	-.038647	123146.	-7487.3410	-.0007066	427.5887	219.1362
149.400	-.039887	110023.	-7091.3327	-.0006729	382.0255	220.8730
151.200	-.041070	97616.7561	-6692.3042	-.0006428	338.9471	222.4921
153.000	-.042201	85931.0458	-6290.4529	-.0006163	298.3717	224.0092
154.800	-.043288	74971.1255	-5885.9505	-.0005930	260.3164	225.4379
156.600	-.044336	64741.6239	-5478.9454	-.0005728	224.7973	226.7900
158.400	-.045350	55246.9219	-5069.5661	-.0005554	191.8296	228.0759
160.200	-.046336	46491.1860	-4657.9234	-.0005407	161.4277	229.3049
162.000	-.047297	38478.3978	-4244.1125	-.0005284	133.6055	230.4849
163.800	-.048238	31212.3809	-3828.2154	-.0005183	108.3763	231.6230
165.600	-.049163	24696.8225	-3410.3018	-.0005102	85.7529	232.7254
167.400	-.050075	18935.2944	-2990.4314	-.0005039	65.7475	233.7973
169.200	-.050977	13931.2694	-2568.6549	-.0004992	48.3725	234.8433
171.000	-.051872	9688.1366	-2145.0155	-.0004958	33.6394	235.8672
172.800	-.052762	6209.2135	-1719.5500	-.0004935	21.5598	236.8723
174.600	-.053649	3497.7567	-1292.2898	-.0004921	12.1450	237.8612
176.400	-.054533	1556.9703	-863.2623	-.0004913	5.4061	238.8359
178.200	-.055417	390.0124	-432.4918	-.0004910	1.3542	239.7980
180.000	-.056301	0.0000	0.0000	-.0004910	0.0000	240.7484

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.01390516
Maximum bending moment           =   844348.83476 lbs-in
Maximum shear force              =    27649.66720 lbs
Depth of maximum bending moment  =    64.80000000 in
Depth of maximum shear force     =        0.00000 in
Number of iterations             =             68
Number of zero deflection points =              1
```

Summary of Pile-Head 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	Boundary Condition 1	Boundary 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	368103.	15327.1088
4	y= .500000	M= 0.000	0.0000	.5000000	567886.	20758.1652
4	y= .750000	M= 0.000	0.0000	.7500000	726159.	24702.7528
4	y= 1.000000	M= 0.000	0.0000	1.0000000	844349.	27649.6672

The analysis ended normally.

```
==============================================================================

                LPILE Plus for Windows, Version 5.0 (5.0.39)

               Analysis of Individual Piles and Drilled Shafts
              Subjected to Lateral Loading Using the p-y Method

                        (c) 1985-2007 by Ensoft, Inc.
                             All Rights Reserved

==============================================================================


This program is licensed to:

Hisham Nofal
CH2MHILL

Path to file locations:      C:\MyFolder\Projects\SR-57\Foundation Reports\Pre-Final
Reports\Retaining Walls\Pile Foundation\Sign Structure 670\Lateral Pile analysis\
Name of input data file:     RW 670.lpd
Name of output file:         RW 670.lpo
Name of plot output file:    RW 670.lpp
Name of runtime file:        RW 670.lpr


------------------------------------------------------------------------------
                          Time and Date of Analysis
------------------------------------------------------------------------------

               Date:  September 28, 2009     Time:  11:19:00


------------------------------------------------------------------------------
                                 Problem Title
------------------------------------------------------------------------------

Retaining Wall 670


------------------------------------------------------------------------------
                                 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 =         1000
- Deflection tolerance for convergence =   1.0000E-05 in
- Maximum allowable deflection         =   1.0000E+01 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 = 363.00 in

Depth of ground surface below top of pile = -216.00 in

Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point	Depth X in	Pile Diameter in	Moment of Inertia in**4	Pile Area Sq.in	Modulus of Elasticity lbs/Sq.in
1	0.0000	16.00000000	1608.0000	201.0000	3600000.
2	363.0000	16.00000000	1608.0000	201.0000	3600000.

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 = -216.000 in
Distance from top of pile to bottom of layer = 48.000 in
p-y subgrade modulus k for top of soil layer = 225.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 225.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974
Distance from top of pile to top of layer = 48.000 in
Distance from top of pile to bottom of layer = 156.000 in
p-y subgrade modulus k for top of soil layer = 125.000 lbs/in**3
p-y subgrade modulus k for bottom of layer = 125.000 lbs/in**3

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 156.000 in
Distance from top of pile to bottom of layer = 984.000 in

(Depth of lowest layer extends 621.00 in below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 6 points

Point No.	Depth X in	Eff. Unit Weight lbs/in**3
1	-216.00	.06900
2	48.00	.06900
3	48.00	.03300
4	156.00	.03300
5	156.00	.03900
6	984.00	.03900

Shear Strength of Soils

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	-216.000	.00000	38.00	------	------
2	48.000	.00000	38.00	------	------
3	48.000	.00000	38.00	------	------
4	156.000	.00000	38.00	------	------
5	156.000	38.89000	.00	.00400	.0
6	984.000	38.89000	.00	.00400	.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	1.0000	1.0000
2	1000.000	1.0000	1.0000

Loading Type

Cyclic loading criteria was used for computation of p-y curves.

Number of cycles of loading = 1000.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 5

Load Case Number 1

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Deflection at pile head = .000 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 = .250 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 = .500 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 Moment (BC Type 4)
Deflection at pile head = .750 in
Bending moment at pile head = .000 in-lbs
Axial load at pile head = .000 lbs

Load Case Number 5

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

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 = .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	Es*h F/L lbs/in
0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	88209.0000
3.630	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	179383.
7.260	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	182348.
10.890	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	185312.
14.520	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	188277.
18.150	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	191242.
21.780	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	194207.
25.410	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	197172.
29.040	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	200136.
32.670	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	203101.
36.300	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	206066.
39.930	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	209031.
43.560	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	211996.
47.190	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	214960.
50.820	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	137326.
54.450	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	138973.
58.080	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	140620.
61.710	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	142268.
65.340	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	143915.
68.970	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	145562.
72.600	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	147209.
76.230	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	148856.
79.860	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	150503.
83.490	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	152150.
87.120	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	153797.
90.750	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	155444.
94.380	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	157092.
98.010	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	158739.
101.640	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	160386.
105.270	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	162033.
108.900	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	163680.
112.530	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	165327.
116.160	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	166974.
119.790	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	168621.
123.420	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	170268.
127.050	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	171916.

130.680	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	173563.
134.310	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	175210.
137.940	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	176857.
141.570	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	178504.
145.200	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	180151.
148.830	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	181798.
152.460	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	183445.
156.090	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
159.720	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
163.350	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
166.980	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
170.610	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
174.240	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
177.870	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
181.500	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
185.130	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
188.760	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
192.390	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
196.020	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
199.650	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
203.280	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
206.910	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
210.540	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
214.170	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
217.800	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
221.430	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
225.060	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
228.690	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
232.320	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
235.950	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
239.580	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
243.210	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
246.840	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
250.470	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
254.100	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
257.730	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
261.360	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
264.990	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
268.620	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
272.250	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
275.880	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
279.510	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
283.140	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
286.770	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
290.400	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
294.030	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
297.660	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
301.290	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
304.920	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
308.550	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
312.180	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
315.810	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
319.440	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
323.070	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
326.700	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
330.330	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
333.960	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
337.590	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
341.220	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
344.850	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
348.480	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
352.110	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
355.740	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
359.370	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	6717143.
363.000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	3358571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	0.00000 in
Computed slope at pile head	=	0.00000
Maximum bending moment	=	0.00000 lbs-in
Maximum shear force	=	0.00000 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	=	0

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 = .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	Es*h F/L lbs/in
0.000	.250000	0.0000	131773.	-.0093051	0.0000	-7148.0495	51894.8394
3.630	.216222	431240.	106303.	-.0091699	2145.4746	-6884.9041	115586.
7.260	.183427	771759.	81888.0266	-.0087927	3839.5975	-6566.8203	129957.
10.890	.152387	1025747.	58720.1234	-.0082291	5103.2212	-6197.8646	147639.
14.520	.123683	1198067.	36977.0837	-.0075319	5960.5333	-5781.7716	169690.
18.150	.097706	1294201.	17140.4383	-.0067505	6438.8114	-5147.5096	191242.
21.780	.074675	1322507.	546.5494	-.0059300	6579.6357	-3995.1289	194207.
25.410	.054654	1298169.	-12092.6961	-.0051084	6458.5525	-2968.6427	197172.
29.040	.037588	1234714.	-21242.1395	-.0043142	6142.8547	-2072.3729	200136.
32.670	.023333	1143951.	-27372.9394	-.0035684	5691.2991	-1305.4783	203101.
36.300	.011681	1035986.	-30945.9403	-.0028849	5154.1605	-663.1172	206066.
39.930	.002388	919284.	-32399.0937	-.0022719	4573.5502	-137.5183	209031.
43.560	-.004812	800769.	-32138.5754	-.0017326	3983.9246	281.0545	211996.
47.190	-.010190	685958.	-30533.2011	-.0012664	3412.7240	603.4492	214960.
50.820	-.014007	579098.	-28476.1932	-.0008698	2881.0836	529.8885	137326.
54.450	-.016505	479220.	-26367.5688	-.0005380	2384.1809	631.8881	138973.
58.080	-.017912	387669.	-23961.2679	-.0002662	1928.7028	693.8975	140620.
61.710	-.018437	305262.	-21390.3259	-4.8905E-05	1518.7142	722.5994	142268.
65.340	-.018267	232375.	-18764.3317	.0001197	1156.0970	724.2294	143915.
68.970	-.017569	169033.	-16171.1981	.0002455	840.9578	704.4944	145562.
72.600	-.016485	114973.	-13679.1739	.0003346	572.0029	668.5217	147209.
76.230	-.015140	69721.7112	-11338.9938	.0003925	346.8742	620.8337	148856.
79.860	-.013636	32651.4954	-9186.0800	.0004246	162.4453	565.3447	150503.
83.490	-.012057	3030.7703	-7242.7227	.0004358	15.0785	505.3756	152150.
87.120	-.010472	-19930.6718	-5520.1837	.0004305	99.1576	443.6817	153797.
90.750	-.008932	-37045.7638	-4020.6783	.0004126	184.3073	382.4921	155444.
94.380	-.007477	-49120.7961	-2739.2043	.0003856	244.3821	323.5542	157092.
98.010	-.006133	-56932.3868	-1665.1976	.0003523	283.2457	268.1850	158739.
101.640	-.004919	-61210.1308	-784.0021	.0003153	304.5280	217.3222	160386.
105.270	-.003844	-62624.2421	-78.1503	.0002765	311.5634	171.5769	162033.
108.900	-.002912	-61777.5020	471.5420	.0002375	307.3508	131.2839	163680.
112.530	-.002120	-59200.8473	885.0595	.0001995	294.5316	96.5494	165327.
116.160	-.001463	-55351.9703	1182.4375	.0001636	275.3829	67.2952	166974.
119.790	-.000932	-50616.3510	1383.1635	.0001304	251.8226	43.2976	168621.
123.420	-.000516	-45310.2030	1505.7128	.0001003	225.4239	24.2226	170268.
127.050	-.000204	-39684.8758	1567.2007	7.3658E-05	197.4372	9.6550	171916.
130.680	1.83E-05	-33932.3258	1583.1325	5.0576E-05	168.8175	-.8771301	173563.
134.310	.000163	-28191.3337	1567.2333	3.1098E-05	140.2554	-7.8828	175210.
137.940	.000244	-22554.2123	1531.3393	1.5187E-05	112.2100	-11.8935	176857.
141.570	.000274	-17073.8104	1485.3355	2.7624E-06	84.9443	-13.4530	178504.
145.200	.000264	-11770.6769	1437.1230	-6.2814E-06	58.5606	-13.1104	180151.

