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INFORMATION HANDOUT

GEOTECHNICAL DESIGN AND MATERIALS REPORT

ROUTE: 10-SJ-205-1.9/R7.9

GEOTECHNICAL DESIGN & MATERIALS REPORT
I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA
10-SJ-205-PM 1.9/R7.9 CU 06241 EA 10-0Q2701

For

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1. INTRODUCTION

This report presents the results of our geotechnical investigation for the proposed improvements along Interstate 205 in the City of Tracy, San Joaquin County. The project limits start from PM 1.9 on the west to PM 7.9 on the east, consisting of various sections as listed in the following table. The general location of the project site and its limits are shown in Plate 1, Project Location Map.

TABLE 1 – PROJECT SUMMARY

Locations	Scope	Project Limits
Location 1	WB & EB Auxiliary Lane	11th Street to Mountain House Pkwy
Location 2	EB Acceleration Lane	Grant Line Road On-Ramp
Location 3	WB Acceleration Lane & EB Deceleration Lane	Tracy Blvd On-Ramp & Tracy Blvd Off-Ramp
Location 4	WB Deceleration Lane & EB Acceleration Lane	Tracy Blvd Off-Ramp & Tracy Blvd On-Ramp

This report addresses the design of the proposed retaining walls, sound wall extension, sign posts at various locations, retention basins and gabion walls, structural pavement sections, and corrosion investigation recommendations. The investigation included review of readily available soils and geologic literature pertaining to the site including as-built information, "Log of Test Borings" (LOTB) and pavement as-built data, site reconnaissance, obtaining representative samples and logging soil materials encountered in exploratory borings, laboratory testing of the representative samples, performing engineering analyses, and preparation of this report.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to recommend design and construction criteria for the project. This report also establishes a geotechnical baseline to be used in assessing the existence and scope of changed site conditions, if any.

The report is intended for use by the project roadway design engineer, construction personnel, bidders, and contractors for information and reference purposes only and should not be construed directly as project specifications.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

2. EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

Interstate 205 (I-205) is a short route of the Interstate Highway System, connecting I-5 with I-580 in the San Joaquin Valley, California. The current facility is a six-lane freeway. The travel lanes measure approximately 12 feet wide with approximately 11 feet wide medians. This project proposes to construct two eastbound and three westbound auxiliary lanes along Interstate 205 between the Mountain House Parkway (formerly Patterson Pass Road) Overcrossing (OC) and MacArthur Drive Undercrossing. All of the proposed improvements would be constructed within the existing Caltrans right-of-way.

In order to collect the excess surface runoff from the project site, retention basins are proposed along the future auxiliary lanes. Eleven retaining walls are planned within the project limit to accommodate the proposed improvement. Two Changeable Message Signs (CMS), six new/relocated overhead sign posts, three new Microwave Vehicle Detection Systems (MVDS) and three new/relocated Roadside Weather Information Systems (RWIS) are also proposed as part of the improvement.

3. PERTINENT REPORTS AND INVESTIGATION

In addition to the plans obtained from the client (Rajappan & Meyer Consulting Engineers, Inc.), the following investigation report was also reviewed to supplement the subsurface information obtained for the project during this study.

- Taber Consultants, April 2005, "Foundation Investigation, Mountain House Parkway Overcrossing/ I-205 (Bridge No. 29-0099)", prepared for HDR Engineering, Inc.

- Caltrans, September 2002, "Final Foundation Recommendations, Corral Hollow UC Widen (Bridge No. 29-132 R/L)"

4. PHYSICAL SETTING

4.1 Climate

This climate in this area consists of mild winters, warm summers, and small daily and seasonal temperature ranges. Extreme temperatures range from average minimum temperature of 3.4°C (38.1°F) in January to average maximum temperature of 33.60°C (92.50°F) in July. The data are based on the Tracy Pumping Plant station, which is the closest climate station to the project area. Based on the statistical data from the Western Regional Climate Center, average total annual precipitation is 12.18 inches in this area. Most of the rainfall is recorded between November and April with the average total monthly precipitation of 1.98 inches. July is the month with the least rainfall precipitation 0.03 inches.

4.2 Topography and drainage

The topography within the project site along Interstate 205 is mainly flat with slight grade decrease from Elevation 130 ft at the west portion of the project to Elevation 24 ft at the east portion of the project. The vicinity around the project area is mainly occupied by farmland and some urban residential/commercial development. The site drainage is generally by sheet flow, or collected by local drainage systems.

4.3 Man-Made and Natural Features of Engineering and Construction Significance

The subject was considered and was determined to be not significant for the project.

4.4 Regional Geology and Seismicity

The proposed project site is located in the northern portion of the San Joaquin Basin/San Joaquin Valley and the central portion of the Great Valley Geomorphic Province of California. The Great Valley (also referred to as the Central Valley) is a large, asymmetrical, northwestwardly trending, structural trough formed between the uplands of the California Coast Ranges to the west and the Sierra Nevada to the east. The San Joaquin Valley is a flat structural basin (with San Joaquin Basin in the north and Tulare Basin in the south) bounded by the Sierra Nevada to the east, the Coast Ranges

to the west and the Sacramental-San Joaquin Delta to the north. The elevation of the land-surface of the San Joaquin Valley is approximately several feet above sea level in the north. Sediments of the San Joaquin Valley consist of interlayered gravel, sand, silt, and clay derived from the adjacent mountains and deposited in alluvial fan, floodplain, flood-basin, lacustrine, and marsh environments. Sediments derived from the Coast Ranges are finer grain than those derived from the Sierra Nevada.

In sharp contrast to the Sierra Nevada tributaries, most streams that drain from the Coast Ranges are intermittent or ephemeral and contribute an insignificant amount of water to the San Joaquin Valley.

The project site is located within a seismically active region. A Fault Map, showing the site location relative to the major active faults in the vicinity is presented on Plate 4. Significant earthquakes, which have occurred in this area, are generally associated with crustal movements along well-defined active fault zones. Since no active faults pass through the project site, the potential for fault rupture is low.

5. EXPLORATION

5.1 Drilling and Sampling

Based on the preliminary plans, discussions with the design team, and readily available geotechnical data in the area, 61 borings were drilled at selected locations to depths ranging from 5 ft to 30 ft below the existing ground surface.

- Borings RB-1, RB-3, RB-7, RB-8, RB-9, RB-10, RB-13, RB-15, RB-21, RB-22, RB-23, RB-30, RB-31, RB-32, RB-38, RB-39, RB-40, RB-45, RB-46, RB-51, and RB-52 were drilled at shallow depth (approximately 5ft) to collect bulk samples for evaluating the feasibility of the proposed retention basins;

- Additional bulk samples were collected from Borings RW-2, R-4, R/RW-14, R/RW-17, R/RW-20A, R/RW-20B, R/RW-26, R/RW-28, R/RW-34, R/RW-37, R/RW-41, R/RW-43, R/RW-48 for pavement design;

- Borings R-11, RW-16, R/RW-17, R/RW-18A, R/RW-18B, RW-19, R/RW-20A, R/RW-20B, RW-24, RW-25, R/RW-26, RW-27, R/RW-28, RW-29, RW/CMS-33, R/RW-34, RW-35,

RW-36, R/RW-37, R/RW-41, R/RW-42, R/RW-43, R/CMS-44, RW-47, RW-48, RW-49, R/RW-50, RW-53, RW-54, RW-55 and RW-56 were drilled along the corridor for the retaining wall design. These borings were drilled up to approximately 25 to 30 feet below the existing grade;

- Borings RB-5 and RB-6 were drilled up to an approximate depth of 15 feet for the retention basin and culvert; Borings CMS-12, RW/CMS-33, R/CMS-44 and CMS-57 were drilled to an approximate depth of 30 feet for the design of the changeable message sign structure.

Selected samples were obtained from 2.5-inch I.D. (Modified California, MC) and 1.4-inch I.D. (Standard Penetration Test, SPT) samplers at various depths. The samplers were driven into subsurface soils under the impact of a 140-pound hammer having a free fall of 30 inches. The blow counts are presented on the Log of Test Boring (LOTB) in Appendix A. When correlating standard penetration data, the blow counts for the Modified California Sampler may be converted to equivalent SPT blow counts by multiplying a conversion factor of 0.65. Bulk samples were collected from the soil cuttings. The samples were sealed and transported to our laboratory for further evaluation and testing. The field investigation was conducted under the supervision of our field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation. The overall boring programs were summarized on the following tables.

TABLE 2 – BORING PROGRAM (TABLES 2.1 THRU 2.4)

TABLE 2.1 – LOCATION 1

Boring No.	Station (ft)	Offset From "I-205" Line (ft)	Boring Depth (ft)	Date Drilled	Purpose
RB-1/RW-53	104+13	96.9 Lt	5/30	11-3-08/2-2-09	Retention Basin & Retaining wall
RW-2	106+97	54.7 Lt	20	10-28-08	Pavement
RB-3	119+93	94.9 Lt	5	11-3-08	Retention Basin
RW-54	113+52	85.7 Lt	30	2-2-09	Retaining Wall
R-4	116+78	52.9 Lt	5	11-3-08	Pavement
RB-5	117+31	78.8 Lt	15	10-28-08	Retention Basin, culvert, bore and jack
RB-6	124+40	56.5 Lt	15	10-28-08	Retention Basin, culvert, bore and jack
RB-7	127+36	93 Lt	5	11-3-08	Retention Basin
RB-8	132+93	98.2 Lt	5	11-3-08	Retention Basin
RB-9	140+00	94.9 Lt	5	11-3-08	Retention Basin

Boring No.	Station (ft)	Offset From "I-205" Line (ft)	Boring Depth (ft)	Date Drilled	Purpose
RB-10	118+17	93.2 Rt	5	11-3-08	Retention Basin
R-11	114+98	55.2 Rt	24.5	10-21-08	Pavement & Retaining wall
CMS-12	121+26	45.5 Rt	29.5	10-21-08	Changeable Message Sign
RB-13/RW-55	132+24	83.9 Rt	5/30	11-3-08/1-23-09	Retention Basin
R/RW-14	136+00	51.9 Rt	25	10-28-08	Pavement
RB-15/RW-56	141+06	85.0 Rt	5/30	11-3-08/1-23-09	Retention Basin

TABLE 2.2 – LOCATION 2

Boring No.	Station (ft)	Offset From "I-205" Line (ft)	Boring Depth (ft)	Date Drilled	Purpose
RW-16	299+17	74.5 Rt	25	10-21-08	Retaining wall
RB-21	301+00	77.6 Rt	5	10-21-08	Retention Basin
R/RW-17	302+17	74.7 Rt	25	10-21-08	Pavement & Retaining wall
R/RW-18A	305+00	82.1 Rt	20	11-11-08	Retaining Wall
R/RW-18B	305+10	115.0 Rt	25	10-22-08	Pavement & Retaining wall
RB-22	306+06	102.2 Rt	5	10-22-08	Retention Basin
RW-19	308+03	75.3 Rt	30	11-6-08	Pavement & Retaining wall
R/RW-20A	311+04	77.9 Rt	20	11-10-08	Pavement & Retaining wall
R/RW-20B	310+90	129.7 Rt	25	11-10-08	Pavement & Retaining wall
RB-23	311+96	130.1 Rt	5	11-10-08	Retention Basin

TABLE 2.3 – LOCATION 3

Boring No.	Station (ft)	Offset From "I-205" Line (ft)	Boring Depth (ft)	Date Drilled	Purpose
RW/CMS-33	343+22	42.8 Rt	30	10-22-08	Retaining wall & CMS
RB-38	344+64	42.6 Rt	5	11-3-08	Retention Basin
R/RW-34	346+00	48.3 Rt	25	10-22-08	Pavement & Retaining wall
RW-35	348+63	43.3 Rt	30	10-22-08	Retaining wall
RB-39	350+29	100.0 Rt	5	11-3-08	Retention Basin
RW-36	352+14	40.5 Rt	30	10-22-08	Retaining wall
R/RW-37	355+41	51.7 Rt	25	10-22-08	Pavement & Retaining wall
RB-40	356+58	110.7 Rt	5	10-22-08	Retention Basin
P-58	357+37	73.5 Rt	30	2-2-09	Sign Post
CMS-57	336+00	57.8 Rt	30	1-23-09	Changeable Message Sign
RW-24	342+00	76.5 Lt	25	10-28-08	Retaining wall