148.830	.000228	-6640.2972	1392.6052	-1.2054E-05	33.0363	-11.4174	181798.
152.460	.000177	-1660.3629	1355.6791	-1.4656E-05	8.2605	-8.9276	183445.
156.090	.000122	3201.9329	931.1850	-1.4173E-05	15.9300	-224.9534	6717143.
159.720	7.38E-05	5100.0401	275.1576	-1.1570E-05	25.3733	-136.4942	6717143.
163.350	3.76E-05	5199.5774	-98.7526	-8.3408E-06	25.8685	-69.5170	6717143.
166.980	1.32E-05	4383.0962	-269.2866	-5.3363E-06	21.8064	-24.4412	6717143.
170.610	-1.17E-06	3244.5563	-309.7043	-2.9448E-06	16.1421	2.1725	6717143.
174.240	-8.17E-06	2134.6428	-278.3193	-1.2582E-06	10.6201	15.1196	6717143.
177.870	-1.03E-05	1223.9582	-216.2557	-2.0514E-07	6.0893	19.0753	6717143.
181.500	-9.66E-06	564.6264	-149.1902	3.5565E-07	2.8091	17.8755	6717143.
185.130	-7.73E-06	140.8376	-90.7965	5.7684E-07	.7006846	14.2974	6717143.
188.760	-5.47E-06	-94.5560	-46.4679	5.9135E-07	.4704278	10.1261	6717143.
192.390	-3.43E-06	-196.5193	-16.5583	5.0008E-07	.9777078	6.3531	6717143.
196.020	-1.84E-06	-214.7690	1.1577	3.7113E-07	1.0685	3.4078	6717143.
199.650	-7.39E-07	-188.1145	9.8243	2.4481E-07	.9358932	1.3672	6717143.
203.280	-6.43E-08	-143.4449	12.5215	1.4086E-07	.7136561	.1189248	6717143.
206.910	2.84E-07	-97.2082	11.7843	6.5402E-08	.4836227	-.5251199	6717143.
210.540	4.11E-07	-57.8909	9.4523	1.6773E-08	.2880144	-.7597102	6717143.
214.170	4.06E-07	-28.5843	6.7114	-1.0340E-08	.1422103	-.7504560	6717143.
217.800	3.35E-07	-9.1663	4.2225	-2.2176E-08	.0456035	-.6208009	6717143.
221.430	2.45E-07	2.0714	2.2744	-2.4401E-08	.0103055	-.4525361	6717143.
225.060	1.58E-07	7.3461	.9212971	-2.1448E-08	.0365478	-.2929964	6717143.
228.690	8.88E-08	8.7600	.0911236	-1.6398E-08	.0435822	-.1643995	6717143.
232.320	3.93E-08	8.0077	-.3392139	-1.1141E-08	.0398392	-.0727011	6717143.
235.950	7.96E-09	6.2973	-.4979051	-6.6556E-09	.0313300	-.0147321	6717143.
239.580	-9.03E-09	4.3929	-.4943121	-3.3038E-09	.0218551	.0167117	6717143.
243.210	-1.60E-08	2.7086	-.4101621	-1.0772E-09	.0134758	.0296520	6717143.
246.840	-1.69E-08	1.4151	-.2997464	2.1574E-10	.0070403	.0311831	6717143.
250.470	-1.45E-08	.5324738	-.1945911	8.2637E-10	.0026491	.0267537	6717143.
254.100	-1.09E-08	.0023736	-.1095854	9.9407E-10	1.1809E-05	.0200814	6717143.
257.730	-7.24E-09	-.2631163	-.0488184	9.1232E-10	.0013090	.0133991	6717143.
261.360	-4.23E-09	-.3520479	-.0102966	7.1944E-10	.0017515	.0078251	6717143.
264.990	-2.02E-09	-.3378693	.0106830	5.0313E-10	.0016809	.0037339	6717143.
268.620	-5.76E-10	-.2744893	.0193947	3.1113E-10	.0013656	.0010659	6717143.
272.250	2.41E-10	-.1970636	.0205201	1.6328E-10	.0009804	-.0004459	6717143.
275.880	6.09E-10	-.1255132	.0176642	6.2140E-11	.0006244	-.0011276	6717143.
279.510	6.92E-10	-.0688213	.0132932	1.2094E-12	.0003424	-.0012807	6717143.
283.140	6.18E-10	-.0290048	.0088926	-2.9463E-11	.0001443	-.0011439	6717143.
286.770	4.78E-10	-.0042611	.0052104	-3.9893E-11	2.1199E-05	-.0008849	6717143.
290.400	3.29E-10	.0088228	.0025010	-3.8462E-11	4.3894E-05	-.0006079	6717143.
294.030	1.99E-10	.0138959	.0007293	-3.1339E-11	6.9134E-05	-.0003682	6717143.
297.660	1.01E-10	.0141178	-.0002781	-2.2556E-11	7.0238E-05	-.0001869	6717143.
301.290	3.52E-11	.0118767	-.0007356	-1.4406E-11	5.9088E-05	-6.5138E-05	6717143.
304.920	-3.57E-12	.0087773	-.0008418	-7.9299E-12	4.3668E-05	6.6146E-06	6717143.
308.550	-2.24E-11	.0057651	-.0007547	-3.3704E-12	2.8682E-05	4.1395E-05	6717143.
312.180	-2.80E-11	.0032983	-.0005854	-5.2863E-13	1.6410E-05	5.1893E-05	6717143.
315.810	-2.62E-11	.0015154	-.0004032	9.8064E-13	7.5391E-06	4.8497E-05	6717143.
319.440	-2.09E-11	.0003714	-.0002449	1.5722E-12	1.8479E-06	3.8719E-05	6717143.
323.070	-1.48E-11	-.0002623	-.0001249	1.6064E-12	1.3051E-06	2.7376E-05	6717143.
326.700	-9.26E-12	-.0005353	-4.4107E-05	1.3563E-12	2.6634E-06	1.7138E-05	6717143.
330.330	-4.95E-12	-.0005825	3.6131E-06	1.0058E-12	2.8982E-06	9.1545E-06	6717143.
333.960	-1.96E-12	-.0005091	2.6808E-05	6.6354E-13	2.5329E-06	3.6252E-06	6717143.
337.590	-1.30E-13	-.0003879	3.3824E-05	3.8229E-13	1.9299E-06	2.4026E-07	6717143.
341.220	8.16E-13	-.0002636	3.1518E-05	1.7803E-13	1.3112E-06	-1.5107E-06	6717143.
344.850	1.16E-12	-.0001591	2.4871E-05	4.5518E-14	7.9152E-07	-2.1515E-06	6717143.
348.480	1.15E-12	-8.2987E-05	1.7115E-05	-3.0383E-14	4.1287E-07	-2.1222E-06	6717143.
352.110	9.42E-13	-3.4844E-05	1.0099E-05	-6.7328E-14	1.7335E-07	-1.7433E-06	6717143.
355.740	6.58E-13	-9.6714E-06	4.7244E-06	-8.1285E-14	4.8117E-08	-1.2177E-06	6717143.
359.370	3.52E-13	-5.4455E-07	1.3322E-06	-8.4488E-14	2.7092E-09	-6.5132E-07	6717143.
363.000	4.47E-14	0.0000	0.0000	-8.4659E-14	0.0000	-8.2653E-08	3358571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

Pile-head deflection = .25000000 in
Computed slope at pile head = -.00930511

```
Maximum bending moment          =       1322507. lbs-in
Maximum shear force             =   131772.71720 lbs
Depth of maximum bending moment =    21.78000000 in
Depth of maximum shear force    =        0.00000 in
Number of iterations            =              5
Number of zero deflection points =             9
```

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   =         .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	Es*h F/L lbs/in
0.000	.500000	0.0000	210512.	-.0174843	0.0000	-10469.5902	38004.6124
3.630	.436532	695181.	173465.	-.0172664	3458.6096	-9941.9861	82673.0173
7.260	.374646	1259356.	138384.	-.0166535	6265.4552	-9386.3137	90945.3140
10.890	.315627	1699850.	105336.	-.0157257	8456.9649	-8822.1137	101462.
14.520	.260477	2024095.	74320.0468	-.0145581	10070.1259	-8266.5233	115202.
18.150	.209935	2239413.	45373.3431	-.0132214	11141.3607	-7682.0738	132831.
21.780	.164490	2353506.	18653.3290	-.0117813	11708.9839	-7039.6971	155353.
25.410	.124403	2374837.	-5630.1623	-.0102988	11815.1078	-6339.6369	184987.
29.040	.089721	2312631.	-26114.8259	-.0088291	11505.6258	-4946.6791	200136.
32.670	.060303	2185243.	-41216.8983	-.0074189	10871.8558	-3374.0219	203101.
36.300	.035860	2013396.	-51035.5161	-.0061024	10016.8961	-2035.6848	206066.
39.930	.016000	1814725.	-56402.4987	-.0049022	9028.4835	-921.3305	209031.
43.560	.000270	1603914.	-58103.3503	-.0038303	7979.6715	-15.7779	211996.
47.190	-.011808	1392895.	-56862.8159	-.0028907	6929.8252	699.2679	214960.
50.820	-.020716	1191090.	-54171.1936	-.0020805	5925.8205	783.7196	137326.
54.450	-.026913	999612.	-50878.6409	-.0013937	4973.1940	1030.3590	138973.
58.080	-.030834	821711.	-46840.5637	-.0008226	4088.1144	1194.4769	140620.
61.710	-.032885	659549.	-42333.3311	-.0003582	3281.3408	1288.8468	142268.
65.340	-.033435	514371.	-37588.1882	9.8762E-06	2559.0597	1325.5569	143915.
68.970	-.032814	386659.	-32794.0980	.0002924	1923.6779	1315.8151	145562.
72.600	-.031312	276286.	-28101.1763	.0005002	1374.5565	1269.8167	147209.
76.230	-.029182	182645.	-23624.5099	.0006441	908.6802	1196.6662	148856.
79.860	-.026636	104772.	-19448.1744	.0007342	521.2533	1104.3451	150503.
83.490	-.023851	41450.9656	-15629.3012	.0007801	206.2237	999.7173	152150.
87.120	-.020972	-8696.8104	-12202.0692	.0007904	43.2677	888.5648	153797.
90.750	-.018113	-47136.0569	-9181.5240	.0007729	234.5077	775.6474	155444.
94.380	-.015361	-75354.6747	-6567.1505	.0007345	374.8989	664.7787	157092.
98.010	-.012781	-94813.5698	-4346.1491	.0006811	471.7093	558.9136	158739.
101.640	-.010417	-106908.	-2496.3808	.0006179	531.8792	460.2425	160386.
105.270	-.008296	-112937.	-988.9674	.0005489	561.8771	370.2882	162033.
108.900	-.006431	-114088.	209.4573	.0004777	567.6001	290.0008	163680.
112.530	-.004827	-111417.	1134.8357	.0004070	554.3116	219.8495	165327.
116.160	-.003476	-105849.	1824.0959	.0003389	526.6105	159.9082	166974.
119.790	-.002367	-98173.6982	2313.8580	.0002749	488.4264	109.9332	168621.
123.420	-.001480	-89050.1043	2639.4080	.0002162	443.0353	69.4332	170268.
127.050	-.000797	-79011.5961	2833.9069	.0001636	393.0925	37.7288	171916.
130.680	-.000293	-68475.9399	2927.8006	.0001173	340.6763	14.0033	173563.
134.310	5.50E-05	-57755.7640	2948.3959	7.7732E-05	287.3421	-2.6560	175210.
137.940	.000271	-47070.5856	2919.5707	4.4865E-05	234.1820	-13.2257	176857.
141.570	.000381	-36559.6810	2861.5838	1.8644E-05	181.8890	-18.7230	178504.
145.200	.000407	-26295.4875	2790.9578	-1.0637E-06	130.8233	-20.1894	180151.
148.830	.000373	-16297.3276	2720.4066	-1.4418E-05	81.0812	-18.6817	181798.
152.460	.000302	-6545.3352	2658.7866	-2.1580E-05	32.5639	-15.2687	183445.
156.090	.000216	3005.4631	1904.4464	-2.2690E-05	14.9526	-400.3457	6717143.
159.720	.000137	7280.9458	716.3311	-1.9465E-05	36.2236	-254.2632	6717143.
163.350	7.50E-05	8206.0271	2.8322	-1.4609E-05	40.8260	-138.8491	6717143.