Boring No.	Station (ft)	Offset From "I-205" Line (ft)	Boring Depth (ft)	Date Drilled	Purpose
RB-30	343+85	102.8 Lt	5	11-11-08	Retention Basin
RW-25	345+28	75.6 Lt	25	10-28-08	Retaining wall
R/RW-26	348+00	93.0 Lt	25	10-28-08	Pavement & Retaining wall
RB-31	350+38	96.0 Lt	5	11-11-08	Retention Basin
RW-27	350+85	72.2 Lt	30	10-24-08	Retaining wall
R/RW-28	353+68	71.7 Lt	30	10-24-08	Pavement & Retaining wall
RW-29	356+26	82.3 Lt	30	10-24-08	Retaining wall
RB-32	356+30	118.0 Lt	5	11-11-08	Retention Basin

TABLE 2.4 – LOCATION 4

Boring No.	Station (ft)	Offset From "I-205" Line (ft)	Boring Depth (ft)	Date Drilled	Purpose
P-59	384+70	72.0 Lt	30	2-2-09	Sign Post
R/RW-41	386+00	60.3 Lt	25	10-24-08	Pavement & Retaining wall
RB-45	387+66	98.5 Lt	5	10-24-08	Retention Basin
R/RW-42	389+00	64.6 Lt	25	10-24-08	Retaining wall
R/RW-43	391+98	68.4 Lt	25	10-24-08	Pavement & Retaining wall
RB-46	394+28	92.0 Lt	5	11-3-08	Retention Basin
R/CMS-44	395+53	61.7 Lt	30	10-23-08	Retaining wall & CMS
RW-47	385+87	73.0 Rt	25	10-23-08	Retaining wall
RB-51	386+97	100.0 Rt	5	10-23-08	Retention Basin
R/RW-48	388+90	70.4 Rt	25	10-23-08	Pavement & Retaining wall
RW-49	392+00	73.3 Rt	25	10-23-08	Retaining wall
RB-52	394+24	85.8 Rt	5	10-23-08	Retention Basin
R/RW-50	395+03	75.9 Lt	25	10-23-08	Pavement & Retaining wall

The approximate locations of these explorations are shown on the attached Site Plans, Plates 2A through 2C.

5.2 Geologic Mapping

The subject was considered and was determined to be not significant for the project.

5.3 Geophysical Studies

The subject was considered and was determined to be not applicable to the project.

5.4 Instrumentation

The subject was considered and was determined to be not applicable to the project.

5.5 Exploration Notes

The exploratory borings mainly encountered undivided surficial deposits. Drilling conditions by using both hollow and solid stem augers were considered normal for this site.

6. GEOTECHNICAL TESTING

6.1 In-Situ Testing

In-situ testing consists of recording blow counts during sampling (using both Modified California sampler and Standard Penetration Test sampler). Based on our previous experience, when correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler may be converted equivalent SPT blow counts by multiplying a conversion factor of 0.65. Based on the average values of the SPT-N values for the soil materials encountered in the field exploration, the subsurface soils are classified generally as firm to stiff cohesive soils with lenses of medium dense to very dense cohesionless soils. The in-situ test results are presented on the LOTB attached in Appendix A.

6.2 Laboratory Testing

Laboratory tests performed for the study include the following: Laboratory determination of Moisture-Density (California Test Method 226), Atterberg Limits (California Test Method 204), Grain Size Analysis (California Test Method 202), Unconfined Compression Test (California Test Method 221), R-value Test (California Test Method 301), and Corrosion Test (California Test Method 643). The laboratory test results are attached in Appendix B. Moisture-Density test and Unit Weight test results are summarized on the LOTBs attached in Appendix A.

7. GEOTECHNICAL CONDITIONS

7.1 Site Geology

General geologic features pertaining to the site were evaluated by reference to the Geologic Map of the San Francisco-San Jose Quadrangle, California, Regional Geological Map 5A. by D.L.

Wagner, E.J. Bortungo, and R.D. McJunkin (California Division of Mines and Geology, 1991). The project site is mainly underlain by Alluvial Fan Deposits (Qf). A geologic map of the general project area is shown on Plate 2. Description of the main geologic units is as follow:

Qf – Typical Alluvial Fans Deposits generally consist of dense gravely and clayey sand/clayey gravel that fines upward to sandy clay.

7.2 Lithology

The site consists of native alluvial and roadway fill. The subject was considered and was determined to be not applicable for the project. Detailed description of subsoil conditions are presented in Section 7.3.

7.2.1 Structure

The site consists of roadway fill, native alluvial soils, and embankments. The subject was considered and was determined to be not applicable for the project.

7.2.2 Existing Slope Stability

The existing slopes within the project limit typically have gradient of 3H:1V or flatter. The slopes of the approach embankments at Corral Hollow Road have gradient of 2H:1V. All slopes are generally covered with vegetations, and appear to be in good condition.

7.3 Subsurface Soil Conditions

The subsurface soil conditions of each segment are summarized in the following paragraphs.

- *Locations 1, approx. Sta. 102+00 to 142+00*

  Based on the boring data (see Table 2.1 for boring summary), the subsurface soil conditions of the site generally consist of interbedded lean clay/silt and slity sand/poorly-graded sand layers to the maximum depth explored (30 feet below the existing grade). Groundwater was not encountered during field exploration.

- *Location 2, approx. Sta. 298+70 to 313+00*

  Based on the boring data (see Table 2.2 for boring summary), Borings RW-16, R/RW-17, R/RW-18A, RW-19, R/RW-20A were drilled from the top of the embankment at the existing I-205 level, and R/RW-18B, R/RW-20B & RB-23 were drilled at the toe of the embankment.

  The subgrade along this segment mainly consists of lean clay. Interbedded dense sand layers were encountered at various locations. Groundwater was encountered between Elev. 8 to 14 feet during field exploration.

- *Location 3, approx. Sta. 340+70 to 357+30*

  Based on the boring data (see Table 2.3 for boring summary), the subgrade mainly consists of lean clay and silt with interbedded sand lenses. Groundwater was encountered at Elev. 6 to 8 feet along the north side of I-205, and Elev. 12 to 13 feet along the south side of I-205 during field exploration. The anticipated groundwater level appears to be close to the footing elevation of the proposed retaining walls, and groundwater may be expected during footing excavation.

- *Location 4, approx. Sta. 383+70 to 396+00*

  Based on the boring data (see Table 2.4 for boring summary), the subgrade mainly consists of lean clay and silt with interbedded sand layers. Groundwater was generally encountered at approximate Elev. 10 feet during field exploration along these two segments. The groundwater level appears to be relatively close to the footing elevation of the proposed retaining walls, and groundwater may be expected during footing excavation.

Detailed descriptions of the materials encountered in the exploratory borings are presented in the LOTB in Appendix A "Log of Test Borings". It should be noted that these descriptions and related information depict subsurface conditions only at the locations indicated and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface soil conditions at other locations may differ from conditions occurring at the locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted due to field limitations. Also, the passage of time may result in a change in the soil conditions at the locations due to environmental changes.

7.4 Water

7.4.1 Surface Water

The terrain along Interstate 205 slightly slopes downward from west to east. The surface water/drainage generally follows the ground topography and is collected in local storm drainage system.

7.4.1.1 *Scour*

The subject was considered and was determined to be not applicable for the roadway project.

7.4.1.2 *Erosion*

The existing slopes have established landscaping to help control erosion. The subject was considered and was determined to be not applicable for the project.

7.4.2 Groundwater

The groundwater conditions of each segment are summarized in the following paragraphs.

- *Location 1, approx. Sta. 102+00 to 142+00*
  Based on the boring data (see Table 2.1), groundwater was not encountered during field exploration. Groundwater was not considered for foundation analysis within this segment.

- *Location 2, approx. Sta. 298+70 to 313+00*
  Based on the boring data (see Table 2.2), groundwater was encountered between Elev. 8 to 14 feet during field exploration.

- *Location 3, approx. Sta. 340+70 to 357+30*
  Based on the boring data (see Table 2.3), groundwater was encountered at Elev. 6 to 8 feet along the north side of I-205, and Elev. 12 to 13 feet along the south side of I-205 during field exploration. The anticipated groundwater level appears to be close to the footing elevation of the proposed retaining walls, and groundwater may be expected during footing excavation.

- *Location 4, approx. Sta. 383+70 to 396+00*
  Based on the boring data (see Table 2.4), groundwater was generally encountered at approximate Elev. 10 feet during field exploration along these two segments. The groundwater level appears to be relatively close to the footing elevation of the proposed retaining walls, and groundwater may be expected during footing excavation.

However, it is anticipated that groundwater level will vary with the passage of time due to seasonal runoff, groundwater fluctuations, surface and subsurface flow, ground surface run-off, and other factors that were not existent at the time of investigation.

7.5 Project Site Seismicity

7.5.1 Ground Motions

The project is located in a seismically active part of northern California. Many faults existing in the San Francisco Bay Area are capable of producing earthquakes that may cause strong ground shaking at the site. The attached Fault Map (Plate 4) presents the locations of the fault systems relative to the project site.

Maximum credible earthquake magnitudes for some of the major faults in the area determined by Mualchin (California Seismic Hazard Map 1996) are summarized below. These maximum credible earthquake magnitudes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

TABLE 3 – EARTHQUAKE DATA

Fault	Estimated Distance From Project Site (miles)	Maximum Credible Earthquake	Anticipated Peak Bedrock Acceleration
Midway San Joaquin/N (MSJ)	2.6	6.75	0.55
Coast Ranges-Sierran Block (CSB)	4.3	7.00	0.55
Greenville (GVE)	8.0	7.25	0.40

7.5.2 Ground Rupture

Since no active faults pass through the project site, the potential for fault rupture is low.

8. GEOTECHNICAL ANALYSIS AND DESIGN

8.1 Dynamic Analysis

8.1.1 Parameter Selection

Based on the seismic hazard map prepared by Mualchin (Caltrans, 1996), the governing faults at the project site consist of the following faults: (1) the Midway San Joaquin Fault (a not known/published fault, Mw=6.75), located at about 2.6 miles from the site with an anticipated Peak Bedrock Acceleration of 0.55g and Peak Ground Acceleration of 0.58g; (2) the Coast Ranges-Sierran Block Fault (a reverse fault, Mw=7.0), located at about 4.3 miles from the site with an anticipated Peak Bedrock Acceleration of 0.55g and Peak Ground Acceleration of 0.55g.

The recommended curve is based on Caltrans Seismic Design Criteria (Version 1.4, June 2006). The ARS Design Curve are presented on Plate 4. The seismic design criteria are as follows:

1. Soil Profile D.
2. ARS Design Curve – an envelope of the following two curves:
   (a) Modified Figure B.7 (SDC 1.4), Mw = 6.75, PBA = 0.55g with 20 % increase of Sa for structual periods ≥ 1 second, no change of Sa for structural periods <0.5 seconds, linear interpolation of Sa between 0.5 and 1 seconds to account for near-fault effect (for the Midway San Joaquin Fault which governs short period range).
   (b) Modified Figure B.8 (SDC 1.4), Mw = 7.0, PBA = 0.55g with no modification. The peak bedrock acceleration has been selected to account for the reverse fault effect. (The Coast Ranges-Sierran Block Fault which governs long period range).

8.1.2 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. We have evaluated the liquefaction potential along the project limit based on the boring data. The detail discussions of each segment are summarized in the following paragraphs.

- *Location 1, approx. Sta. 102+00 to 142+00*

  Based on the boring data, groundwater was not encountered during field exploration to a maximum depth of 30 feet below the existing grade. The liquefaction potential is considered low, and liquefaction was not considered for foundation design within this segment.

- *Location 2, approx. Sta. 298+70 to 313+00*

  Based on the boring data, a thin layer of submerged, loose silty sand pocket was encountered between Elev. 9 to 13 feet in Boring RW-19, which may be subject to liquefaction during earthquake. Based on the subsoil condition along this segment, this sand pocket is considered local and discontinuous. The impact to foundation design due to the potential liquefaction may be limited to post-liquefaction settlement. Liquefaction was considered for foundation design within this segment.