166.980	3.13E-05	7301.5075	-354.4488	-9.7470E-06	36.3259	-57.9999	6717143.
170.610	4.27E-06	5632.7290	-474.0674	-5.6916E-06	28.0235	-7.9057	6717143.
174.240	-9.98E-06	3859.7783	-454.9063	-2.7154E-06	19.2029	18.4627	6717143.
177.870	-1.54E-05	2330.1093	-369.5360	-7.7460E-07	11.5926	28.5732	6717143.
181.500	-1.56E-05	1176.9469	-265.2784	3.2499E-07	5.8555	28.8690	6717143.
185.130	-1.31E-05	404.1880	-168.9451	8.2073E-07	2.0109	24.2072	6717143.
188.760	-9.64E-06	-49.5945	-92.6238	9.3191E-07	.2467388	17.8430	6717143.
192.390	-6.32E-06	-268.2611	-39.0256	8.3225E-07	1.3346	11.6877	6717143.
196.020	-3.60E-06	-332.9200	-5.7202	6.4376E-07	1.6563	6.6623	6717143.
199.650	-1.64E-06	-309.7898	11.8883	4.4224E-07	1.5412	3.0393	6717143.
203.280	-3.90E-07	-246.6113	18.7133	2.6779E-07	1.2269	.7211008	6717143.
206.910	3.02E-07	-173.9309	19.0088	1.3594E-07	.8653279	-.5583211	6717143.
210.540	5.97E-07	-108.6075	15.9896	4.7351E-08	.5403357	-1.1051	6717143.
214.170	6.45E-07	-57.8461	11.8159	-4.8379E-09	.2877915	-1.1945	6717143.
217.800	5.62E-07	-22.8239	7.7602	-3.0131E-08	.1135518	-1.0401	6717143.
221.430	4.27E-07	-1.5074	4.4391	-3.7760E-08	.0074995	-.7896656	6717143.
225.060	2.88E-07	9.4038	2.0387	-3.5284E-08	.0467850	-.5328539	6717143.
228.690	1.71E-07	13.2936	.4986657	-2.8167E-08	.0661373	-.3156522	6717143.
232.320	8.35E-08	13.0241	-.3545609	-1.9916E-08	.0647965	-.1544451	6717143.
235.950	2.60E-08	10.7195	-.7221751	-1.2471E-08	.0533308	-.0480972	6717143.
239.580	-7.08E-09	7.7811	-.7856974	-6.6707E-09	.0387120	.0130987	6717143.
243.210	-2.24E-08	5.0153	-.6865654	-2.6586E-09	.0249519	.0415195	6717143.
246.840	-2.64E-08	2.7966	-.5226082	-2.0926E-10	.0139136	.0488151	6717143.
250.470	-2.40E-08	1.2212	-.3535485	1.0505E-09	.0060756	.0443308	6717143.
254.100	-1.88E-08	.2298790	-.2101027	1.5054E-09	.0011437	.0347027	6717143.
257.730	-1.30E-08	-.3041571	-.1033644	1.4821E-09	.0015132	.0241063	6717143.
261.360	-7.99E-09	-.5205466	-.0327656	1.2236E-09	.0025898	.0147911	6717143.
264.990	-4.14E-09	-.5420356	.0079985	8.9042E-10	.0026967	.0076685	6717143.
268.620	-1.53E-09	-.4624779	.0270514	5.7546E-10	.0023009	.0028290	6717143.
272.250	3.38E-11	-.3456428	.0320726	3.2209E-10	.0017196	-6.2467E-05	6717143.
275.880	8.10E-10	-.2296308	.0292403	1.4172E-10	.0011424	-.0014980	6717143.
279.510	1.06E-09	-.1333583	.0229524	2.7909E-11	.0006635	-.0019664	6717143.
283.140	1.01E-09	-.0629962	.0159840	-3.3656E-11	.0003134	-.0018730	6717143.
286.770	8.18E-10	-.0173141	.0098363	-5.8836E-11	8.6140E-05	-.0015142	6717143.
290.400	5.85E-10	.0084154	.0051232	-6.1626E-11	4.1867E-05	-.0010825	6717143.
294.030	3.71E-10	.0198802	.0019127	-5.2754E-11	9.8907E-05	-.0006863	6717143.
297.660	2.02E-10	.0223015	-1.1477E-05	-3.9529E-11	.0001110	-.0003738	6717143.
301.290	8.39E-11	.0197969	-.0009718	-2.6329E-11	9.8492E-05	-.0001553	6717143.
304.920	1.09E-11	.0152462	-.0012901	-1.5342E-11	7.5852E-05	-2.0113E-05	6717143.
308.550	-2.75E-11	.0104305	-.0012344	-7.2916E-12	5.1893E-05	5.0833E-05	6717143.
312.180	-4.21E-11	.0062846	-.0010008	-2.0508E-12	3.1266E-05	7.7844E-05	6717143.
315.810	-4.24E-11	.0031644	-.0007173	9.1181E-13	1.5743E-05	7.8384E-05	6717143.
319.440	-3.54E-11	.0010771	-.0004560	2.2417E-12	5.3586E-06	6.5594E-05	6717143.
323.070	-2.61E-11	-.0001459	-.0002493	2.5336E-12	7.2589E-07	4.8268E-05	6717143.
326.700	-1.71E-11	-.0007329	-.0001044	2.2581E-12	3.6461E-06	3.1557E-05	6717143.
330.330	-9.69E-12	-.0009040	-1.4596E-05	1.7449E-12	4.4975E-06	1.7932E-05	6717143.
333.960	-4.39E-12	-.0008388	3.2681E-05	1.1985E-12	4.1733E-06	8.1157E-06	6717143.
337.590	-9.90E-13	-.0006667	5.0737E-05	7.2641E-13	3.3170E-06	1.8321E-06	6717143.
341.220	8.88E-13	-.0004705	5.1080E-05	3.6985E-13	2.3407E-06	-1.6431E-06	6717143.
344.850	1.70E-12	-.0002959	4.2405E-05	1.2957E-13	1.4721E-06	-3.1366E-06	6717143.
348.480	1.83E-12	-.0001626	3.0570E-05	-1.4187E-14	8.0906E-07	-3.3838E-06	6717143.
352.110	1.59E-12	-7.3944E-05	1.9082E-05	-8.8359E-14	3.6788E-07	-2.9460E-06	6717143.
355.740	1.19E-12	-2.4087E-05	9.7478E-06	-1.1910E-13	1.1983E-07	-2.1967E-06	6717143.
359.370	7.27E-13	-3.1752E-06	3.3177E-06	-1.2764E-13	1.5797E-08	-1.3460E-06	6717143.
363.000	2.60E-13	0.0000	0.0000	-1.2864E-13	0.0000	-4.8193E-07	3358571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection              =      .50000000 in
Computed slope at pile head       =     -.01748432
Maximum bending moment            =       2374837. lbs-in
Maximum shear force               =   210512.09341 lbs
Depth of maximum bending moment   =    25.41000000 in
Depth of maximum shear force      =        0.00000 in
Number of iterations              =              6
```

Number of zero deflection points = 9

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Displacement and Moment (BC Type 4)
Specified deflection at pile head = .750000 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	Es*h F/L lbs/in
0.000	.750000	0.0000	274849.	-.0251809	0.0000	-11796.7214	28548.0657
3.630	.658593	919979.	231327.	-.0248924	4577.0098	-12182.3616	67146.0918
7.260	.569281	1679432.	187182.	-.0240774	8355.3840	-12139.6102	77407.8034
10.890	.483791	2278923.	144683.	-.0228363	11337.9252	-11276.2644	84608.4694
14.520	.403489	2729828.	105305.	-.0212659	13581.2315	-10419.2189	93736.7679
18.150	.329401	3043439.	68988.8971	-.0194558	15141.4880	-9589.7925	105680.
21.780	.262240	3230687.	35600.2742	-.0174886	16073.0693	-8806.1430	121897.
25.410	.202433	3301897.	5081.1925	-.0154404	16427.3487	-8008.7780	143612.
29.040	.150143	3267576.	-22417.7728	-.0133806	16256.5989	-7142.1670	172676.
32.670	.105290	3139144.	-46073.0675	-.0113719	15617.6321	-5891.0532	203101.
36.300	.067583	2933086.	-63728.5842	-.0094680	14592.4672	-3836.5042	206066.
39.930	.036552	2676475.	-74512.0915	-.0077092	13315.7937	-2104.8222	209031.
43.560	.011614	2392128.	-79563.3733	-.0061200	11901.1350	-678.2533	211996.
47.190	-.007879	2098844.	-79947.5179	-.0047120	10442.0122	466.6034	214960.
50.820	-.022595	1811709.	-77549.1846	-.0034859	9013.4783	854.7923	137326.
54.450	-.033187	1535837.	-73691.6996	-.0024363	7640.9819	1270.5438	138973.
58.080	-.040282	1276707.	-68553.3949	-.0015544	6351.7781	1560.4781	140620.
61.710	-.044472	1038140.	-62557.6654	-.0008287	5164.8742	1742.9541	142268.
65.340	-.046298	822539.	-56062.6891	-.0002453	4092.2326	1835.5452	143915.
68.970	-.046253	631125.	-49364.8681	.0002105	3139.9233	1854.7143	145562.
72.600	-.044770	464150.	-42703.2800	.0005539	2309.2031	1815.5822	147209.
76.230	-.042231	321099.	-36264.8187	.0008001	1597.5064	1731.7794	148856.
79.860	-.038961	200867.	-30189.7458	.0009638	999.3395	1615.3683	150503.
83.490	-.035234	101921.	-24577.4148	.0010587	507.0708	1476.8251	152150.
87.120	-.031275	22435.1978	-19491.9751	.0010977	111.6179	1325.0701	153797.
90.750	-.027265	-39590.5139	-14967.8965	.0010923	196.9677	1167.5352	155444.
94.380	-.023345	-86231.7304	-11015.1961	.0010529	429.0136	1010.2611	157092.
98.010	-.019621	-119561.	-7624.2784	.0009884	594.8300	858.0131	158739.
101.640	-.016169	-141584.	-4770.3298	.0009065	704.3980	714.4104	160386.
105.270	-.013040	-154193.	-2417.2341	.0008137	767.1315	582.0611	162033.
108.900	-.010261	-159133.	-520.9959	.0007155	791.7070	462.6983	163680.
112.530	-.007845	-157976.	967.3222	.0006161	785.9496	357.3117	165327.
116.160	-.005789	-152110.	2099.1290	.0005189	756.7679	266.2733	166974.
119.790	-.004078	-142736.	2926.2714	.0004264	710.1303	189.4525	168621.
123.420	-.002693	-130866.	3499.3976	.0003406	651.0727	126.3196	170268.
127.050	-.001606	-117331.	3866.6751	.0002628	583.7341	76.0372	171916.
130.680	-.000785	-102794.	4072.8136	.0001938	511.4107	37.5377	173563.
134.310	-.000199	-87761.9315	4158.3460	.0001340	436.6265	9.5876	175210.
137.940	.000188	-72603.9683	4159.1188	8.3760E-05	361.2138	-9.1618	176857.
141.570	.000409	-57566.7291	4105.9448	4.2947E-05	286.4016	-20.1352	178504.
145.200	.000500	-42794.8088	4024.3762	1.1480E-05	212.9095	-24.8063	180151.
148.830	.000493	-28349.7581	3934.5573	-1.0827E-05	141.0436	-24.6807	181798.
152.460	.000421	-14229.9229	3851.1247	-2.4177E-05	70.7956	-21.2877	183445.
156.090	.000317	-390.5929	2990.1380	-2.8761E-05	1.9432	-453.0852	5183744.
159.720	.000212	7478.4789	1454.3167	-2.6539E-05	37.2064	-393.0974	6717143.
163.350	.000125	10167.7460	322.3364	-2.1006E-05	50.5858	-230.5832	6717143.
166.980	5.99E-05	9818.6412	-297.4501	-1.4740E-05	48.8490	-110.8970	6717143.
170.610	1.76E-05	8008.2579	-557.8396	-9.1501E-06	39.8421	-32.5683	6717143.
174.240	-6.50E-06	5768.7260	-595.1191	-4.8306E-06	28.7001	12.0286	6717143.
177.870	-1.75E-05	3687.6936	-514.6141	-1.8656E-06	18.3467	32.3268	6717143.
181.500	-2.00E-05	2032.6275	-388.6194	-7.2090E-08	10.1126	37.0918	6717143.

185.130	-1.80E-05	866.3171	-260.8668	8.3684E-07	4.3100	33.2952	6717143.
188.760	-1.40E-05	138.7345	-153.5190	1.1520E-06	.6902212	25.8496	6717143.
192.390	-9.63E-06	-248.2311	-74.2596	1.1176E-06	1.2350	17.8195	6717143.
196.020	-5.86E-06	-400.3905	-22.2515	9.1426E-07	1.9920	10.8351	6717143.
199.650	-2.99E-06	-409.7772	7.4640	6.6024E-07	2.0387	5.5371	6717143.
203.280	-1.06E-06	-346.2018	21.0807	4.2321E-07	1.7224	1.9652	6717143.
206.910	8.02E-08	-256.7310	24.3782	2.3417E-07	1.2773	-.1484506	6717143.
210.540	6.38E-07	-169.2163	21.9657	1.0062E-07	.8418721	-1.1807	6717143.
214.170	8.11E-07	-97.2599	17.0998	1.7072E-08	.4838802	-1.5002	6717143.
217.800	7.62E-07	-45.0721	11.8175	-2.7554E-08	.2242391	-1.4101	6717143.
221.430	6.11E-07	-11.4647	7.2072	-4.5280E-08	.0570382	-1.1301	6717143.
225.060	4.33E-07	7.2519	3.7009	-4.6601E-08	.0360789	-.8017722	6717143.
228.690	2.72E-07	15.4035	1.3308	-3.9498E-08	.0766344	-.5040184	6717143.
232.320	1.47E-07	16.9138	-.0760804	-2.9365E-08	.0841481	-.2711463	6717143.
235.950	5.92E-08	14.8512	-.7669848	-1.9406E-08	.0738864	-.1095173	6717143.
239.580	5.64E-09	11.3455	-.9847139	-1.1192E-08	.0564451	-.0104436	6717143.
243.210	-2.21E-08	7.7021	-.9295417	-5.2200E-09	.0383191	.0408415	6717143.
246.840	-3.23E-08	4.5970	-.7470878	-1.3638E-09	.0228706	.0596841	6717143.
250.470	-3.20E-08	2.2783	-.5313795	7.9183E-10	.0113348	.0591635	6717143.
254.100	-2.65E-08	.7391771	-.3349787	1.7379E-09	.0036775	.0490464	6717143.
257.730	-1.94E-08	-.1536558	-.1809538	1.9215E-09	.0007645	.0358158	6717143.
261.360	-1.26E-08	-.5745476	-.0737813	1.6932E-09	.0028584	.0232324	6717143.
264.990	-7.06E-09	-.6893081	-.0078940	1.2969E-09	.0034294	.0130691	6717143.
268.620	-3.14E-09	-.6318581	.0263703	8.8268E-10	.0031436	.0058093	6717143.
272.250	-6.54E-10	-.4978597	.0391120	5.2847E-10	.0024769	.0012109	6717143.
275.880	6.97E-10	-.3479051	.0389678	2.6330E-10	.0017309	-.0012904	6717143.
279.510	1.26E-09	-.2149536	.0324036	8.6819E-11	.0010694	-.0023263	6717143.
283.140	1.33E-09	-.1126552	.0237224	-1.5898E-11	.0005605	-.0024567	6717143.
286.770	1.14E-09	-.0427289	.0154289	-6.4617E-11	.0002126	-.0021127	6717143.
290.400	8.59E-10	-.0006412	.0087110	-7.8215E-11	3.1900E-06	-.0015887	6717143.
294.030	5.74E-10	.0205130	.0039002	-7.1984E-11	.0001021	-.0010619	6717143.
297.660	3.36E-10	.0276743	.0008446	-5.6876E-11	.0001377	-.0006216	6717143.
301.290	1.61E-10	.0266450	-.0008241	-3.9845E-11	.0001326	-.0002978	6717143.
304.920	4.66E-11	.0216911	-.0015213	-2.4690E-11	.0001079	-8.6306E-05	6717143.
308.550	-1.83E-11	.0156000	-.0016165	-1.2998E-11	7.7612E-05	3.3856E-05	6717143.
312.180	-4.77E-11	.0099550	-.0013948	-4.9852E-12	4.9527E-05	8.8308E-05	6717143.
315.810	-5.45E-11	.0054736	-.0010515	-1.4775E-13	2.7232E-05	.0001008	6717143.
319.440	-4.88E-11	.0023209	-.0007046	2.2961E-12	1.1547E-05	9.0293E-05	6717143.
323.070	-3.78E-11	.0003579	-.0004138	3.1360E-12	1.7805E-06	6.9982E-05	6717143.
326.700	-2.60E-11	-.0006830	-.0001993	3.0341E-12	3.3978E-06	4.8163E-05	6717143.
330.330	-1.58E-11	-.0010892	-5.8869E-05	2.4784E-12	5.4188E-06	2.9221E-05	6717143.
333.960	-8.03E-12	-.0011104	2.1150E-05	1.7888E-12	5.5241E-06	1.4867E-05	6717143.
337.590	-2.80E-12	-.0009356	5.7552E-05	1.1473E-12	4.6549E-06	5.1894E-06	6717143.
341.220	2.96E-13	-.0006925	6.5978E-05	6.3684E-13	3.4454E-06	-5.4687E-07	6717143.
344.850	1.82E-12	-.0004566	5.8876E-05	2.7654E-13	2.2718E-06	-3.3661E-06	6717143.
348.480	2.30E-12	-.0002651	4.5031E-05	5.0259E-14	1.3188E-06	-4.2620E-06	6717143.
352.110	2.18E-12	-.0001297	2.9960E-05	-7.3521E-14	6.4528E-07	-4.0413E-06	6717143.
355.740	1.77E-12	-4.7572E-05	1.6683E-05	-1.2910E-13	2.3668E-07	-3.2743E-06	6717143.
359.370	1.25E-12	-8.5870E-06	6.5526E-06	-1.4671E-13	4.2722E-08	-2.3069E-06	6717143.
363.000	7.04E-13	0.0000	0.0000	-1.4940E-13	0.0000	-1.3033E-06	3358571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection             =      .75000000 in
Computed slope at pile head      =     -.02518088
Maximum bending moment           =       3301897. lbs-in
Maximum shear force              =   274848.78197 lbs
Depth of maximum bending moment  =    25.41000000 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 5

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	Es*h F/L lbs/in
0.000	1.000000	0.0000	318229.	-.0324135	0.0000	-11796.7214	21411.0493
3.630	.882339	1077449.	274707.	-.0320757	5360.4446	-12182.3430	50118.9543
7.260	.767130	1994373.	229774.	-.0311126	9922.2547	-12574.1612	59499.9261
10.890	.656462	2745609.	183407.	-.0296264	13659.7442	-12972.1769	71731.5297
14.520	.552043	3325911.	136895.	-.0277228	16546.8203	-12654.6692	83211.7661
18.150	.455194	3739464.	92979.8906	-.0255075	18604.2978	-11540.8005	92033.4364
21.780	.366858	4000945.	53015.7138	-.0230806	19905.1984	-10478.0297	103678.
25.410	.287629	4124358.	16780.5050	-.0205330	20519.1938	-9486.2726	119721.
29.040	.217788	4122771.	-15933.5822	-.0179473	20511.3002	-8538.0178	142308.
32.670	.157332	4008680.	-45070.4459	-.0153978	19943.6823	-7515.3506	173396.
36.300	.106001	3795560.	-69632.3727	-.0129508	18883.3826	-6017.3914	206066.
39.930	.063309	3503149.	-87170.7008	-.0106624	17428.6026	-3645.5993	209031.
43.560	.028591	3162701.	-96818.0919	-.0085724	15734.8290	-1669.7676	211996.
47.190	.001073	2800250.	-99964.0523	-.0067028	13931.5909	-63.5438	214960.
50.820	-.020071	2436962.	-98701.2355	-.0050608	12124.1871	759.3107	137326.
54.450	-.035668	2083679.	-94844.6223	-.0036434	10366.5612	1365.5450	138973.
58.080	-.046522	1748390.	-89095.1715	-.0024419	8698.4559	1802.1965	140620.
61.710	-.053396	1436848.	-82025.8973	-.0014432	7148.4968	2092.7204	142268.
65.340	-.057000	1152882.	-74126.0467	-.0006312	5735.7295	2259.8144	143915.
68.970	-.057979	898693.	-65804.7066	1.2005E-05	4471.1082	2324.9460	145562.
72.600	-.056913	675139.	-57395.8961	.0005055	3358.9028	2308.0074	147209.
76.230	-.054310	481999.	-49164.7105	.0008683	2398.0027	2227.0811	148856.
79.860	-.050609	318204.	-41314.1383	.0011192	1583.1028	2098.3031	150503.
83.490	-.046185	182058.	-33992.2278	.0012760	905.7607	1935.8074	152150.
87.120	-.041345	71420.0868	-27299.3326	.0013555	355.3238	1751.7382	153797.
90.750	-.036344	-16135.2507	-21295.2143	.0013728	80.2749	1556.3159	155444.
94.380	-.031379	-83183.1693	-16005.8326	.0013417	413.8466	1357.9440	157092.
98.010	-.026603	-132338.	-11429.6903	.0012741	658.3960	1163.3465	158739.
101.640	-.022129	-166163.	-7543.6457	.0011805	826.6802	977.7248	160386.
105.270	-.018033	-187104.	-4308.1347	.0010697	930.8680	804.9259	162033.
108.900	-.014362	-197440.	-1671.7749	.0009492	982.2875	647.6139	163680.
112.530	-.011142	-199242.	424.6485	.0008248	991.2515	507.4403	165327.
116.160	-.008374	-194357.	2044.8001	.0007014	966.9494	385.2053	166974.
119.790	-.006049	-184396.	3253.9806	.0005826	917.3945	281.0099	168621.
123.420	-.004144	-170733.	4116.8364	.0004713	849.4176	194.3928	170268.
127.050	-.002628	-154508.	4695.5404	.0003693	768.6969	124.4524	171916.
130.680	-.001463	-136643.	5048.3841	.0002780	679.8175	69.9519	173563.
134.310	-.000609	-117857.	5228.7209	.0001982	586.3522	29.4072	175210.
137.940	-2.38E-05	-98682.7943	5284.1975	.0001303	490.9592	1.1584	176857.
141.570	.000337	-79493.5256	5256.2149	7.4485E-05	395.4902	-16.5758	178504.
145.200	.000517	-60522.6741	5179.5622	3.0585E-05	301.1078	-25.6571	180151.
148.830	.000559	-41889.9042	5082.1705	-1.5253E-06	208.4075	-28.0022	181798.
152.460	.000506	-23626.1162	4984.9430	-2.2067E-05	117.5429	-25.5667	183445.
156.090	.000399	-5699.2178	4071.1280	-3.1262E-05	28.3543	-477.9126	4348815.
159.720	.000279	5930.2734	2266.8342	-3.1189E-05	29.5038	-516.1887	6717143.
163.350	.000172	10757.9982	750.6461	-2.5957E-05	53.5224	-319.1767	6717143.
166.980	9.05E-05	11379.9641	-132.6336	-1.9016E-05	56.6167	-167.4788	6717143.
170.610	3.44E-05	9795.0784	-552.2503	-1.2377E-05	48.7317	-63.7150	6717143.
174.240	6.54E-07	7370.6269	-670.0879	-6.9944E-06	36.6698	-1.2094	6717143.
177.870	-1.63E-05	4930.2399	-617.3789	-3.1377E-06	24.5286	30.2502	6717143.
181.500	-2.21E-05	2888.4563	-488.1636	-6.8621E-07	14.3704	40.9428	6717143.
185.130	-2.13E-05	1386.1722	-342.2163	6.5404E-07	6.8964	39.4689	6717143.
188.760	-1.74E-05	403.9660	-212.2166	1.2153E-06	2.0098	32.1562	6717143.
192.390	-1.25E-05	-154.5207	-111.8503	1.2935E-06	.7687595	23.1420	6717143.
196.020	-7.99E-06	-408.0673	-43.0243	1.1171E-06	2.0302	14.7786	6717143.
199.650	-4.40E-06	-466.8771	-1.4376	8.4281E-07	2.3228	8.1341	6717143.

203.280	-1.87E-06	-418.5045	19.5987	5.6521E-07	2.0821	3.4561	6717143.
206.910	-2.92E-07	-324.5906	26.8534	3.3222E-07	1.6149	.5409634	6717143.
210.540	5.44E-07	-223.5484	26.0076	1.6036E-07	1.1122	-1.0070	6717143.
214.170	8.72E-07	-135.7754	21.2517	4.7697E-08	.6754994	-1.6133	6717143.
217.800	8.90E-07	-69.2611	15.3328	-1.6589E-08	.3445827	-1.6478	6717143.
221.430	7.51E-07	-24.4594	9.8184	-4.5974E-08	.1216886	-1.3905	6717143.
225.060	5.57E-07	2.0202	5.4249	-5.3009E-08	.0100506	-1.0301	6717143.
228.690	3.67E-07	14.9256	2.3241	-4.7696E-08	.0742568	-.6783289	6717143.
232.320	2.10E-07	18.8928	.3861594	-3.7093E-08	.0939939	-.3893799	6717143.
235.950	9.73E-08	17.7291	-.6472832	-2.5611E-08	.0882046	-.1800099	6717143.
239.580	2.45E-08	14.1935	-1.0563	-1.5602E-08	.0706144	-.0453175	6717143.
243.210	-1.60E-08	10.0607	-1.0848	-7.9973E-09	.0500534	.0295900	6717143.
246.840	-3.36E-08	6.3179	-.9183439	-2.8620E-09	.0314322	.0621202	6717143.
250.470	-3.68E-08	3.3936	-.6821054	1.8290E-10	.0168834	.0680387	6717143.
254.100	-3.22E-08	1.3658	-.4503265	1.6751E-09	.0067949	.0596631	6717143.
257.730	-2.46E-08	.1241857	-.2593925	2.1423E-09	.0006178	.0455346	6717143.
261.360	-1.67E-08	-.5174065	-.1206944	2.0190E-09	.0025742	.0308831	6717143.
264.990	-9.95E-09	-.7520555	-.0312258	1.6210E-09	.0037416	.0184109	6717143.
268.620	-4.92E-09	-.7441059	.0187182	1.1519E-09	.0037020	.0091065	6717143.
272.250	-1.59E-09	-.6161612	.0405759	7.2538E-10	.0030655	.0029363	6717143.
275.880	3.45E-10	-.4495246	.0447466	3.9125E-10	.0022364	-.0006384	6717143.
279.510	1.25E-09	-.2913009	.0393774	1.5897E-10	.0014493	-.0023198	6717143.
283.140	1.50E-09	-.1636446	.0301320	1.6328E-11	.0008142	-.0027741	6717143.
286.770	1.37E-09	-.0725423	.0204885	-5.7725E-11	.0003609	-.0025391	6717143.
290.400	1.08E-09	-.0148979	.0122525	-8.5141E-11	7.4119E-05	-.0019986	6717143.
294.030	7.54E-10	.0164111	.0060926	-8.4666E-11	8.1647E-05	-.0013953	6717143.
297.660	4.65E-10	.0293341	.0019970	-7.0324E-11	.0001459	-.0008612	6717143.
301.290	2.43E-10	.0309095	-.0003838	-5.1435E-11	.0001538	-.0004506	6717143.
304.920	9.20E-11	.0265477	-.0015105	-3.3420E-11	.0001321	-.0001702	6717143.
308.550	8.65E-13	.0199435	-.0018222	-1.8843E-11	9.9222E-05	-1.6012E-06	6717143.
312.180	-4.48E-11	.0133182	-.0016746	-8.4146E-12	6.6260E-05	8.2970E-05	6717143.
315.810	-6.02E-11	.0077862	-.0013217	-1.7976E-12	3.8738E-05	.0001114	6717143.
319.440	-5.79E-11	.0037227	-.0009250	1.8109E-12	1.8521E-05	.0001071	6717143.
323.070	-4.71E-11	.0010707	-.0005725	3.3138E-12	5.3268E-06	8.7115E-05	6717143.
326.700	-3.38E-11	-.0004334	-.0003007	3.5136E-12	2.1564E-06	6.2601E-05	6717143.
330.330	-2.16E-11	-.0011127	-.0001147	3.0288E-12	5.5358E-06	3.9912E-05	6717143.
333.960	-1.18E-11	-.0012660	-2.4730E-06	2.2830E-12	6.2986E-06	2.1910E-05	6717143.
337.590	-4.99E-12	-.0011306	5.4066E-05	1.5316E-12	5.6251E-06	9.2410E-06	6717143.
341.220	-7.21E-13	-.0008735	7.3261E-05	9.0322E-13	4.3457E-06	1.3343E-06	6717143.
344.850	1.56E-12	-.0005988	7.0431E-05	4.4162E-13	2.9789E-06	-2.8931E-06	6717143.
348.480	2.49E-12	-.0003622	5.6834E-05	1.4033E-13	1.8018E-06	-4.5985E-06	6717143.
352.110	2.58E-12	-.0001862	3.9815E-05	-3.1590E-14	9.2614E-07	-4.7783E-06	6717143.
355.740	2.26E-12	-7.3108E-05	2.3566E-05	-1.1288E-13	3.6372E-07	-4.1741E-06	6717143.
359.370	1.76E-12	-1.5063E-05	1.0070E-05	-1.4052E-13	7.4940E-08	-3.2619E-06	6717143.
363.000	1.24E-12	0.0000	0.0000	-1.4525E-13	0.0000	-2.2863E-06	3358571.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