- *Location 3, approx. Sta. 340+70 to 357+30*

  Submerged, loose silty sand pockets were encountered from Elev. 4 to 9 feet in Boring RW-25 and Elev. 8 to 11.5 feet in Boring RW/CMS-33. According to our analysis, these layers may be subject to liquefaction during earthquake.

  Based on the subsoil condition along this segment, these sand pockets are considered local and discontinuous. Also, the boring was advanced by hollow stem drilling method, which may yield lower driving resistance. In our opinion, the impact due to the potentially liquefiable soils is considered moderate, and the consequence may be limited to post-liquefaction settlement. We have considered liquefaction for foundation design within this segment. Proper mitigation measure will be designed to minimize the impact.

- *Location 4, approx. Sta. 383+70 to 396+00*

  Submerged, loose silty sand pockets were encountered at about Elev. 10 feet in Borings R/RW-42, R/RW-43, RW-47 and R/RW-48, which may be subject to liquefaction during earthquake.

  Based on the boring data, the lenses are relatively thin, and the consequence may be limited to post-liquefaction settlement on the order of 3/4 inch. We have considered liquefaction for foundation design within this segment. Proper mitigation measure will be designed to minimize the impact.

8.2 Cuts and Excavations

Based on the plans and profiles provided to us, no major cuts and excavations are planned for the project. For retaining wall construction, groundwater may be expected at some areas. Therefore, it is recommended that the footing excavation conform to Caltrans standard specification Section 19-3.04.

8.2.1 Stability

Retention basins are planned on both sides of the project alignment. Based on the subsurface condition, the subsoils generally consist of fine-grained materials. For the proposed retention basins, the proposed excavation is relatively shallow. The slopes are generally 3H:1V. In our opinion, the stability of these retention basins should be satisfactory.

For the retaining wall construction, it is recommended that the temporary cut slope be 1:1 or flatter. Based on the subsoil condition, in our opinion, the temporary cut slope should be satisfactory during the construction of the retaining walls.

8.2.2 Rippability

Based on the investigation, rippability does not appear to be a concern for construction.

8.2.3 Grading Factor

The on-site native soil meeting the project specifications may be used as engineered fill. For preliminary estimate, a grading factor of 0.9 may be assumed for the import materials based on our previous experience.

8.3 Embankments

There is no major fill embankment proposed for the future widening. The subject was considered and was determined to be not applicable for the project.

8.4 Earth Retaining Systems

8.4.1 Retaining Walls

It is our understanding that eleven retaining walls are proposed along I-205 to accommodate the future auxiliary lane. It is planned to use Caltrans Standard Type 1 wall at all locations. Information of the proposed walls is summarized below.

TABLE 4 – RETAINING WALL SUMMARY

Wall No.	Approx. Station ("I205" Line)	Wall Type	Maximum Design Wall Height (ft)	Approx. Total Length (ft)
1	102+63 – 104+75 ("A2" Line)	Caltrans Standard Type I	8	212
2	106+54 – 109+50 ("A2" Line)	Caltrans Standard Type I	10	296
3	111+72 – 115+25 ("A2" Line)	Caltrans Standard Type I	8	353
4	132+28 – 134+25 ("A2" Line)	Caltrans Standard Type I	6	198
5	136+75 – 141+00 ("A2" Line)	Caltrans Standard Type I	8	425
6	298+70 – 312+73 ("G" Line)	Caltrans Standard Type I	16	1403
7	343+09 – 356+56 ("G" Line)	Caltrans Standard Type I	10	1347
8	343+10 – 356+95 ("G" Line)	Caltrans Standard Type I	14	1385
9	383+77 – 395+79 ("G" Line)	Caltrans Standard Type I	12	1201
10	385+50 – 395+75 ("G" Line)	Caltrans Standard Type I	10	1025

- ***Retaining wall No. 1**, "A2" Line, Sta. 102+63 – 104+75 (Type I, loading condition I)*

  Retaining wall No. 1 is located along the north side of westbound I-205 and is approximately 212 feet long. The design wall heights range from 6 to 8 feet. Based on the plans provided, the proposed footing bottom elevations range from approximate Elev. 116.5 to 117.5 feet.

  Based on the boring data (RW-53), the footing subgrade may consist of sandy silt overlying silty sand/poorly-graded sand. Groundwater was not encountered during field exploration to a depth of 30 feet. The bearing capacity of the subgrade is governed by the sandy silt layer, and the recommended allowable bearing capacity is 3 ksf. In our opinion, Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 1 (per Caltrans Standard Plan, Sheet B3-1).

- ***Retaining wall No. 2, "A2" Line, Sta. 106+54 – 109+50 (Type I, loading condition I)***
  Retaining wall No. 2 is located along the north side of westbound I-205 and is approximately 296 feet long. The design wall heights range from 6 to 10 feet. Based on the plans provided, the proposed footing bottom elevations range from approximate Elev. 112.25 to 113.5 feet.

  Based on the boring data (RW-2), the subgrade consists of silty sand/poorly-graded sand overlying sandy silt. Groundwater was not encountered during field exploration to a depth of 20 feet. The bearing capacity of the subgrade is governed by the sandy silt layer, and the recommended allowable bearing capacity is 3 ksf. In our opinion, Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 2 (per Caltrans Standard Plan, Sheet B3-1).

- ***Retaining wall No. 3, "A2" Line, Sta. 111+72 – 115+25 (Type I, loading condition I)***
  Retaining wall No. 3 is located along the north side of westbound I-205 and is approximately 353 feet long. The design wall heights range from 6 to 8 feet. Based on the plans provided, the proposed footing bottom elevations range from approximate Elev. 108.8 to 110.1 feet.

  Based on the boring data (RW-54), the subgrade consists of lean clay overlying silty sand. Groundwater was not encountered during field exploration to a depth of 30 feet. The bearing capacity of the subgrade is governed by the fine-grained materials, and the recommended allowable bearing capacity is 3 ksf. In our opinion, Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 3 (per Caltrans Standard Plan, Sheet B3-1).

- ***Retaining wall No. 4, "A2" Line, Sta. 132+28 – 134+25 (Type I, loading condition I)***
  Retaining wall No. 4 is located along the south side of eastbound I-205 and is approximately 198 feet long. The design wall height is 6 feet. Based on the plans provided, the proposed footing bottom elevations range from approximate Elev. 101.5 to 102.7 feet.

  Based on the boring data (RW-55), the subgrade consists of interbedded sandy lean clay and clayey/silty sand. Groundwater was not encountered during field exploration to a depth of 25 feet. The recommended allowable bearing capacity is 2.5 ksf. In our opinion, Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 4 (per Caltrans Standard Plan, Sheet B3-1).

- ***Retaining wall No. 5**, "A2" Line, Sta. 136+75 – 141+00 (Type I, loading condition I)*

  Retaining wall No. 5 is located along the south side of eastbound I-205 and is approximately 425 feet long. The design wall heights range from 6 to 8 feet. Based on the plans provided, the proposed footing bottom elevation is at approximate Elev. 98.42 feet.

  Based on the boring data (R/RW-14 & RW-56), the subgrade consists of sandy silt/sandy lean clay. Groundwater was not encountered during field exploration to a depth of 25 feet. The recommended allowable bearing capacity is 2.5 ksf. In our opinion, Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 5 (per Caltrans Standard Plan, Sheet B3-1).

- ***Retaining wall No. 6**, "G" Line, Sta. 298+70 – 312+73 (Type I, loading condition I)*

  Retaining wall No. 6 is located along the south side of eastbound I-205 and is approximately 1403 feet long. The design wall heights range from 6 to 16 feet. Based on the plans provided, the proposed footing bottom elevations range from approximate Elev. 15.75 to 37.6 feet.

  Based on the boring data (RW-16 thru RW-23), the subgrade mainly consists of lean clay. Groundwater was encountered between Elev. 8 to 14 feet during field exploration. The recommended allowable bearing capacity is 3 ksf. In order to lower the footing contact pressure and account for the local irregularity at the footing subgrade, it is recommended that the subgrade be over-excavated 2 feet below the bottom of the footing and replace with compacted Aggregate Base rock. This is applicable for the portion of the wall that has design wall height of 10 feet or higher. This pad should serve as a "load distribution bridge" for reducing loads and differential settlements. With the proposed over-excavation, the footing contact pressure can be reduced by approximately 20%, and it is our opinion that Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 6.

  A thin layer of submerged, loose silty sand lens was encountered between Elev. 9 to 13 feet in Boring RW-19, which may be subject to liquefaction during earthquake. Based on the subsoil condition along Retaining Wall No. 6, this sand pocket is considered local and discontinuous,

and it is not located in the close proximity of the footing subgrade (approximately 16 feet below the proposed footing bottom). The impact due to the potential liquefaction is considered minor, which may be limited to post-liquefaction settlement. It is estimated that the post-liquefaction settlements may be on the order of 1 inch, and probably would be random and localized. Based on the spacing of the exploratory borings (typically 300 feet apart), it is recommended that more joints be designed in-between segments for the proposed wall between Sta. 306+50 and 309+50.

Based on the boring data (RW-16), high plasticity clay was encountered at the proposed footing elevation at the western end of the wall. Such material may have relatively high expansion potential (swell and shrink with variations in moisture content).

Based on the plans provided, the bottom of the footing is generally embedded 34 inches or more below the lowest adjacent finish grade. In our opinion, the moisture fluctuation should be relatively minor. In order to reduce potential expansion, it is recommended that the expansive subgrade be compacted at about 2% to 3% over optimum moisture content.

For Retaining Wall No. 6, it is recommended that the subgrade be over-excavated 2 feet below the bottom of the footing and replace with compacted Aggregate Base rock for wall height greater than 10 feet. Based on the boring data, this measure will most likely remove major portion of the high plasticity materials, and also lower the footing subgrade to avoid moisture fluctuation.

- ***Retaining wall No. 7, "G" Line, Sta. 343+09 – 356+56 (Type I, loading condition I)***

  Retaining wall No. 7 is located along the south side of eastbound I-205 and is approximately 1347 feet long. The design wall heights range from 8 to 10 feet. Based on the plans provided, the proposed footing bottom elevations range from approximate Elev. 13.2 to 15.2 feet.

  Based on the boring data (RW/CMS-33 thru R/RW-37), the subgrade mainly consists of lean clay and silt, and the recommended allowable bearing capacity is 3 ksf. Groundwater was encountered between Elev. 12 to 13 feet during field exploration, which is close to the footing elevation. In our opinion, buoyancy was not considered for the foundation design of the Caltrans standard retaining wall.

However, groundwater may be expected during footing excavation. Tremie concrete seal may be required if significant water is encountered to hinder with the construction. In our opinion, Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 7 (per Caltrans Standard Plan, Sheet B3-1).

A thin layer of submerged, loose silty sand pocket was encountered between Elev. 8 to 11.5 feet in Boring RW/CMS-33, which may be subject to liquefaction during earthquake. This potential liquefiable sand pocket is located immediately below the proposed footing bottom elevation. Based on the subsoil condition along Retaining Wall No. 7, this sand pocket is considered local and discontinuous. It is estimated that the post-liquefaction settlements may be on the order of ¾ inch, and probably would be random and localized.

Due to the presence of the liquefiable sand and high groundwater table, it is recommended to construct a working platform to stabilize the subgrade west of Sta. 346+00. The pad should also serve as a "load distribution bridge" for reducing loads and differential settlements. This platform should consist of a minimum of 24 inches of compacted Aggregate Base overlying a layer of Subgrade Enhancement Geotextile (SEG) conforming to the Class B2 SEG per Caltrans "Guide for designing Subgrade Enhancement Geotextile" (April 2009). Lean Concrete Base (LCB) may also be considered instead of compacted AB. It is also recommended that more joints be designed in-between segments west of Sta. 346+00.

- ***Retaining wall No. 8**, "G" Line, Sta. 343+10 – 356+95 (Type I, loading condition I)*

  Retaining wall No. 8 is located along the north side of westbound I-205 and is approximately 1385 feet long. The design wall height is 14 feet. Based on the plans provided, the proposed footing bottom elevation is at approximate Elev. 12.0 feet.

  Based on the boring data (RW-24 thru RW-29), the subgrade mainly consists of lean clay and silt, and the recommended allowable bearing capacity is 3.5 ksf. Groundwater was encountered between Elev. 6 to 8 feet during field exploration, which is close to the footing elevation. In our opinion, buoyancy was not considered for the foundation design of the Caltrans standard retaining wall.

However, groundwater may be expected during footing excavation. Tremie concrete seal may be required if significant water is encountered to hinder with the construction. In our opinion, Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 8 (per Caltrans Standard Plan, Sheet B3-1).

Based on the design wall height of 14 feet, it is our opinion that the subgrade should be over-excavated 2 feet below the bottom of the footing and replaced with compacted Aggregate Base (AB) to account for the local irregularity at the footing subgrade. Should groundwater be encountered during footing excavation, a layer of Subgrade Enhancement Geotextile (SEG) conforming to the Class B2 SEG per Caltrans "Guide for designing Subgrade Enhancement Geotextile" (April 2009) should be placed to stabilize the subgrade underneath the AB layer, or Lean Concrete Base (LCB) may be used.

A thin layer of submerged, loose silty sand layer was encountered between Elev. 4 to 9 feet in Boring RW-25, which may be subject to liquefaction during earthquake. Based on the subsoil condition, this sand pocket is considered local and discontinuous. Also, the boring was advanced by hollow stem drilling method, which may yield lower driving resistance. The consequence may be limited to post-liquefaction settlement. It is estimated that the post-liquefaction settlements may be on the order of 1 inch, and probably would be random and localized. With the proposed two-foot-thick over-excavation, the impact due to the potential liquefiable layer may be minimized. However, it is recommended that more joints be designed in-between segments between Sta. 343+50 and 346+75.

Based on the boring data (R/RW-26 & RW-29), high plasticity clay was encountered near the proposed footing elevation, which may have relatively high expansion potential (swell and shrink with variations in moisture content). However, this layer appears to be local and discontinuous.

Based on the plans provided, the bottom of the footing is generally embedded 34 inches or more below the lowest adjacent finish grade. In our opinion, the moisture fluctuation should be relatively minor. In order to reduce potential expansion, it is recommended that the

expansive subgrade be compacted at about 2% to 3% over optimum moisture content. In our opinion, the impact due to expansion is considered relatively minor.

- ***Retaining wall No. 9**, "G" Line, Sta. 383+77 – 395+79 (Type I, loading condition I)*

Retaining wall No. 9 is located along the north side of westbound I-205 and is approximately 1201 feet long. The design wall heights range from 10 to 12 feet. Based on the plans provided, the proposed footing bottom elevations range from approximate Elev. 14.4 to 15.7 feet.

Based on the boring data (R/RW-41 thru R/RW-44), the subgrade mainly consists of lean clay and silt. The recommended allowable bearing capacity is 2.8 ksf. Groundwater was generally encountered at approximate Elev. 10 feet during field exploration, which is close to the footing elevation. Per Caltrans Standard Plan, the recommended bearing capacity is considered marginal for wall height of 12 feet. In our opinion, buoyancy was not considered for the foundation design of the Caltrans standard retaining wall.

Therefore, in order to lower the footing contact pressure and account for the local irregularity at the footing subgrade, it is recommended that the subgrade be over-excavated 2 feet below the bottom of the footing and replace with compacted Aggregate Base rock for the entire wall segment. According to the groundwater level encountered during exploration, water may be anticipated during footing excavation. Should groundwater be encountered during footing excavation, a layer of Subgrade Enhancement Geotextile (SEG) conforming to the Class B2 SEG per Caltrans "Guide for designing Subgrade Enhancement Geotextile" (April 2009) should be placed to stabilize the subgrade underneath the AB layer, or Lean Concrete Base (LCB) may be used instead of compacted AB.

This pad should serve as a "load distribution bridge" for reducing loads and differential settlements. With the proposed over-excavation, the footing contact pressure can be reduced by approximately 20%. It is our opinion that Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 10.

A thin layer of submerged, loose silty sand pocket was encountered at about Elev. 10 feet in Borings R/RW-42 and R/RW-43, which may be subject to liquefaction during earthquake. The

consequence may be limited to post-liquefaction settlement. It is estimated that the post-liquefaction settlements may be on the order of ½ inch, and probably would be random and localized. With the proposed two-foot-thick over-excavation, the impact due to the potential liquefiable layer may be minimized. However, it is recommended that more joints be designed in-between segments for Retaining Wall No. 9 between Sta. 386+50 and 395+00.

- ***Retaining wall No. 10**, "G" Line, Sta. 385+50 – 395+75 (Type I, loading condition I)*

  Retaining wall No. 10 is located along the south side of eastbound I-205 and is approximately 1025 feet long. The design wall heights range from 8 to 10 feet. Based on the plans provided, the proposed footing bottom elevations range from approximate Elev. 15.2 to 16.7 feet.

  Based on the boring data (RW-47 thru R/RW-50), the subgrade mainly consists of lean clay and silt. The recommended allowable bearing capacity is 2.5 ksf. Groundwater was generally encountered at approximate Elev. 10 feet during field exploration, which is about 5 feet below the proposed footing elevation.

  In order to lower the footing contact pressure and account for the local irregularity at the footing subgrade, it is recommended that the subgrade be over-excavated 2 feet below the bottom of the footing and replaced with compacted Aggregate Base rock for the design wall height of 10 feet. Should groundwater be encountered during footing excavation, a layer of Subgrade Enhancement Geotextile (SEG) conforming to the Class B2 SEG per Caltrans "Guide for designing Subgrade Enhancement Geotextile" (April 2009) should be placed to stabilize the subgrade underneath the compacted AB layer, or Lean Concrete Base (LCB) may be used.

  This pad should serve as a "load distribution bridge" for reducing loads and differential settlements. With the proposed over-excavation, the footing contact pressure can be reduced by approximately 20%. It is our opinion that Caltrans Standard Type I wall supported on spread footing is considered feasible for Retaining Wall No. 10.

  A thin layer of submerged, loose silty sand pocket was encountered at about Elev. 10 feet in Borings R/RW-47 and R/RW-48, which may be subject to liquefaction during earthquake. The

layer is relatively thin, and the consequence may be limited to post-liquefaction settlement. It is estimated that the post-liquefaction settlements may be on the order of ¾ inch, and probably would be random and localized. With the recommended two-foot-thick over-excavation, the impact due to the potential liquefiable layer may be minimized. However, it is recommended that more joints be designed in-between segments for the portion where the design wall height is 10 feet.

8.5 Minor Structures

8.5.1 Sound Wall Extension at Sta. 126+00

The proposed sound wall extension is located on the north side of westbound I-205, immediately east of Hansen Road. The segment is approximately 130 feet long with design wall height of 14 feet. It is planned to use standard Caltrans Sound Wall – Masonry Block on Type 736S Barrier. The wall will be supported on barrier and CIDH concrete pile.

According to the boring data within the vicinity (RB-6), the foundation subsoils generally consist of stiff to hard lean clay with interbedded dense sand layers. Based on the plan provided, the finished grade will be classified as Case 1, level ground condition. Based on the subsurface condition, an angle of shearing resistance (ϕ) of 35° is recommended for the standard Caltrans Sound Wall design.

Caltrans standard specification for "Cast-in-Place Concrete Piling" should be used for the construction of CIDH concrete piles. The borings encountered interbedded sand lenses. Therefore, granular materials should be expected during pile construction. Therefore, raveling or caving might be expected which may require additional drilling and cleaning effort and may increase the concrete volume for the piles. The use of temporary steel casing should be expected. It is prudent to make the contractor aware of the subsoil condition so that he takes appropriate steps to comply with the standards and maintain the integrity of the piles.

Per discussion with the designer, the existing concrete pedestal of the CMS post is in the close proximity of the proposed sound wall extension. Based on the information provided by the designer, the existing CMS is Type VI post, supported on 5'-9" square pedestal with 5-foot

diameter CIDH of 22 feet long. Based on the layout plan provided, we have evaluated the impact on the future sound wall due to the existing sign post foundation.

Based on our analysis, the deflection toward the wall is relatively small. It is our opinion that if a gap could be maintained between the pedestal and the barriers, the existing foundation should not impose significant load onto the barrier. In our opinion, it is recommended that a minimum 2-inch gap be maintained between the existing post and the new sound wall.

However, according to the loading condition provided of the existing CMS sign, more deflection is anticipated parallel to the sound wall. According to the layout and the subsoil condition, the sound wall piles may experience an extra horizontal load of approximate 3 kips. Per our discussion with the designer, the extra lateral load is relatively insignificant and the impact is considered low.

Due to the extension of the sound wall, more masonry blocks will be installed on top of the existing sound wall. Per our discussion with the designer, the current sound wall is supported on 12 foot long piles. Based on the subsoils condition, the minimum required pile length per Caltrans Standard Plan (Sheet B15-8) is 9 feet long for Case I level ground condition and the recommended angle of shearing resistance (ϕ) of 35°. The existing foundation is considered adequate for the proposed improvement.

8.5.2 Gabion Walls

It is our understanding that gabion walls are proposed along the edges of Retention Basins 9, 11 and 14. Based on the plans provided by the designer, the proposed gabion walls will be up to 7.5 feet high.

Based on the boring data, it is expected that the subgrade below the proposed gabion walls generally consists of fine-grained materials. For the walls along Retention Basins 9 and 11 between Sta. 128+50 and Sta. 137+30, the recommended allowable bearing capacity is 2500 psf. For the walls along Retention Basin 14 between Sta. 307+65 and Sta. 312+63, the recommended allowable bearing capacity is 1500 psf. For the wall design, the recommended active pressure is 36 pcf Equivalent Fluid Pressure (EFP), and the passive pressure is 310 pcf EFP.

The boring data indicate that groundwater is relatively shallow along Retention Basin 14. A thin layer of submerged, loose silty sand lens was encountered between Elev. 9 to 13 feet in Boring RW-19, which may be subject to liquefaction during earthquake. Gabion walls are relatively flexible and more tolerable for settlement. In our opinion, the potential post-liquefaction settlement should not pose any impact for the gabion walls.

8.5.3 Changeable Message Signs (CMS)

- *CMS at Sta. 124+70*

  A full cantilever CMS structure and model 500 sign panel is proposed, located on the south side of eastbound I-205, approximately 75 feet west of Hansen Road. Based on the boring (RB-6 & CMS-12) drilled in the vicinity of the proposed CMS, the subsoils generally consist of stiff to hard clay with interbedded dense sand layers. Groundwater was not encountered during field exploration to a depth of 30 feet. Liquefaction potential is considered low at this proposed sign location.

  Lateral pile capacity was evaluated by using "LPile" program with the design loads provided by the designer. The pile head deflection under the design load is relatively minimal based on the analyses, and the results are attached. The torsional resistance appears to be satisfactory with factor of safety (F.S.) greater than 1.5. In our opinion, it is feasible for the proposed CMS being supported on a 5 feet diameter CIDH concrete pile with minimum pile length of 22 feet (per Caltrans Standard Plan, Sheet S116).

- *CMS at Sta. 336+00*

  A full cantilever CMS structure and model 500 sign panel is proposed, located on the south side of eastbound I-205, approximately 2200 feet east of Coral Hollow Road.

  Based on the boring data (CMS-57) drilled in the vicinity of the proposed CMS sign, the subsoils generally consist of lean clay overlying sand formation. Groundwater was encountered at 15 feet below grade during field exploration. A thin layer of submerged, loose sand pocket was encountered between 22 to 27 feet in Boring CMS-57, which may be subject to liquefaction during earthquake. For analysis purpose, we have assumed liquefaction in this layer.

Lateral pile capacity was evaluated by using "LPile" program with the design loads provided by the designer. The effect of liquefaction was accounted for by using the p-y relationship for liquefied sand presented by Rollins et al (2003) of LPILE Plus Ver. 5.0 (ENSOFT). The pile head deflection under the design load is relatively minimal based on the analyses, and the results are attached.

The capacities within the potential liquefaction zone were neglected for estimating torsional and vertical resistances. The torsional resistance appears to be satisfactory with factor of safety (F.S.) greater than 1.5. Down drag force due to post-liquefaction settlement has been considered for estimating the vertical pile capacity. According to our analysis, the proposed pile is considered adequate to provide sufficient vertical resistance, including the potential down drag force.