```
Pile-head deflection             =     1.00000000 in
Computed slope at pile head      =     -.03241352
Maximum bending moment           =       4124358. lbs-in
Maximum shear force              =   318229.05376 lbs
Depth of maximum bending moment  =    25.41000000 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= 0.000	M= 0.000	0.0000	0.0000	0.0000	0.0000
4	y= .250000	M= 0.000	0.0000	.2500000	1322507.	131773.
4	y= .500000	M= 0.000	0.0000	.5000000	2374837.	210512.
4	y= .750000	M= 0.000	0.0000	.7500000	3301897.	274849.
4	y= 1.000000	M= 0.000	0.0000	1.0000000	4124358.	318229.

The analysis ended normally.

==========

LPILE Plus for Windows, Version 5.0 (5.0.17)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

(c) 1985-2005 by Ensoft, Inc.
All Rights Reserved

==========

This program is licensed to:

Hisham Nofal
CH2MHill

Path to file locations: C:\MyFolder\Projects\SR-57\Final Reports\Retaining Walls\Pile Foundation\Sign Structure 698\Lateral Capacity\
Name of input data file: RW 698.lpd
Name of output file: RW 698.lpo
Name of plot output file: RW 698.lpp
Name of runtime file: RW 698.lpr

Time and Date of Analysis

Date: April 14, 2009 Time: 14:57:59

Problem Title

RW 698

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 =         1000
- Deflection tolerance for convergence =   10.000E-12 in
- Maximum allowable deflection         =   1.0000E+01 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                                 =     240.00 in
Depth of ground surface below top of pile =    -252.00 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   16.00000000    1608.0000     201.0000      3600000.
  2     240.0000   16.00000000    1608.0000     201.0000      3600000.


--------------------------------------------------------------------------------
                      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    =     -252.000 in
Distance from top of pile to bottom of layer =      420.000 in
p-y subgrade modulus k for top of soil layer =      115.000 lbs/in**3
p-y subgrade modulus k for bottom of layer   =      115.000 lbs/in**3

Layer  2 is stiff clay without free water
Distance from top of pile to top of layer    =      420.000 in
Distance from top of pile to bottom of layer =      564.000 in

Layer  3 is stiff clay without free water
Distance from top of pile to top of layer    =      564.000 in
Distance from top of pile to bottom of layer =     1000.000 in