In our opinion, it is feasible for the proposed CMS being supported on a 5 feet diameter CIDH concrete pile with the pile length no less than 22 feet long (per Caltrans Standard Plan, Sheet S116).

8.5.4 Single Post Overhead Signs

- *Overhead Sign "D" at Sta. 306+54*

A single-post overhead sign will be relocated. The new location is on the south side of eastbound I-205, approximately 750 feet west of Coral Hollow Road. Based on the information provided by the designer, it is planned to use Caltrans standard Type VI post supported on 5-foot diameter CIDH pile. The specified pile length is 22 feet long per standard plan (Sheet S-8).

Based on the borings (R/RW-18A, R/RW-18B, RW-19, R/RW-20A & R/RW-20B) drilled in the vicinity of the proposed overhead sign, the subgrade mainly consists of lean clay overlying dense sand formation. Groundwater was encountered between Elev. 8 to 10 feet during field exploration.

A thin layer of submerged, loose silty sand pocket was encountered between Elev. 9 to 13 feet in Boring RW-19, which may be subject to liquefaction during earthquake. However, such

layer was not encountered in Boring R/RW-18B. This sand pocket appears to be local and discontinuous. Due to the variation of the available boring data, we have conservatively assumed liquefaction for the 5-foot thick layer between Elev. 9 and 14 feet for analysis purpose.

Lateral pile capacity was evaluated by using "LPile" program with the design loads provided by the designer. The effect of liquefaction was accounted for by using the p-y relationship for liquefied sand presented by Rollins et al (2003) of LPILE Plus Ver. 5.0 (ENSOFT). The pile head deflection under the design load is relatively minimal based on the analyses, and the results are attached.

The capacities within the potential liquefaction zone were neglected for estimating torsional and vertical resistances. The torsional resistance appears to be satisfactory with factor of safety (F.S.) greater than 1.5. Down drag force due to post-liquefaction settlement has been considered for estimating the vertical pile capacity. According to our analysis, the proposed pile is considered adequate to provide sufficient vertical resistance, including the potential down drag force.

In our opinion, it is feasible for the proposed post being supported on a 5 feet diameter CIDH concrete pile with pile length of 22 feet (per Caltrans Standard Plan, Sheet S8).

- *Overhead Sign "E" at Sta. 344+27*

A new single-post overhead sign is proposed on the south side of eastbound I-205, approximately 3000 feet east of Coral Hollow Road. Based on the information provided by the designer, it is planned to use Caltrans standard Type VIII post supported on 5-foot diameter CIDH pile. The specified pile length is 25 feet long per standard plan (Sheet S-8).

Based on the boring (RW/CMS-33) drilled in the vicinity of the proposed overhead sign, the subgrade mainly consists of interbedded lean clay/silt and sand lenses. Groundwater was encountered between Elev. 12 to 13 feet during field exploration. A thin layer of submerged, loose silty sand pocket was encountered between Elev. 8 and 11.5 feet in Boring RW/CMS-33, which may be subject to liquefaction during earthquake. This sand pocket is considered local

and discontinuous. However, we have considered liquefaction for analysis purpose.

Lateral pile capacity was evaluated by using "LPile" program with the design loads provided by the designer. The effect of liquefaction was accounted for by using the p-y relationship for liquefied sand presented by Rollins et al (2003) of LPILE Plus Ver. 5.0 (ENSOFT). The pile head deflection under the design load is relatively minimal based on the analyses, and the results are attached.

The capacities within the potential liquefaction zone were neglected for estimating torsional and vertical resistances. The torsional resistance appears to be satisfactory with factor of safety (F.S.) greater than 1.5. Down drag force due to post-liquefaction settlement has been considered for estimating the vertical pile capacity. According to our analysis, the proposed pile is considered adequate to provide sufficient vertical resistance, including the potential down drag force.

In our opinion, it is feasible for the proposed post being supported on a 5 feet diameter CIDH concrete pile with pile length of 25 feet (per Caltrans Standard Plan, Sheet S8).

- *Overhead Sign at Sta. 347+74*

  A single-post overhead sign will be relocated. The new location is on the north side of westbound I-205 at Sta. 347+74. Based on the information provided by the designer, it is planned to use Caltrans standard Type VII post supported on 5-foot diameter CIDH pile. The specified pile length is 23 feet long per standard plan (Sheet S-8).

  Based on the borings (R/RW-26 & RW-27) drilled in the vicinity of the proposed overhead sign, the subgrade mainly consists of lean clay and silt. Groundwater was encountered between Elev. 6 to 8 feet during field exploration. The liquefaction potential at the proposed sign location is considered low.

  Lateral pile capacity was evaluated by using "LPile" program with the design loads provided by the designer. The pile head deflection under the design load is relatively minimal based on the analyses, and the results are attached. The torsional resistance appears to be satisfactory

with factor of safety (F.S.) greater than 1.5. In our opinion, it is feasible for the proposed post being supported on a 5 feet diameter CIDH concrete pile with pile length of 23 feet (per Caltrans Standard Plan, Sheet S8).

- *Overhead Sign at Sta. 356+94*

  A new single-post overhead sign is proposed on the south side of eastbound I-205 at approximate Sta. 356+94. Based on the information provided by the designer, it is planned to use Caltrans standard Type V post supported on 4.5-foot diameter CIDH pile. The specified pile length is 19 feet long per standard plan (Sheet S-8).

  Based on the boring (P-58) drilled in the vicinity of the proposed overhead sign, the subgrade mainly consists of lean clay and silt overlying sand formation. Groundwater was encountered between Elev. 7 feet during field exploration. The liquefaction potential at the proposed sign location is considered low.

  Lateral pile capacity was evaluated by using "LPile" program with the design loads provided by the designer. The pile head deflection under the design load is relatively minimal based on the analyses, and the results are attached. The torsional resistance appears to be satisfactory with factor of safety (F.S.) greater than 1.5. In our opinion, it is feasible for the proposed post being supported on a 4.5 feet diameter CIDH concrete pile with pile length of 19 feet (per Caltrans Standard Plan, Sheet S8).

- *Overhead Sign at Sta. 384+22*

  A new single-post overhead sign is proposed on the north side of westbound I-205 at approximate Sta. 384+22. Based on the information provided by the designer, it is planned to use Caltrans standard Type VI post supported on 5-foot diameter CIDH pile. The specified pile length is 22 feet long per standard plan (Sheet S-8).

  Based on the boring (P-59) drilled in the vicinity of the proposed overhead sign, the subgrade mainly consists of lean clay. Groundwater was encountered between Elev. 10 feet during field exploration. The liquefaction potential at the proposed sign location is considered low.

Lateral pile capacity was evaluated by using "LPile" program with the design loads provided by the designer. The pile head deflection under the design load is relatively minimal based on the analyses, and the results are attached. The torsional resistance appears to be satisfactory with factor of safety (F.S.) greater than 1.5. In our opinion, it is feasible for the proposed post being supported on a 5 feet diameter CIDH concrete pile with pile length of 22 feet (per Caltrans Standard Plan, Sheet S8).

- *Overhead Sign at Sta. 393+51*

A new single-post overhead sign is proposed on the north side of westbound I-205 at approximate Sta. 393+51. Based on the information provided by the designer, it is planned to use Caltrans standard Type VIII post supported on 5-foot diameter CIDH pile. The specified pile length is 25 feet long per standard plan (Sheet S-8).

Based on the borings (R/RW-43 & R/CMS-44) drilled in the vicinity of the proposed overhead sign, the subgrade mainly consists of lean clay and silt with interbedded sand layer. Groundwater was generally encountered at approximate Elev. 10 feet during field exploration.

A thin layer of submerged, loose silty sand pocket was encountered at about Elev. 10 feet in Boring R/RW-43, which may be subject to liquefaction during earthquake. The potential liquefiable layer is relatively thin. However, we have considered liquefaction for analysis purpose, but the impact is considered low.

Lateral pile capacity was evaluated by using "LPile" program with the design loads provided by the designer. The effect of liquefaction was accounted for by using the p-y relationship for liquefied sand presented by Rollins et al (2003) of LPILE Plus Ver. 5.0 (ENSOFT). The pile head deflection under the design load is relatively minimal based on the analyses, and the results are attached.

The capacities within the potential liquefaction zone were neglected for estimating torsional and vertical resistances. The torsional resistance appears to be satisfactory with factor of safety (F.S.) greater than 1.5. Down drag force due to post-liquefaction settlement has been considered for estimating the vertical pile capacity. According to our analysis, the proposed

pile is considered adequate to provide sufficient vertical resistance, including the potential down drag force.

In our opinion, it is feasible for the proposed post being supported on a 5 feet diameter CIDH concrete pile with pile length of 25 feet (per Caltrans Standard Plan, Sheet S8).

8.5.5 MVDS & RWIS

Per discussion with the designer, three Microwave Vehicle Detection Systems (MVDS) will be installed along the project limit. Based on the plans provided, the MVDS are located at approximate Sta. 312+00, Sta. 227+45 & Sta. 245+90, respectively. In addition, there will be two new Roadside Weather Information Systems (RWIS) located at approximate Sta. 125+00 and Sta. 261+00, and one of the existing RWIS at Sta. 345+80 will be relocated to Sta. 342+50.

Based on the boring data and the overall geologic information, no special subsoil/adverse condition was noted. For the proposed MVDS and RWIS, it is reasonable to construct the foundation piers per Caltrans Standard Plans. In order for the structure engineer to verify the standard design, the recommended soil parameters are summarized as follows:

- Angle of shearing resistance (ϕ) = 30°;
- Total unit weight, γ_T = 125 pcf and dry unit weight, γ_d = 65 pcf;
- Groundwater = 7.5 feet below existing grade.

8.5.6 CIDH Construction for the Sign Structures

Caltrans standard specification for "Cast-in-Place Concrete Piling" should be used for the construction of CIDH concrete piles. Sandy material and groundwater may be expected during pile construction. Therefore, raveling or caving might be expected which may require additional drilling and cleaning effort and may increase the concrete volume for the piles. The use of temporary steel casing should be expected. It is prudent to make the contractor aware of the subsoil condition so that he takes appropriate steps to comply with the standards and maintain the integrity of the piles.

8.6 Culverts

8.6.1 Culvert Replacement

It is planned to replace the existing culvert with 24-inch diameter corrugated steel pipe (CSP) at approximate Sta. 124+30, located approximately 100 feet west of Hansen Road. The condition of the existing culvert is old, and it is located relatively shallow. Therefore, it is planned to use cut-and-cover method for the proposed replacement.

Based on the boring data in the vicinity, no special subsoil/adverse condition was noted. It is reasonable to construct the new culvert per Caltrans standard.

8.6.2 Corrosion Investigation

The corrosion investigation for this project was performed in general accordance with the provisions of California Test Method 643. Chemical tests were performed on selected samples to evaluate the corrosion potential of the subsurface soil. A summary of the corrosion test results is presented in the following table.

TABLE 5 – SUMMARY OF CORROSION TEST RESULTS

Boring No.	Station & Offset	Depth (ft)	Min. Resistivity (ohm-cm)	pH	Sulfate (ppm)	Chloride (ppm)
CMS-12	121+26, 45.5 Rt	2	2600	6.88	1.8	6.3
R/RW-17	302+17, 74.7 Rt	19.5	670	7.99	38.7	35.5
R/RW-20A	311+04, 77.9 Rt	9.5	480	7.90	10.1	292.2
RW-24	342+00, 75.6 Lt	4.5	320	7.99	351.7	418.6
R/RW-26	348+00, 93.0 Rt	4.5	990	8.35	66.4	15.8
R/RW-28	353+68, 71.7 Lt	4.5	620	8.13	88.0	189.2
R/RW-37	355+41, 51.7 Lt	2	1690	7.67	4.3	11.1
R/RW-42	389+00, 64.6 Lt	4.5	460	7.56	254.9	130.9
R/CMS-44	395+53, 61.7 Lt	4.5	1450	7.50	37.5	11.1
RW-47	385+87, 73.0 Lt	4.5	1370	6.81	25.5	11.6
RB-52	394+25, 85.8 Rt	4.5	620	8.02	27.3	16.3
RW-53	104+13, 96.9 Lt	4.5	1290	7.12	30.0	11.9
RW-55	132+24, 83.9 Rt	4.5	1180	7.11	37.2	13.0
CMS-57	336+00, 57.8 Rt	3.0	940	8.16	70.5	9.5
P-58	357+37, 73.5 Rt	4.5	1550	7.72	18.5	20.7
P-59	384+70, 72.0 Rt	4.5	1880	7.52	33.4	6.6

TABLE 6 – RECOMMENDED MINIMUM THICKNESS AND PROTECTIVE MEASURES FOR CULVERTS

Location			Culvert Type		Corrugated Steel Pipe (Galv., Gage)			Reinforced Concrete	Corrugated Aluminum (Gage)	Corrugated Aluminized Steel (Type 2, Gage)	Steel Pipe (Galv., Gage)
			Est. Service Life (yr.)		25	50	50				50
Boring Number	Station & Offset*		Resistivity (ohms-cm)	pH	Galv.(2 oz)		Bit. Coat. (Soil Sides)		50	50	Polymeric Coat. (90° Invert)
CMS-12	121+26	45.5 Rt	2600	6.9	16	12	16	Note (1)*	16	16	18
R/RW-17	302+17	74.7 Rt	670	8.0	16	10	16	Note (1)	No	No	18
R/RW-20A	311+04	77.9 Rt	480	7.9	16	10	16	Note (1)	No	No	18
RW-24	342+00	75.6 Lt	320	8.0	14	8	14	Note (1)	No	No	18
R/RW-26	348+00	93.0 Rt	990	8.4	18	12	18	Note (1)	No	No	18
R/RW-28	353+68	71.7 Lt	620	8.1	16	10	16	Note (1)	No	No	18
R/RW-37	355+41	51.7 Lt	1690	7.7	18	14	18	Note (1)	16	16	18
R/RW-42	389+00	64.6 Lt	460	7.6	14	10	14	Note (1)	No	No	18
R/CMS-44	395+53	61.7 Lt	1450	7.5	18	14	16	Note (1)	No	No	18
RW-47	385+87	73.0 Lt	1370	6.8	14	8	14	Note (1)*	No	No	18
RB-52	394+25	85.8 Rt	620	8.0	16	10	12	Note (1)	No	No	18
RW-53	104+13	96.9 Lt	1290	7.12	16	10	16	Note (1)	No	No	18
RW-55	132+24	83.9 Rt	1180	7.11	16	10	16	Note (1)	No	No	18
CMS-57	336+00	57.8 Rt	940	8.16	16	12	16	Note (1)	No	No	18
P-58	357+37	73.5 Rt	1550	7.72	18	12	18	Note (1)	16	16	18
P-59	384+70	72.0 Rt	1880	7.52	18	14	18	Note (1)	16	16	18

Note (1): Standard reinforced concrete pipe design is suitable with Type IP (MS) modified cement or Type II Modified cement, minimum required by Caltrans Std. Specs 90-1.01.

Note (2): Alternative Design: Thermoplastic pipe can be used as an alternative and should not have any corrosion concerns. However, the types of thermoplastic pipe can be used will depend on the height of fill, available sizes and manufacturer's specifications.

* Maximum water-to-cementitious ratio of 0.45.

Based on the test results, the resistivities at some area are relatively low (less than 1000 ohm-cm). According to the Corrosion Guidelines by Caltrans Division of Engineering Services, the on-site soil is considered non-corrosive. (Chloride concentration less than 500 ppm, sulfate concentration less than 2000 ppm, and pH greater than 5.5.)

Based on our analysis, standard reinforced concrete pipe design is suitable with Type IP (MS) Modified cement or Type II Modified cement. This is a minimum requirement as per Caltrans Bridge Design Specifications (Section 8.22). Per Highway Design Manual (Chap. 850), the water-to-cement ratio should not exceed 0.45 for the reinforced concrete pipe design where the pH values are between than 5.6 to 7.0.

The uncoated corrugated steel/Steel spiral rib pipes are generally feasible for the pipe design for the entire corridor. The thickness of the pipes may vary from location to location. Most areas within the project are not suitable for corrugated aluminum and corrugated aluminized steel pipe. For steel pipes, 18-gage thick pipe can be used with polymeric coat. (90° invert). Thermoplastic pipe can be used as an alternative and should not have any corrosion concerns. However, the types of thermoplastic pipe that can be used will depend on the height of fill, available sizes and manufacturer's specifications.

We have performed the analyses by using CULVERT 4 program, which relies on the test results of resistivity, pH, sulfate and chloride contents. It is our understanding that a new web-based program "Altpipe" has been developed by Caltrans, which allows the designer to perform more specific culvert/pipe design. It requires that the civil/hydraulic designer may verify the culvert design by using "Altpipe" during the final design phase with the corrosion test results provided in this report.

8.7 Drainage

Runoff from streets, driveways, paved areas, and other impervious surfaces should be properly collected and discharged in a manner that will not cause the surface soils to become overly saturated and will not cause erosion. It is our understanding that the runoff generated from the new improvements should be discharged into the proposed retention basins per Caltrans guideline (The Construction Site Best Management Practices, BMPs).

For the proposed project, the retention basins are planned along the project limit. The runoff within the project limits is expected to be self-contained. Final grading plans should be reviewed by our office prior to grading to see that the intent of our recommendations is included in the plans.

8.8 Retention Basins

For the proposed retention basins, multiple borings were performed along the proposed basin locations. Based on the typical cross sections provided by the designer, the depths of the basins are generally 3± feet below the existing grade. The bottom elevation of the proposed retention basins are summarized as follows.

TABLE 7 – SUMMARY OF RETENTION BASINs

Location	Approx. Station	Proposed Basin Bottom Elev. (ft)
Retention Basin No. 1	Sta. 102+40 to 106+20 (Westbound)	115.50
Retention Basin No. 2	Sta. 103+80 to 106+30 (Eastbound)	118.25
Retention Basin No. 3	Sta. 106+30 to 111+30 (Westbound)	112.00
Retention Basin No. 4	Sta. 107+60 to 112+80 (Eastbound)	113.00
Retention Basin No. 5	Sta. 111+70 to 117+00 (Westbound)	108.00
Retention Basin No. 6	Sta. 113+00 to 117+30 (Eastbound)	110.00
Retention Basin No. 7	Sta. 118+00 to 123+60 (Eastbound)	108.25
Retention Basin No. 8	Sta. 118+00 to 124+80 (Westbound)	106.50
Retention Basin No. 9	Sta. 128+50 to 133+50 (Westbound)	101.00
Retention Basin No. 10	Sta. 132+00 to 136+10 (Eastbound)	102.00
Retention Basin No. 11	Sta. 133+60 to 137+30 (Westbound)	99.00
Retention Basin No. 12	Sta. 136+20 to 142+00 (Eastbound)	102.00
Retention Basin No. 13	Sta. 298+70 to 306+70 (Eastbound)	18.75
Retention Basin No. 14	Sta. 307+60 to 312+60 (Eastbound)	18.00
Retention Basin No. 15	Sta. 343+30 to 346+00 (Eastbound)	15.50
Retention Basin No. 16	Sta. 343+40 to 356+40 (Westbound)	11.50
Retention Basin No. 17	Sta. 346+50 to 356+80 (Eastbound)	12.50
Retention Basin No. 18	Sta. 384+10 to 396+00 (Westbound)	15.90
Retention Basin No. 19	Sta. 385+50 to 396+00 (Eastbound)	17.70

Based on the boring data, the subsoils encountered at the basin bottom are generally fine-grained materials. The laboratory test results indicate that the fines contents (FC) are generally greater than 50%. The laboratory test results are summarized in the following table.

TABLE 8 – SUMMARY OF SUBGRADE MATERALS AT THE RETENTION BASIN

Location	Boring	Station	Elev. (ft)	Sample Depth (ft)	GW Depth (ft)	Fines Contents (%)	Atterberg Limit		
							LL	PL	PI
1	RB-1	104+13	119.7				45	18	27
	RW-2	106+97	122.0	4.5	-	69	18	17	1
	RB-5	117+31	111.0	9.5	-	-	37	19	18
	RB-6	124+40	110.5	4.5	-	66	-	-	-
	R-11	114+98	116.0	4.5	-	69	26	17	9
				9.5		73	-	-	-
	CMS-12	121+14	111.0	2	-	-	25	15	10
				4.5		41	22	15	7
				9.5		70	-	-	-
	RB-13/RW-55	132+24	107.4	107.4	-	46	-	-	-
	R/RW-14	135+97	106.8	4.5	-	-	43	16	27
				9.5		52	-	-	-
	RB-15/RW-56	141+06	102.0	9.5	-	68	-	-	-
2	RW-16	299+17	27.0	9.5	13.1	-	49	19	30
	R/RW-18B	305+10	20.5	9.5	8	-	42	15	27
				14.5		5	-	-	-
	R/RW-19	308+03	36.8	9.5	22.5	-	51	-	31
	R/RW-20B	310+90	23.0	6.5	10	89	-	-	-
				9.5		-	33	22	11
	R/RW-20A	311+04	40.0	9.5	-	51	-	-	-
3	RW-24	342+00	26.0	14.5	18	-	35	18	17
	RB-30	343+98	19.0	4.5	-	62			
	RW-25	345+42	26.5	9.5	17.1	51	30	20	10
	R/RW-26	348+14	26.0	14.5	17.5	50	-	-	-
	RB-31	350+30	18.0	4.5	-	53	-	-	-
	RW-27	350+85	23.0	9.5	19.5	72	33	18	15
	R/RW-28	353+68	25.0	9.5	18	42	-	-	-
	RW-29	356+26	26.5	14.5	19.8	-	60	20	40
	R/RW-34	345+95	23.5	4.5	12	-	31	16	15
	RW-35	348+63	22.0	4.5	17	67	34	16	18
	RW-36	352+03	23.5	9.5	19	-	24	11	13
	R/RW-37	355+41	22.5	9.5	19	-	29	15	14
	P-58	357+37	24.5	9.5	17.5	72	-	-	-
	P-59	384+70	26.0	9.5	17	-	26	16	10
4	R/RW-41	386+00	24.0	4.5	16	-	27	15	12
	R/RW-42	389+00	23.0	4.5	15	82	-	-	-
	R/RW-43	391+98	26.0	4.5	16	-	43	18	25
	RW-47	385+79	26.0	9.5	15	-	26	16	10
	RB-51	387+08	22.5	4.5	-	88	-	-	-
	R/RW-48	388+90	26.0	4.5	15.6	92	40	19	21
	RW-49	392+00	25.0	4.5	16	87	-	-	-
				9.5		-	35	20	15
	R/RW-50	395+03	24.0	4.5	13.5	-	32	17	15

At most of the locations, the FCs of the subsoils are greater than 40%, which are deemed not suitable for infiltration basin per Caltrans Storm Water Quality Handbook: Project Planning and Design Guide (May 2007). In addition, the groundwater level along Locations 2, 3 & 4 are relatively shallow. The distances between the proposed invert elevation and the groundwater are approximately 10+ feet.

Based on the above data and the potential variation of the subsoils, it is our opinion that the on-site soils are not suitable for infiltration basins per Caltrans design guideline. The basins should be designed mainly for runoff retention purpose.

9. STRUCTURAL PAVEMENT

New pavement will be constructed on existing grade and on import borrow materials. For the pavement design, we have collected bulk samples along the project limit for at grade sections. After further examining the samples, we have selected representative samples at proposed subgrade level for R-value tests. The test results are summarized in the following table.

TABLE 9 – SUMMARY OF R-VALUE TEST RESULTS

Boring No.	Station (ft.)	Offset (ft.) From "I-205" Line	Description	R-value
R-4	116+78	52.9 Rt.	Brown CLAY	<5
RB-8	132+93	98.2 Lt.	Brown Sandy CLAY	<5
RB-21	301+00	77.6 Rt.	Brown Sandy CLAY	4
R/RW-26	348+00	93.0 Lt.	Brown Clayey SAND	12
RB-52	394+24	85.8 Rt.	Brown Sandy CLAY	<5

Based on the boring data and laboratory test results, the subgrade materials along the project limit are mostly fine-grained materials. The R-values are generally low, ranging between <5 and 12. Therefore, an R-value of 5 was selected to account for the subgrade variation for the pavement design of the proposed auxiliary lanes. The recommended minimum R-value for Aggregate Base (AB, Class 3) is 78 and Aggregate Subbase (AS, Class 4) is 40. Based on the provided TIs and utilizing State of California Department of Transportation design procedures (Highway Design Manual – Section 608), the structural pavement section data are tabulated in the following Table 10.