(Depth of lowest layer extends  760.00 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        Depth X    Eff. Unit Weight
 No.           in          lbs/in**3
-----      ----------   ----------------
  1          -252.00         .06900
```

2	420.00	.06900
3	420.00	.06900
4	564.00	.06900
5	564.00	.03900
6	1000.00	.03900

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	-252.000	.00000	33.00	------	------
2	420.000	.00000	33.00	------	------
3	420.000	10.42000	.00	.00700	.0
4	564.000	10.42000	.00	.00700	.0
5	564.000	27.78000	.00	.00470	.0
6	1000.000	27.78000	.00	.00470	.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	1.0000	1.0000
2	1000.000	1.0000	1.0000

Loading Type

Cyclic loading criteria was used for computation of p-y curves

Number of cycles of loading = 1000.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 4

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 = .750 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 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

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	107775.	-.0084476	0.0000	-6189.8508
2.400	.229726	240833.	93146.9426	-.0083977	1198.1754	-6000.2055
4.800	.209691	447105.	78990.0005	-.0082551	2224.4046	-5797.2463
7.200	.190101	619985.	65334.4989	-.0080339	3084.5038	-5582.3383
9.600	.171128	760711.	52457.8248	-.0077477	3784.6314	-5148.2234
12.000	.152912	871783.	40709.0556	-.0074093	4337.2279	-4642.4177
14.400	.135564	956114.	30154.3961	-.0070304	4756.7880	-4153.1319
16.800	.119167	1016524.	20750.2242	-.0066214	5057.3329	-3683.6780
19.200	.103781	1055715.	12445.7483	-.0061919	5252.3157	-3236.7186
21.600	.089446	1076264.	5184.5045	-.0057499	5354.5448	-2814.3180
24.000	.076181	1080601.	-1094.2710	-.0053028	5376.1248	-2417.9950
26.400	.063992	1071011.	-6454.3943	-.0048568	5328.4130	-2048.7744
28.800	.052869	1049620.	-10961.6098	-.0044172	5221.9900	-1707.2385
31.200	.042790	1018395.	-14682.5879	-.0039885	5066.6432	-1393.5765
33.600	.033724	979144.	-17684.0387	-.0035744	4871.3610	-1107.6326
36.000	.025633	933512.	-20031.9405	-.0031779	4644.3378	-848.9523
38.400	.018470	882990.	-21790.8744	-.0028014	4392.9863	-616.8260

40.800	.012186	828916.	-23023.4616	-.0024465	4123.9587	-410.3301
43.200	.006727	772478.	-23789.8962	-.0021145	3843.1723	-228.3654
45.600	.002036	714724.	-24147.5664	-.0018062	3555.8418	-69.6931
48.000	-.001943	656569.	-24150.7583	-.0015220	3266.5140	67.0331
50.400	-.005269	598801.	-23850.4345	-.0012617	2979.1072	183.2367
52.800	-.007999	542087.	-23294.0806	-.0010252	2696.9514	280.3915
55.200	-.010190	486989.	-22525.6133	-.0008119	2422.8307	359.9979
57.600	-.011896	433964.	-21585.3426	-.0006210	2159.0263	423.5611
60.000	-.013171	383379.	-20509.9818	-.0004516	1907.3598	472.5730
62.400	-.014064	335516.	-19332.6992	-.0003025	1669.2357	508.4959
64.800	-.014623	290582.	-18083.2054	-.0001727	1445.6834	532.7490
67.200	-.014893	248717.	-16787.8700	-6.0953E-05	1237.3980	546.6972
69.600	-.014916	210001.	-15469.8634	3.4137E-05	1044.7791	551.6416
72.000	-.014729	174462.	-14149.3182	.0001138	867.9684	548.8128
74.400	-.014369	142084.	-12843.5048	.0001795	706.8849	539.3651
76.800	-.013868	112813.	-11567.0192	.0002323	561.2578	524.3729
79.200	-.013254	86562.1730	-10331.9776	.0002736	430.6576	504.8285
81.600	-.012555	63219.3329	-9148.2142	.0003047	314.5240	481.6410
84.000	-.011792	42650.7450	-8023.4810	.0003266	212.1928	455.6367
86.400	-.010987	24706.6243	-6963.6453	.0003406	122.9185	427.5598
88.800	-.010157	9225.2477	-5972.8836	.0003476	45.8968	398.0750
91.200	-.009318	-3963.2171	-5053.8698	.0003487	19.7175	367.7699
93.600	-.008483	-15033.3275	-4207.9558	.0003448	74.7927	337.1585
96.000	-.007663	-24161.4051	-3435.3439	.0003366	120.2060	306.6848
98.400	-.006867	-31522.9781	-2735.2493	.0003251	156.8307	276.7273
100.800	-.006103	-37290.6019	-2106.0529	.0003108	185.5254	247.6031
103.200	-.005375	-41632.0320	-1545.4423	.0002945	207.1245	219.5724
105.600	-.004689	-44708.7249	-1050.5428	.0002766	222.4315	192.8438
108.000	-.004048	-46674.6376	-618.0364	.0002576	232.2121	167.5782
110.400	-.003453	-47675.2998	-244.2697	.0002381	237.1905	143.8940
112.800	-.002905	-47847.1324	74.6489	.0002183	238.0454	121.8715
115.200	-.002405	-47316.9853	342.7631	.0001985	235.4079	101.5571
117.600	-.001952	-46201.8694	564.1929	.0001792	229.8600	82.9678
120.000	-.001545	-44608.8593	743.0683	.0001603	221.9346	66.0951
122.400	-.001182	-42635.1414	883.4732	.0001423	212.1151	50.9089
124.800	-.000862	-40368.1882	989.3969	.0001250	200.8368	37.3608
127.200	-.000582	-37886.0365	1064.6950	.0001088	188.4877	25.3876
129.600	-.000340	-35257.6522	1113.0571	9.3659E-05	175.4112	14.9142
132.000	-.000133	-32543.3623	1137.9815	7.9605E-05	161.9073	5.8562
134.400	4.22E-05	-29795.3408	1142.7562	6.6682E-05	148.2355	-1.8773
136.800	.000187	-27058.1327	1130.4453	5.4896E-05	134.6176	-8.3817
139.200	.000306	-24369.2035	1103.8811	4.4236E-05	121.2398	-13.7551
141.600	.000400	-21759.5035	1065.6596	3.4673E-05	108.2562	-18.0962
144.000	.000472	-19254.0376	1018.1403	2.6171E-05	95.7912	-21.5032
146.400	.000525	-16872.4300	963.4496	1.8682E-05	83.9424	-24.0724
148.800	.000562	-14629.4793	903.4862	1.2152E-05	72.7835	-25.8972
151.200	.000584	-12535.6963	839.9291	6.5209E-06	62.3666	-27.0671
153.600	.000593	-10597.8197	774.2478	1.7254E-06	52.7255	-27.6673
156.000	.000592	-8819.3066	707.7136	-2.2997E-06	43.8771	-27.7779
158.400	.000582	-7200.7943	641.4116	-5.6206E-06	35.8248	-27.4737
160.800	.000565	-5740.5308	576.2544	-8.3033E-06	28.5599	-26.8240
163.200	.000542	-4434.7733	512.9952	-1.0413E-05	22.0635	-25.8920
165.600	.000515	-3278.1539	452.2420	-1.2011E-05	16.3092	-24.7356
168.000	.000485	-2264.0118	394.4713	-1.3160E-05	11.2637	-23.4066
170.400	.000452	-1384.6918	340.0416	-1.3917E-05	6.8890	-21.9514
172.800	.000418	-631.8119	289.2070	-1.4335E-05	3.1433	-20.4108
175.200	.000383	3.5016	242.1294	-1.4465E-05	.0174211	-18.8205
177.600	.000348	530.4090	198.8912	-1.4354E-05	2.6389	-17.2112
180.000	.000314	958.1796	159.5069	-1.4046E-05	4.7671	-15.6090
182.400	.000281	1296.0422	123.9335	-1.3578E-05	6.4480	-14.0355
184.800	.000249	1553.0602	92.0806	-1.2988E-05	7.7267	-12.5085
187.200	.000219	1738.0291	63.8201	-1.2306E-05	8.6469	-11.0419
189.600	.000190	1859.3967	38.9943	-1.1560E-05	9.2507	-9.6463

192.000	.000163	1925.2015	17.4234	-1.0775E-05	9.5781	-8.3294
194.400	.000138	1943.0291	-1.0871	-9.9734E-06	9.6668	-7.0960
196.800	.000115	1919.9836	-16.7407	-9.1726E-06	9.5522	-5.9487
199.200	9.42E-05	1862.6739	-29.7443	-8.3885E-06	9.2670	-4.8877
201.600	7.50E-05	1777.2108	-40.3039	-7.6340E-06	8.8418	-3.9119
204.000	5.76E-05	1669.2151	-48.6200	-6.9195E-06	8.3046	-3.0182
206.400	4.18E-05	1543.8347	-54.8847	-6.2535E-06	7.6808	-2.2024
208.800	2.75E-05	1405.7685	-59.2788	-5.6420E-06	6.9939	-1.4593
211.200	1.47E-05	1259.2967	-61.9694	-5.0896E-06	6.2652	-.7828725
213.600	3.11E-06	1108.3155	-63.1086	-4.5988E-06	5.5140	-.1664369
216.000	-7.38E-06	956.3756	-62.8318	-4.1708E-06	4.7581	.3970427
218.400	-1.69E-05	806.7227	-61.2576	-3.8053E-06	4.0135	.9148317
220.800	-2.56E-05	662.3392	-58.4867	-3.5007E-06	3.2952	1.3942
223.200	-3.37E-05	525.9865	-54.6027	-3.2544E-06	2.6168	1.8424
225.600	-4.13E-05	400.2463	-49.6721	-3.0624E-06	1.9913	2.2664
228.000	-4.84E-05	287.5605	-43.7455	-2.9198E-06	1.4306	2.6725
230.400	-5.53E-05	190.2681	-36.8585	-2.8208E-06	.9466073	3.0667
232.800	-6.20E-05	110.6396	-29.0336	-2.7584E-06	.5504458	3.4541
235.200	-6.85E-05	50.9066	-20.2820	-2.7249E-06	.2532665	3.8390
237.600	-7.50E-05	13.2862	-10.6055	-2.7116E-06	.0661003	4.2247
240.000	-8.15E-05	0.0000	0.0000	-2.7088E-06	0.0000	4.6132

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      =     -.00844763
Maximum bending moment           =       1080601. lbs-in
Maximum shear force              =   107775.01023 lbs
Depth of maximum bending moment  =    24.00000000 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 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	179523.	-.0162661	0.0000	-9066.1378
2.400	.460961	404744.	158204.	-.0161822	2013.6502	-8699.5666
4.800	.422326	759378.	137769.	-.0159409	3777.9995	-8329.1664
7.200	.384445	1066036.	118223.	-.0155624	5303.6622	-7959.2404
9.600	.347626	1326849.	99559.6598	-.0150664	6601.2391	-7593.6770
12.000	.312127	1543922.	81764.1086	-.0144713	7681.2063	-7235.9490
14.400	.278164	1719317.	64814.0331	-.0137949	8553.8149	-6889.1139
16.800	.245911	1855030.	48686.5525	-.0130539	9229.0041	-6550.4533

19.200	.215505	1953012.	33382.1395	-.0122645	9716.4788	-6203.2241
21.600	.187042	2015264.	18922.1640	-.0114419	10026.1895	-5846.7555
24.000	.160584	2043839.	5789.7444	-.0106005	10168.3514	-5096.9275
26.400	.136159	2043055.	-5557.7066	-.0097533	10164.4521	-4359.2817
28.800	.113768	2017162.	-15197.4043	-.0089116	10035.6300	-3673.7997
31.200	.093384	1970107.	-23255.5550	-.0080850	9801.5290	-3041.3258
33.600	.074960	1905535.	-29859.5269	-.0072816	9480.2735	-2461.9841
36.000	.058432	1826782.	-35136.2315	-.0065079	9088.4656	-1935.2697
38.400	.043722	1736881.	-39210.7179	-.0057692	8641.1993	-1460.1356
40.800	.030740	1638570.	-42204.9704	-.0050695	8152.0903	-1035.0748
43.200	.019388	1534297.	-44236.8970	-.0044117	7633.3194	-658.1974
45.600	.009564	1426233.	-45419.4967	-.0037980	7095.6868	-327.3024
48.000	.001158	1316284.	-45860.1929	-.0032295	6548.6747	-39.9444
50.400	-.005938	1206104.	-45660.3187	-.0027066	6000.5180	206.5062
52.800	-.011834	1097114.	-44914.7418	-.0022292	5458.2791	414.8078
55.200	-.016638	990513.	-43711.6149	-.0017964	4927.9271	587.7979
57.600	-.020457	887298.	-42132.2384	-.0014072	4414.4196	728.3492
60.000	-.023393	788279.	-40251.0228	-.0010598	3921.7841	839.3305
62.400	-.025544	694093.	-38135.5385	-.0007525	3453.2011	923.5731
64.800	-.027005	605228.	-35846.6406	-.0004832	3011.0847	983.8419
67.200	-.027863	522030.	-33438.6574	-.0002495	2597.1620	1022.8108
69.600	-.028203	444722.	-30959.6328	-4.9109E-05	2212.5496	1043.0430
72.000	-.028099	373423.	-28451.6119	.0001205	1857.8274	1046.9744
74.400	-.027624	308155.	-25950.9606	.0002618	1533.1081	1036.9017
76.800	-.026843	248859.	-23488.7110	.0003772	1238.1030	1014.9729
79.200	-.025813	195409.	-21090.9262	.0004693	972.1837	983.1812
81.600	-.024590	147622.	-18779.0743	.0005405	734.4391	943.3620
84.000	-.023219	105269.	-16570.4098	.0005929	523.7282	897.1917
86.400	-.021744	68084.2924	-14478.3535	.0006288	338.7278	846.1885
88.800	-.020201	35773.2669	-12512.8682	.0006503	177.9765	791.7159
91.200	-.018622	8022.5253	-10680.8250	.0006594	39.9131	734.9867
93.600	-.017036	-15494.6929	-8986.3583	.0006579	77.0880	677.0688
96.000	-.015465	-35111.9945	-7431.2050	.0006474	174.6865	618.8922
98.400	-.013928	-51164.4771	-6015.0271	.0006295	254.5496	561.2561
100.800	-.012443	-63984.1248	-4735.7149	.0006056	318.3290	504.8375
103.200	-.011021	-73895.9086	-3589.6704	.0005770	367.6413	450.1996