TABLE 10 – RECOMMENDED STRUCTURAL PAVEMENT SECTIONS

Location	TI	Structural Pavement Section (ft)							
		Option 1		Option 2			Option 3		
		HMA	AB	HMA	AB	AS	HMA	LCB	AS
Main Line (Auxiliary Lane)	14.5 (20-yr)	-	-	0.75	1.60	1.40	0.80	0.85	1.45
Temporary Pavement/ Construction Staging	11	0.60	2.10	0.60	1.15	1.05	-	-	-

*Note: TI: Traffic Index; HMA: Hot Mix Asphalt (Type A); AB: Aggregate Base (Class 2 or 3) with R-value of 78; AS: Aggregate Sub-base (Class 4) with the R-value of 40

For the proposed pavement sections along the mainline, we have also provided the option consisting of lean concrete base (LCB) due to the relatively high TI value (greater than 12). Asphalt Concrete (Type A, Hot Mix Asphalt) and Aggregate Bases (Class 3, AB) should conform to the Caltrans Standard Specifications in Section 39 and 26 respectively. Pavement subgrade and structural sections should be prepared and compacted in accordance with the project specification and Caltrans standard.

10. MATERIAL SOURCES

There are several commercial sources of asphalt, concrete, and aggregate products in the area. Table 9 lists available commercial suppliers in the area.

TABLE 11 – SOURCES OF ASPHALT AND AGGREGATE MATERIAL

Source	Location	Approx. Haul Dist. (one way, miles)
Rc Readymix Co.	Tracy, CA 95304	2.9
A&A Concrete Supply Inc.	10250 W. Linne Rd, Tracy, CA	6.1
Cemex	30350 S. Tracy Blvd, Tracy, CA	7.2

11. MATERIAL DISPOSAL

Majority of the project will require fill for the proposed widening. Based on our understanding, the project will require minimal disposal of the excess materials.

12. CONSTRUCTION CONSIDERATIONS

12.1 Construction Advisories

These sections are written primarily for the engineer responsible for the preparation of plans and specifications. Since these sections identify potential construction issues related to the project, it may also be of use to the Agency's representatives involved in monitoring of construction activity. The field investigation performed by us primarily addresses design issues and was not planned specifically to identify construction issues.

The project site is located along the existing I-205. Traffic control is required to maintain traffic flow along I-205. Several underground utilities exist at the site. The contractor should verify the utility lines, be aware of the existing conditions and plan the construction activities accordingly.

In our opinion, conventional equipment may be used to excavate the on-site soil materials. The materials to be excavated may consist of clay with varying amounts of silt with occasional sand. Localized subgrade pumping may be encountered during earthwork construction depending on the weather, moisture condition of the subsurface soils, and surface drainage conditions. Equipment mobility may also be difficult if the subgrade is wet. In which case, the subgrade soils may require reworking, aeration, or over-excavation and replacing with dry granular fill to facilitate earthwork construction. It is possible that unknown old buried utilities or abandoned structures, concrete rubble etc. are located along the alignment. It might require special equipment and additional efforts to remove these buried objects.

Prospective contractors for the project must evaluate construction-related issues on the basis of their own knowledge and experience in the local area, on the basis of similar projects in other localities, or on the basis of field investigation on the site performed by them, taking into account their proposed construction methods and procedures. In addition, construction activities related to excavation and lateral earth support must conform to safety requirements of OSHA and other applicable municipal and Stage regulatory agencies.

12.2 Construction Consideration that Influence Specifications

The contractor should verify the conditions of the existing utility lines. These locations should not be used for stockpiling of borrow materials. Any conflicts with proposed construction should also be reviewed prior to construction.

12.3 Hazardous Waste Considerations

The project environmental study report should be referred to for further details about any potential hazardous materials within the project site.

12.4 Differing Site Conditions

The soil conditions described in this report are based on available boring data. It should be noted that these borings depict subsurface conditions only at the locations drilled. Because of the variability from place to place within soils in general, and the nature of geologic depositions, subsurface conditions could change between the explored locations.

Early communication should be made between the Resident Engineer, the Contractor, and the Geotechnical Engineer as soon as conditions that differ from those established in this report are recognized by any of the parties. Additional recommendations could be provided if such conditions arise.

13. RECOMMENDATIONS AND SPECIFICATIONS

13.1 Summary of Recommendations

If the designer has questions or concerns with any of these recommendations, or, if conditions are found to be different during construction, the Geotechnical Engineer who prepared this report should be contacted. Additional fieldwork, analysis or changes in recommendations may be required. These services may be provided under a separate authorization, as necessary. A concise summary of the geotechnical recommendations is presented below:

- Based on investigation, the subsoils generally consist of firm to very stiff clay and silt with interbedded sand lenses. Groundwater was not encountered at Locations 1 & 1A. For the rest of the locations, groundwater was generally encountered at approximately 13.5 to 20 feet below the existing ground surface. (Ref: Section 7)

- The project consists of eleven retaining walls along the project alignment. Based on the boring data, Caltrans Standard Type I walls are considered feasible to support the proposed widening. (Ref: Section 8.4)
- Two CMS signs and six overhead sign posts are planned within the project limit. Based on the subsoil condition, it is reasonable to use Caltrans standard plan for the new facilities. (Ref: Section 8.5)
- Refer to Table 9 for the design structural pavement sections. The structural pavement sections were calculated based on R-value of 5, with design TI values of 14.5 for the auxiliary lane (20-year design) and 11 for temporary construction/staging areas. (Ref: Section 9).

13.2 Recommended Materials Specifications

13.2.1 Standard Specifications

Unless otherwise stated in the special provisions, all materials specifications should conform to Caltrans Standard Specifications, May 2006 edition, including but not limited to the following: Earthwork, Structure Backfill, Pervious Backfill Material, Reinforcing Geofabric, Thermoplastic Pipes, Asphalt Concrete, Aggregate Base, Aggregate Subbase, Cement Treated Base, etc.

13.2.2 Special Provisions

Imported Borrow:
Imported material should be in accordance with the specifications set forth in Caltrans Section 19. In particular, for new roadway construction, the material placed within 4 ft of the finish pavement subgrade should meet the following requirements:

1. Free of organic or other deleterious materials.
2. An R-value of no less than 15.

Aggregate Base: Class 3 aggregate base shall conform to the provisions in Section 26 of the Standard Specifications and to these Special Provisions. It shall also be clean and free from organic matter and other deleterious substances. The percentage composition by weight of Class 3 aggregate base shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing)

Sieve Sizes	1-1/2 inch Maximum		¾ inch Maximum	
	Operating Range	Contract Compliance	Operating Range	Contract Compliance
2"	100	100		
1-1/2"	90 – 100	87 - 100		
1"	--	--	100	100
¾"	50 – 85	45 – 90	90 – 100	87 – 100
No. 4	24 - 45	20 – 50	35 – 60	30 – 65
No. 30	10 – 25	6 – 29	10 – 30	5 – 35
No. 200	2 – 11	0 – 14	2 – 11	0 – 14

Quality requirements

California Test Method	Operating Range	Contract Compliance
Sand Equivalent (217)	25 min.	22 min.
Resistance (R-value) (301)	-	78 min.
Durability Index	-	35 min.

Aggregate Subbase: Aggregate Subbase shall be Class 4 and shall conform to the provisions in Section 25 of the Standard Specifications and to these Special Provisions. Class 4 aggregate subbase shall be clean and free from organic matter and other deleterious substances. The percentage composition by weight of Class 4 aggregate subbase shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing)

Sieve Sizes	Operating Range	Contract Compliance
2-1/2"	100	100
No. 4	30 – 65	25 – 70
No. 200	0 – 15	0 – 18

Class 4 aggregate subbase shall also conform to the quality requirements given on the following table:

Quality requirements

California Test Method	Operating Range	Contract Compliance
Sand Equivalent (217)	21 min.	18 min.
Resistance (R-value) (301)	40	40 min.

14. INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions.

No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our findings and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the soil conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
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EXP. 12-31-09
GEOTECHNICAL
STATE OF CALIFORNIA

REFERENCES

1. California Department of Transportation, May 2006, Standard Plans.

2. California Department of Transportation, May 2006, Standard Specifications, Sections 1 through 95.

3. California Department of Transportation, Highway Design Manual, September 2006.

4. California Department of Transportation, April 1992, Information and Procedures Guide.

5. Department of the Navy, Navy Facilities Engineering Command, May 1982, Soil Mechanics, Design Manual 7.1

6. Department of the Navy, Navy Facilities Engineering Command, May 1982, Foundation and Earth Structures, Design Manual 7.2

7. Department of the Navy, Navy Facilities Engineering Command, April 1983, Soil Dynamics, Deep Stabilization, and Special Geotechnical Construction, Design Manual 7.3

8. Earthquake Engineering Research Institute, May 1990, Loma Prieta Earthquake Reconnaissance Report, Earthquake Spectra, Supplement to Volume 6.

9. D.L. Wagner , 1991, Geologic Map of the San Francisco-San Jose Quadrangle, California: California Division of Mines and Geology, Regional Geological Map 5A

10. Highway Design Manual, Chapter 600, California Department of Transportation, September 2006.

11. Kramer, S.L., 1996, Geotechnical Earthquake Engineering, Prentice-Hall, Inc.

12. Merriam, M., 2008, Personal communication with Caltrans on 2008 Criteria (in-progress).

13. National Research Council, Washington, DC, 1985, Liquefaction of Soils during Earthquakes, PB86-163110, November 1985.

14. Sadigh, K., Chang, C.Y., Egan, J.A., Makdisi, and Youngs, R.R., 1997, "Attenuation Relationships for Shallow Crustal Earthquakes Based on California Strong Motion Data", Seismological Research Letters, Volume 68, No. 1, January/February 1997.

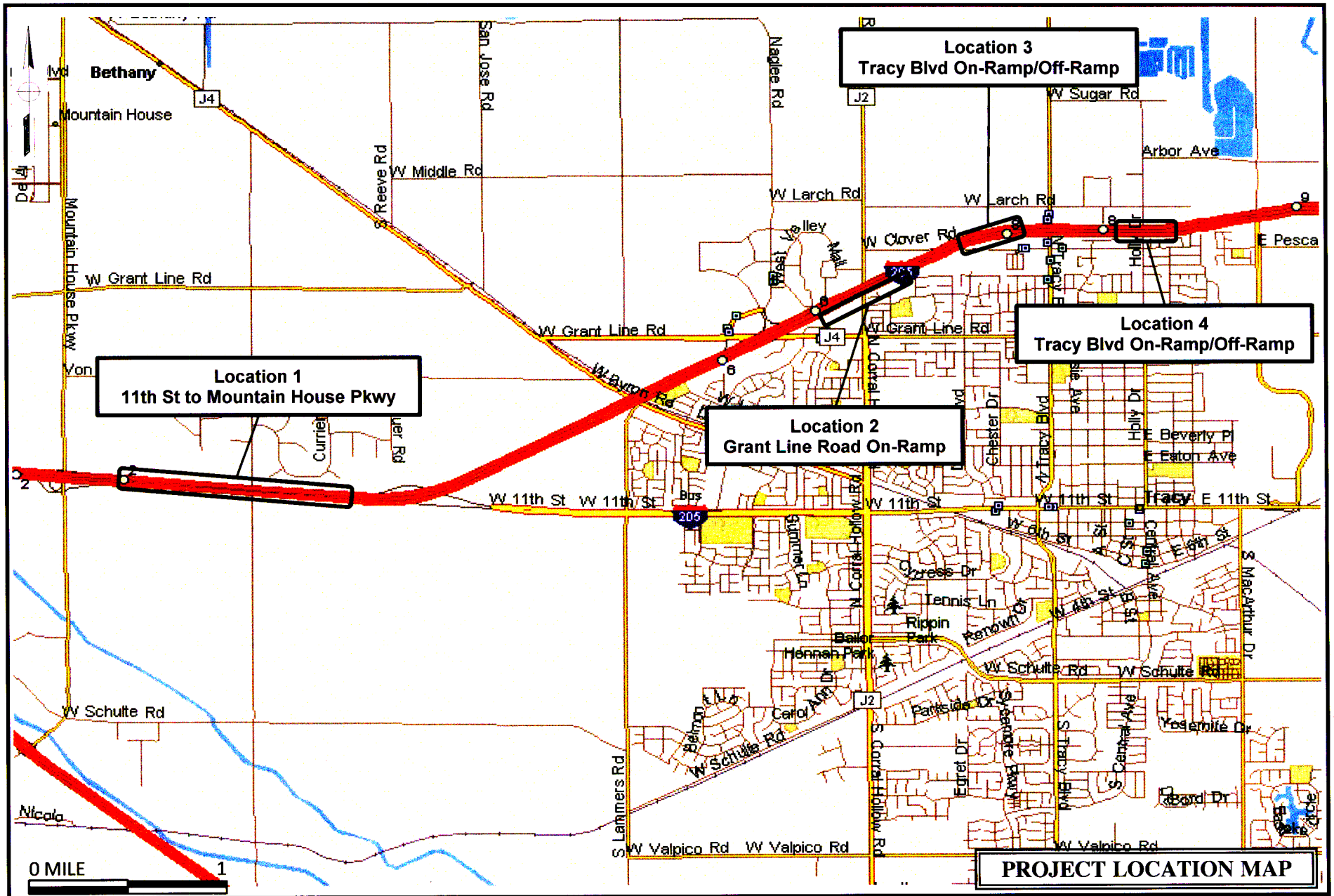
15. Seed, H. B. and I. M. Idriss, "Ground Motions and Soil Liquefaction during Earthquakes", 1982.