105.600	-.009673	-81214.5428	-2572.0701	.0005449	404.0525	397.8007
108.000	-.008406	-86241.8450	-1677.1053	.0005102	429.0639	348.0032
110.400	-.007224	-89264.6484	-898.2024	.0004738	444.1027	301.0825
112.800	-.006132	-90553.2166	-228.2204	.0004365	450.5135	257.2358
115.200	-.005129	-90360.1066	340.3715	.0003990	449.5528	216.5908
117.600	-.004216	-88919.4336	815.3371	.0003619	442.3852	179.2139
120.000	-.003392	-86446.4886	1204.5357	.0003255	430.0820	145.1183
122.400	-.002654	-83137.6624	1515.8030	.0002903	413.6202	114.2712
124.800	-.001999	-79170.6343	1756.8499	.0002567	393.8838	86.6012
127.200	-.001422	-74704.7831	1935.1770	.0002248	371.6656	62.0047
129.600	-.000920	-69881.7847	2058.0050	.0001948	347.6706	40.3520
132.000	-.000487	-64826.3589	2132.2184	.0001669	322.5192	21.4925
134.400	-.000118	-59647.1362	2164.3220	.0001411	296.7519	5.2605
136.800	.000191	-54437.6133	2160.4090	.0001175	270.8339	-8.5212
139.200	.000445	-49277.1728	2126.1396	9.5950E-05	245.1601	-20.0366
141.600	.000651	-44232.1434	2066.7276	7.6566E-05	220.0604	-29.4733
144.000	.000813	-39356.8801	1986.9366	5.9238E-05	195.8054	-37.0192
146.400	.000935	-34694.8477	1891.0812	4.3888E-05	172.6112	-42.8602
148.800	.001024	-30279.6903	1783.0356	3.0419E-05	150.6452	-47.1777
151.200	.001081	-26136.2766	1666.2462	1.8724E-05	130.0312	-50.1468
153.600	.001113	-22281.7086	1543.7482	8.6869E-06	110.8543	-51.9348
156.000	.001123	-18726.2851	1418.1862	1.8609E-07	93.1656	-52.7002
158.400	.001114	-15474.4150	1291.8360	-6.9036E-06	76.9871	-52.5916
160.800	.001090	-12525.4725	1166.6295	-1.2708E-05	62.3158	-51.7471
163.200	.001053	-9874.5934	1044.1799	-1.7351E-05	49.1273	-50.2942
165.600	.001007	-7513.4089	925.8080	-2.0956E-05	37.3801	-48.3491
168.000	.000953	-5430.7151	812.5684	-2.3639E-05	27.0185	-46.0172

170.400	.000893	-3613.0804	705.2761	-2.5514E-05	17.9755	-43.3930
172.800	.000830	-2045.3896	604.5321	-2.6687E-05	10.1761	-40.5604
175.200	.000765	-711.3266	510.7480	-2.7258E-05	3.5389	-37.5930
177.600	.000699	406.2009	424.1708	-2.7322E-05	2.0209	-34.5547
180.000	.000634	1324.6934	344.9050	-2.6963E-05	6.5905	-31.5002
182.400	.000570	2061.7449	272.9343	-2.6261E-05	10.2574	-28.4754
184.800	.000508	2634.7781	208.1418	-2.5287E-05	13.1083	-25.5183
187.200	.000449	3060.8256	150.3285	-2.4106E-05	15.2280	-22.6595
189.600	.000392	3356.3547	99.2301	-2.2776E-05	16.6983	-19.9225
192.000	.000339	3537.1302	54.5332	-2.1347E-05	17.5977	-17.3249
194.400	.000290	3618.1141	15.8887	-1.9864E-05	18.0006	-14.8788
196.800	.000244	3613.3961	-17.0752	-1.8365E-05	17.9771	-12.5912
199.200	.000202	3536.1529	-44.7424	-1.6883E-05	17.5928	-10.4648
201.600	.000163	3398.6326	-67.4984	-1.5445E-05	16.9086	-8.4986
204.000	.000128	3212.1604	-85.7228	-1.4075E-05	15.9809	-6.6883
206.400	9.54E-05	2987.1634	-99.7813	-1.2790E-05	14.8615	-5.0271
208.800	6.62E-05	2733.2104	-110.0204	-1.1604E-05	13.5981	-3.5055
211.200	3.97E-05	2459.0656	-116.7623	-1.0528E-05	12.2342	-2.1127
213.600	1.56E-05	2172.7515	-120.3011	-9.5675E-06	10.8097	-.8363257
216.000	-6.26E-06	1881.6201	-120.9003	-8.7270E-06	9.3613	.3369944
218.400	-2.63E-05	1592.4299	-118.7906	-8.0068E-06	7.9225	1.4211
220.800	-4.47E-05	1311.4252	-114.1691	-7.4049E-06	6.5245	2.4301
223.200	-6.18E-05	1044.4181	-107.1994	-6.9165E-06	5.1961	3.3780
225.600	-7.79E-05	796.8681	-98.0119	-6.5348E-06	3.9645	4.2782
228.000	-9.32E-05	573.9607	-86.7058	-6.2507E-06	2.8555	5.1436
230.400	-.000108	380.6804	-73.3507	-6.0528E-06	1.8939	5.9857
232.800	-.000122	221.8775	-57.9901	-5.9279E-06	1.1039	6.8148
235.200	-.000136	102.3279	-40.6450	-5.8606E-06	.5090939	7.6394
237.600	-.000150	26.7814	-21.3183	-5.8339E-06	.1332408	8.4662
240.000	-.000164	0.0000	0.0000	-5.8283E-06	0.0000	9.2991

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     =     -.01626607
Maximum bending moment          =       2043839. lbs-in
Maximum shear force             =   179522.57370 lbs
Depth of maximum bending moment =    24.00000000 in
Depth of maximum shear force    =        0.00000 in
Number of iterations            =             11
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 = .750000 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	.750000	0.0000	235930.	-.0235650	0.0000	-10215.3665
2.400	.693444	536811.	211296.	-.0234538	2670.6999	-10312.6557
4.800	.637422	1014220.	186429.	-.0231322	5045.8729	-10409.9449
7.200	.582409	1431669.	161578.	-.0226252	7122.7311	-10299.2989
9.600	.528821	1789793.	137512.	-.0219574	8904.4452	-9755.3502
12.000	.477014	2091727.	114740.	-.0211528	10406.6030	-9221.1121
14.400	.427287	2340547.	93234.0631	-.0202340	11644.5140	-8700.8193
16.800	.379890	2539251.	72955.2517	-.0192224	12633.0881	-8198.1902
19.200	.335020	2690733.	53857.7018	-.0181383	13386.7290	-7716.4347
21.600	.292827	2797768.	35888.0643	-.0170005	13919.2421	-7258.2632
24.000	.253417	2862995.	18989.7265	-.0158271	14243.7574	-6823.6850
26.400	.216857	2888918.	3136.8375	-.0146347	14372.7282	-6387.0559
28.800	.183171	2878052.	-11625.5698	-.0134392	14318.6669	-5914.9502
31.200	.152348	2833116.	-24677.5319	-.0122553	14095.1026	-4961.6849
33.600	.124345	2759600.	-35532.3463	-.0110960	13729.3527	-4083.9937
36.000	.099088	2662560.	-44371.2842	-.0099720	13246.5690	-3281.7879
38.400	.076480	2546618.	-51374.3694	-.0088921	12669.7400	-2554.1165
40.800	.056406	2415963.	-56718.4553	-.0078634	12019.7184	-1899.2885
43.200	.038735	2274369.	-60575.5879	-.0068911	11315.2694	-1314.9887
45.600	.023328	2125201.	-63111.6370	-.0059791	10573.1371	-798.3856
48.000	.010036	1971433.	-64485.1788	-.0051299	9808.1258	-346.2325
50.400	-.001295	1815672.	-64846.6091	-.0043448	9033.1926	45.0406
52.800	-.010819	1660170.	-64337.4700	-.0036243	8259.5501	379.2421
55.200	-.018692	1506852.	-63089.9688	-.0029678	7496.7754	660.3422
57.600	-.025065	1357338.	-61226.6723	-.0023740	6752.9239	892.4049
60.000	-.030087	1212964.	-58860.3547	-.0018412	6034.6459	1079.5265
62.400	-.033903	1074808.	-56093.9838	-.0013670	5347.3035	1225.7827
64.800	-.036649	943713.	-53020.8257	-.0009485	4695.0881	1335.1824
67.200	-.038456	820308.	-49724.6526	-.0005829	4081.1346	1411.6285
69.600	-.039446	705034.	-46280.0367	-.0002667	3507.6337	1458.8847
72.000	-.039736	598164.	-42752.7163	3.4814E-06	2975.9397	1480.5489
74.400	-.039430	499821.	-39200.0194	.0002311	2486.6733	1480.0319
76.800	-.038626	410004.	-35671.3323	.0004197	2039.8198	1460.5407
79.200	-.037415	328599.	-32208.6025	.0005728	1634.8206	1425.0675
81.600	-.035877	255402.	-28846.8628	.0006939	1270.6591	1376.3821
84.000	-.034085	190134.	-25614.7707	.0007862	945.9403	1317.0280
86.400	-.032103	132452.	-22535.1506	.0008531	658.9631	1249.3221
88.800	-.029990	81965.2732	-19625.5356	.0008975	407.7874	1175.3571
91.200	-.027795	38249.0161	-16898.6992	.0009225	190.2936	1097.0066
93.600	-.025562	851.5172	-14363.1728	.0009306	4.2364	1015.9320
96.000	-.023328	-30694.2133	-12023.7453	.0009244	152.7075	933.5909
98.400	-.021125	-56862.4602	-9881.9393	.0009062	282.8978	851.2474
100.800	-.018978	-78127.5219	-7936.4624	.0008782	388.6941	769.9833
103.200	-.016909	-94957.4797	-6183.6307	.0008424	472.4253	690.7097
105.600	-.014935	-107809.	-4617.7635	.0008003	536.3629	614.1797
108.000	-.013068	-117123.	-3231.5468	.0007537	582.7002	541.0008
110.400	-.011317	-123320.	-2016.3680	.0007039	613.5342	471.6482
112.800	-.009689	-126801.	-962.6176	.0006520	630.8523	406.4771
115.200	-.008187	-127941.	-59.9628	.0005992	636.5221	345.7352
117.600	-.006813	-127089.	702.4099	.0005463	632.2842	289.5754
120.000	-.005565	-124569.	1335.5803	.0004942	619.7481	238.0666
122.400	-.004441	-120678.	1850.7072	.0004433	600.3898	191.2058
124.800	-.003437	-115686.	2258.8674	.0003943	575.5521	148.9277
127.200	-.002548	-109836.	2570.9187	.0003476	546.4467	111.1151
129.600	-.001768	-103346.	2797.3864	.0003034	514.1570	77.6080
132.000	-.001092	-96408.3284	2948.3698	.0002620	479.6434	48.2115
134.400	-.000511	-89193.3916	3033.4687	.0002235	443.7482	22.7042
136.800	-1.89E-05	-81847.6785	3061.7272	.0001881	407.2024	.8444897
139.200	.000392	-74497.1011	3041.5930	.0001556	370.6323	-17.6230
141.600	.000728	-67248.0323	2980.8910	.0001263	334.5673	-32.9619
144.000	.000998	-60188.8241	2886.8095	9.9846E-05	299.4469	-45.4393
146.400	.001207	-53391.3465	2765.8964	7.6301E-05	265.6286	-55.3216

148.800	.001364	-46912.5216	2624.0651	5.5508E-05	233.3956	-62.8710
151.200	.001474	-40795.8339	2466.6089	3.7327E-05	202.9643	-68.3424
153.600	.001543	-35072.7987	2298.2207	2.1599E-05	174.4915	-71.9811
156.000	.001578	-29764.3745	2123.0188	8.1587E-06	148.0815	-74.0205
158.400	.001582	-24882.3086	1944.5767	-3.1694E-06	123.7926	-74.6812
160.800	.001562	-20430.4065	1765.9562	-1.2563E-05	101.6438	-74.1692
163.200	.001522	-16405.7189	1589.7426	-2.0199E-05	81.6205	-72.6755
165.600	.001465	-12799.6419	1418.0815	-2.6253E-05	63.6798	-70.3755
168.000	.001396	-9598.9279	1252.7158	-3.0896E-05	47.7559	-67.4292
170.400	.001317	-6786.6061	1095.0240	-3.4293E-05	33.7642	-63.9806
172.800	.001231	-4342.8126	946.0570	-3.6600E-05	21.6060	-60.1586
175.200	.001141	-2245.5325	806.5744	-3.7965E-05	11.1718	-56.0769
177.600	.001049	-471.2554	677.0798	-3.8529E-05	2.3446	-51.8352
180.000	.000957	1004.4507	557.8544	-3.8418E-05	4.9973	-47.5193
182.400	.000865	2206.4456	448.9886	-3.7752E-05	10.9773	-43.2022
184.800	.000775	3159.5959	350.4123	-3.6640E-05	15.7194	-38.9447
187.200	.000689	3888.4248	261.9228	-3.5179E-05	19.3454	-34.7966
189.600	.000606	4416.8254	183.2102	-3.3457E-05	21.9743	-30.7973
192.000	.000528	4767.8337	113.8812	-3.1553E-05	23.7206	-26.9769
194.400	.000455	4963.4552	53.4807	-2.9536E-05	24.6938	-23.3569
196.800	.000387	5024.5412	1.5110	-2.7466E-05	24.9977	-19.9513
199.200	.000323	4970.7078	-42.5514	-2.5394E-05	24.7299	-16.7673
201.600	.000265	4820.2946	-79.2399	-2.3364E-05	23.9816	-13.8064
204.000	.000211	4590.3565	-109.0852	-2.1413E-05	22.8376	-11.0647
206.400	.000162	4296.6858	-132.6038	-1.9571E-05	21.3765	-8.5341
208.800	.000117	3953.8584	-150.2884	-1.7861E-05	19.6709	-6.2030
211.200	7.62E-05	3575.3015	-162.6002	-1.6300E-05	17.7876	-4.0568
213.600	3.88E-05	3173.3776	-169.9623	-1.4901E-05	15.7879	-2.0784
216.000	4.63E-06	2759.4822	-172.7556	-1.3671E-05	13.7288	-.2493460
218.400	-2.68E-05	2344.1506	-171.3148	-1.2613E-05	11.6624	1.4500
220.800	-5.59E-05	1937.1712	-165.9268	-1.1726E-05	9.6377	3.0399
223.200	-8.31E-05	1547.7018	-156.8302	-1.1003E-05	7.7000	4.5406
225.600	-.000109	1184.3862	-144.2155	-1.0437E-05	5.8925	5.9716
228.000	-.000133	855.4673	-128.2274	-1.0014E-05	4.2561	7.3518
230.400	-.000157	568.8948	-108.9673	-9.7188E-06	2.8303	8.6982
232.800	-.000180	332.4242	-86.4980	-9.5319E-06	1.6539	10.0262
235.200	-.000203	153.7042	-60.8487	-9.4311E-06	.7646976	11.3483
237.600	-.000225	40.3502	-32.0217	-9.3909E-06	.2007472	12.6743
240.000	-.000248	0.0000	0.0000	-9.3826E-06	0.0000	14.0105

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

```
Pile-head deflection             =      .75000000 in
Computed slope at pile head      =     -.02356504
Maximum bending moment           =       2888918. lbs-in
Maximum shear force              =   235929.55441 lbs
Depth of maximum bending moment  =    26.40000000 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 4

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	272842.	-.0303848	0.0000	-10215.3665
2.400	.927076	625401.	248209.	-.0302552	3111.4488	-10312.6557
4.800	.854775	1191402.	223342.	-.0298786	5927.3708	-10409.9449
7.200	.783659	1697441.	198241.	-.0292797	8444.9779	-10507.2341
9.600	.714232	2142958.	172907.	-.0284836	10661.4822	-10604.5233
12.000	.646938	2527393.	147339.	-.0275155	12574.0957	-10701.8125
14.400	.582158	2850186.	121798.	-.0264007	14180.0304	-10582.3391
16.800	.520214	3112025.	97197.4054	-.0251648	15482.7100	-9918.3418
19.200	.461367	3316734.	74160.4961	-.0238321	16501.1625	-9279.0826
21.600	.405820	3467995.	52623.8531	-.0224257	17253.7069	-8668.1199
24.000	.353724	3569328.	32515.9913	-.0209669	17757.8515	-8088.4316
26.400	.305179	3624072.	13758.9561	-.0194757	18030.2082	-7542.4311
28.800	.260241	3635371.	-3729.7132	-.0179708	18086.4236	-7031.4599
31.200	.218919	3606169.	-19999.5823	-.0164697	17941.1404	-6526.7643
33.600	.181186	3539373.	-34972.7503	-.0149884	17608.8216	-5950.8757
36.000	.146975	3438300.	-47955.1653	-.0135420	17105.9702	-4867.8034
38.400	.116185	3309188.	-58452.6502	-.0121432	16463.6236	-3880.1006
40.800	.088687	3157727.	-66692.3001	-.0108027	15710.0861	-2986.2743
43.200	.064332	2989065.	-72896.5508	-.0095285	14870.9717	-2183.9346
45.600	.042951	2807824.	-77281.1998	-.0083268	13969.2729	-1469.9395
48.000	.024363	2618116.	-80053.7633	-.0072020	13025.4505	-840.5300
50.400	.008381	2423566.	-81412.1452	-.0061569	12057.5412	-291.4549
52.800	-.005190	2227337.	-81543.5940	-.0051928	11081.2799	181.9142
55.200	-.016544	2032157.	-80623.9227	-.0043098	10110.2315	584.4785
57.600	-.025877	1840342.	-78816.9674	-.0035070	9155.9325	921.3176
60.000	-.033378	1653835.	-76274.2601	-.0027827	8228.0353	1197.6052
62.400	-.039234	1474226.	-73134.8919	-.0021343	7334.4576	1418.5349
64.800	-.043623	1302788.	-69525.5438	-.0015586	6481.5304	1589.2552
67.200	-.046715	1140503.	-65560.6616	-.0010521	5674.1461	1714.8133
69.600	-.048673	988096.	-61342.7562	-.0006109	4915.9027	1800.1079
72.000	-.049647	846058.	-56962.8071	-.0002306	4209.2445	1849.8498
74.400	-.049780	714675.	-52500.7515	9.2897E-05	3555.5968	1868.5299
76.800	-.049201	594055.	-48026.0423	.0003642	2955.4952	1860.3944
79.200	-.048032	484150.	-43598.2580	.0005877	2408.7063	1829.4258
81.600	-.046380	384783.	-39267.7510	.0007678	1914.3427	1779.3301
84.000	-.044346	295665.	-35076.3204	.0009089	1470.9689	1713.5287
86.400	-.042018	216417.	-31057.8992	.0010150	1076.6993	1635.1556
88.800	-.039474	146587.	-27239.2432	.0010903	729.2878	1547.0577
91.200	-.036784	85668.1839	-23640.6154	.0011384	426.2099	1451.7989
93.600	-.034009	33111.8878	-20276.4557	.0011631	164.7358	1351.6675
96.000	-.031202	-11658.8034	-17156.0316	.0011675	58.0040	1248.6859
98.400	-.028405	-49237.0637	-14284.0622	.0011549	244.9605	1144.6219
100.800	-.025658	-80222.3020	-11661.3135	.0011280	399.1159	1041.0020
103.200	-.022991	-105211.	-9285.1595	.0010896	523.4396	939.1263
105.600	-.020428	-124791.	-7150.1077	.0010419	620.8511	840.0835
108.000	-.017990	-139532.	-5248.2876	.0009871	694.1885	744.7666
110.400	-.015690	-149983.	-3569.8998	.0009271	746.1833	653.8899
112.800	-.013539	-156667.	-2103.6266	.0008635	779.4398	568.0045
115.200	-.011545	-160080.	-837.0032	.0007979	796.4192	487.5149
117.600	-.009710	-160685.	243.2481	.0007314	799.4280	412.6945
120.000	-.008034	-158913.	1150.9228	.0006651	790.6103	343.7010
122.400	-.006517	-155161.	1900.0729	.0006000	771.9432	280.5907
124.800	-.005154	-149792.	2504.7812	.0005368	745.2354	223.3329

127.200	-.003940	-143138.	2978.9675	.0004761	712.1276	171.8224
129.600	-.002869	-135493.	3336.2249	.0004183	674.0959	125.8921
132.000	-.001932	-127124.	3589.6840	.0003639	632.4565	85.3239
134.400	-.001122	-118263.	3751.9042	.0003130	588.3721	49.8595
136.800	-.000430	-109115.	3834.7870	.0002659	542.8588	19.2095
139.200	.000154	-99855.8096	3849.5122	.0002226	496.7951	-6.9384
141.600	.000639	-90636.9630	3806.4927	.0001831	450.9302	-28.9112
144.000	.001033	-81584.6449	3715.3460	.0001474	405.8938	-47.0444
146.400	.001346	-72803.3023	3584.8817	.0001154	362.2055	-61.6759
148.800	.001587	-64377.2129	3423.1010	8.6942E-05	320.2846	-73.1413
151.200	.001763	-56372.4174	3237.2082	6.1911E-05	280.4598	-81.7694
153.600	.001884	-48838.6137	3033.6305	4.0101E-05	242.9782	-87.8786
156.000	.001956	-41810.9910	2818.0470	2.1310E-05	208.0149	-91.7743
158.400	.001986	-35311.9883	2595.4224	5.3226E-06	175.6815	-93.7462
160.800	.001982	-29352.9637	2370.0467	-8.0822E-06	146.0346	-94.0668
163.200	.001948	-23935.7641	2145.5782	-1.9129E-05	119.0834	-92.9903
165.600	.001890	-19054.1885	1925.0885	-2.8041E-05	94.7970	-90.7512
168.000	.001813	-14695.3395	1711.1098	-3.5037E-05	73.1111	-87.5644
170.400	.001722	-10840.8615	1505.6826	-4.0330E-05	53.9346	-83.6250
172.800	.001619	-7468.0632	1310.4029	-4.4126E-05	37.1545	-79.1081
175.200	.001510	-4550.9276	1126.4694	-4.6617E-05	22.6414	-74.1698
177.600	.001396	-2061.0100	954.7290	-4.7988E-05	10.2538	-68.9472
180.000	.001279	31.7716	795.7206	-4.8408E-05	.1580677	-63.5598
182.400	.001163	1758.4488	649.7171	-4.8037E-05	8.7485	-58.1098
184.800	.001049	3150.4135	516.7650	-4.7020E-05	15.6737	-52.6836
187.200	.000938	4238.9209	396.7217	-4.5488E-05	21.0892	-47.3525
189.600	.000830	5054.6779	289.2897	-4.3561E-05	25.1477	-42.1742
192.000	.000728	5627.5113	194.0482	-4.1347E-05	27.9976	-37.1936
194.400	.000632	5986.1094	110.4828	-3.8940E-05	29.7816	-32.4442
196.800	.000542	6157.8288	38.0110	-3.6422E-05	30.6360	-27.9489
199.200	.000457	6168.5623	-23.9937	-3.3867E-05	30.6894	-23.7217
201.600	.000379	6042.6590	-76.1814	-3.1336E-05	30.0630	-19.7680
204.000	.000307	5802.8919	-119.2068	-2.8880E-05	28.8701	-16.0865
206.400	.000240	5470.4665	-153.7140	-2.6543E-05	27.2163	-12.6695
208.800	.000179	5065.0649	-180.3225	-2.4359E-05	25.1993	-9.5043
211.200	.000123	4604.9186	-199.6162	-2.2355E-05	22.9100	-6.5739
213.600	7.21E-05	4106.9069	-212.1344	-2.0549E-05	20.4324	-3.8579
216.000	2.48E-05	3586.6736	-218.3641	-1.8954E-05	17.8441	-1.3335
218.400	-1.89E-05	3058.7592	-218.7357	-1.7576E-05	15.2177	1.0239
220.800	-5.96E-05	2536.7423	-213.6191	-1.6416E-05	12.6206	3.2399
223.200	-9.77E-05	2033.3873	-203.3227	-1.5469E-05	10.1164	5.3405
225.600	-.000134	1560.7935	-188.0929	-1.4724E-05	7.7651	7.3510
228.000	-.000168	1130.5413	-168.1170	-1.4166E-05	5.6246	9.2956
230.400	-.000202	753.8319	-143.5258	-1.3775E-05	3.7504	11.1970
232.800	-.000235	441.6174	-114.3994	-1.3527E-05	2.1971	13.0750
235.200	-.000267	204.7148	-80.7737	-1.3394E-05	1.0185	14.9464
237.600	-.000299	53.9038	-42.6489	-1.3340E-05	.2681780	16.8242
240.000	-.000331	0.0000	0.0000	-1.3329E-05	0.0000	18.7166

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

```
Pile-head deflection              =     1.00000000 in
Computed slope at pile head       =     -.03038485
Maximum bending moment            =       3635371. lbs-in
Maximum shear force               =   272842.27842 lbs
Depth of maximum bending moment   =    28.80000000 in
Depth of maximum shear force      =        0.00000 in
Number of iterations              =             14
```

Number of zero deflection points = 3

Summary of Pile-Head 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	Boundary Condition 1	Boundary 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	1080601.	107775.
4	y= .500000	M= 0.000	0.0000	.5000000	2043839.	179523.
4	y= .750000	M= 0.000	0.0000	.7500000	2888918.	235930.
4	y= 1.000000	M= 0.000	0.0000	1.0000000	3635371.	272842.

The analysis ended normally.