REFERENCES (Continued)

16. Seed, H.B. and Martin, G.R., 1966, "The Seismic Coefficient of Earth Dam Design," Journal of the Soil Mechanics and Foundations Division, ASCE, Vol. 92, No. SM3, Proceedings Paper 4824, pp. 25-48.

17. Tokimatsu, K. and Seed, H.B., 1987, "Evaluation of Settlements in Sand due to Earthquake Shaking," Journal of Geotechnical Engineering, ASCE, Vol., 113, No. 8.

18. Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G., Christian, J.T., Dobry, R., Liam Finn, W.D., Harder, L.F., Hynes, M.E., Ishihara, K., Koester, J.P., Liao, S.S.C., Marcuson, W.F., III, Martin, G.R., Mitchell, J.K., Moriwaki, Power, M.S., Robertson, P.K., Seed, R.B., Stokoe, K.H., II, 2001, "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, " Journal of Geotechnical and Geoenvironmental Engineering, ASCE, V. 127, No. 10.



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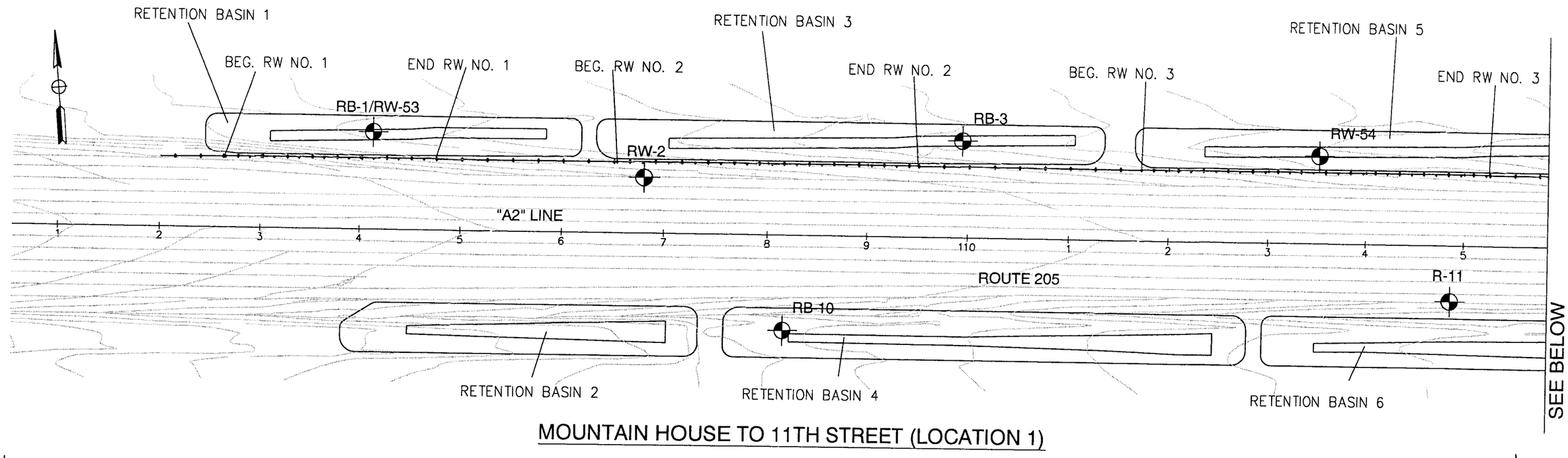
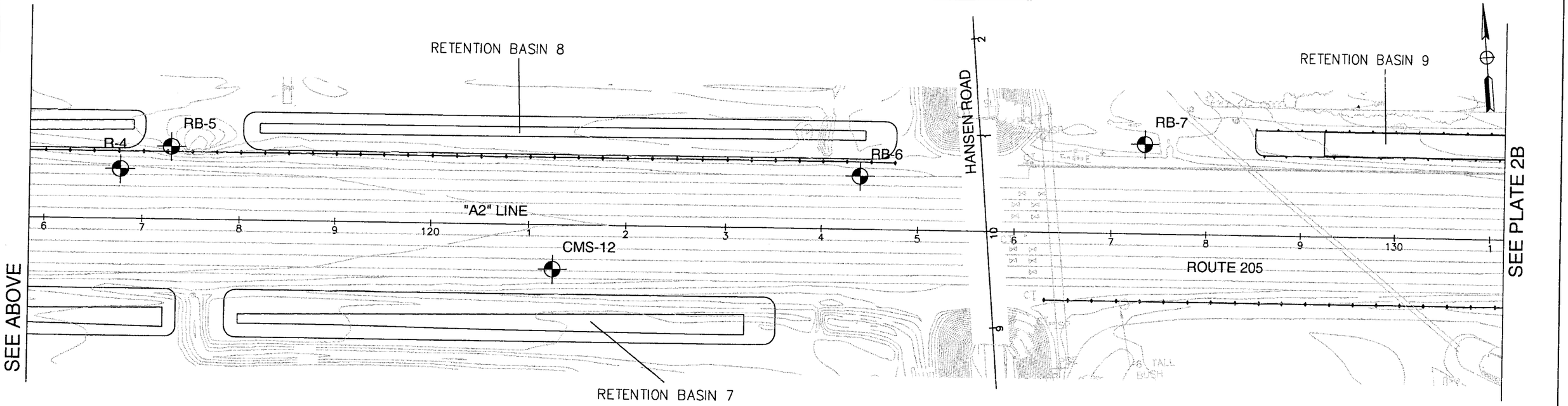
MATERIALS TESTING

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

JOB NO.: 206144.GDR	PLATE NO.: 1



MOUNTAIN HOUSE TO 11TH STREET (LOCATION 1)



MOUNTAIN HOUSE TO 11TH STREET (LOCATION 1)

SITE PLAN

LEGEND

RB-1/RW-53
Approx. Boring Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by Rajappan & Meyer Consulting Engineers, Inc.

PARIKH CONSULTANTS, INC.
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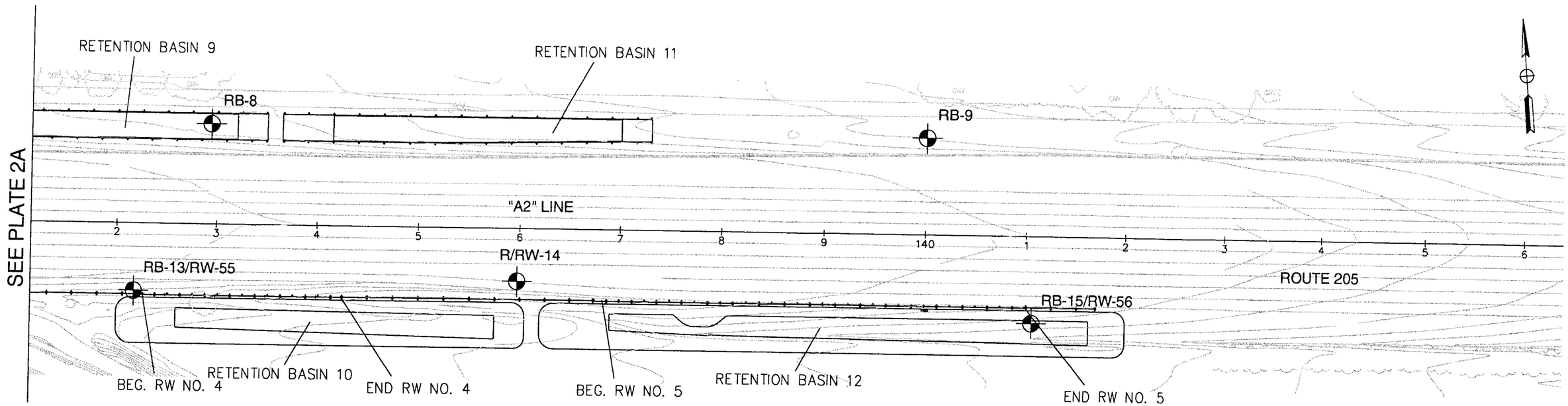
MATERIALS ENGINEERING

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

JOB NO.:206144.GDR

PLATE NO: 2A



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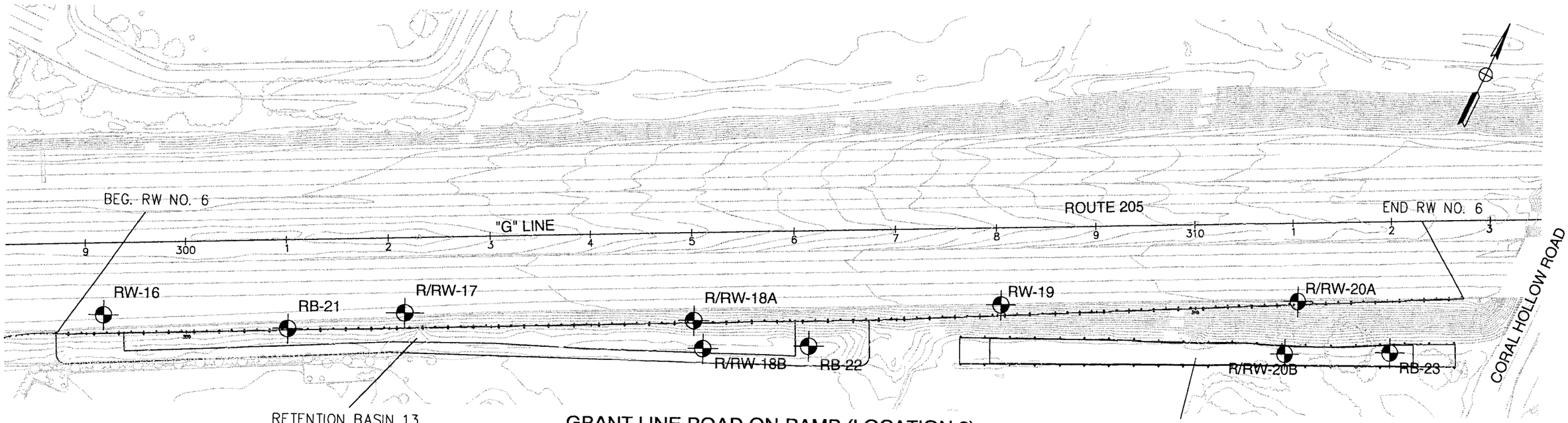


GRANT LINE ROAD ON-RAMP (LOCATION 2)

LEGEND

RB-1/RW-53
Approx. Boring Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by Rajappan & Meyer Consulting Engineers, Inc.

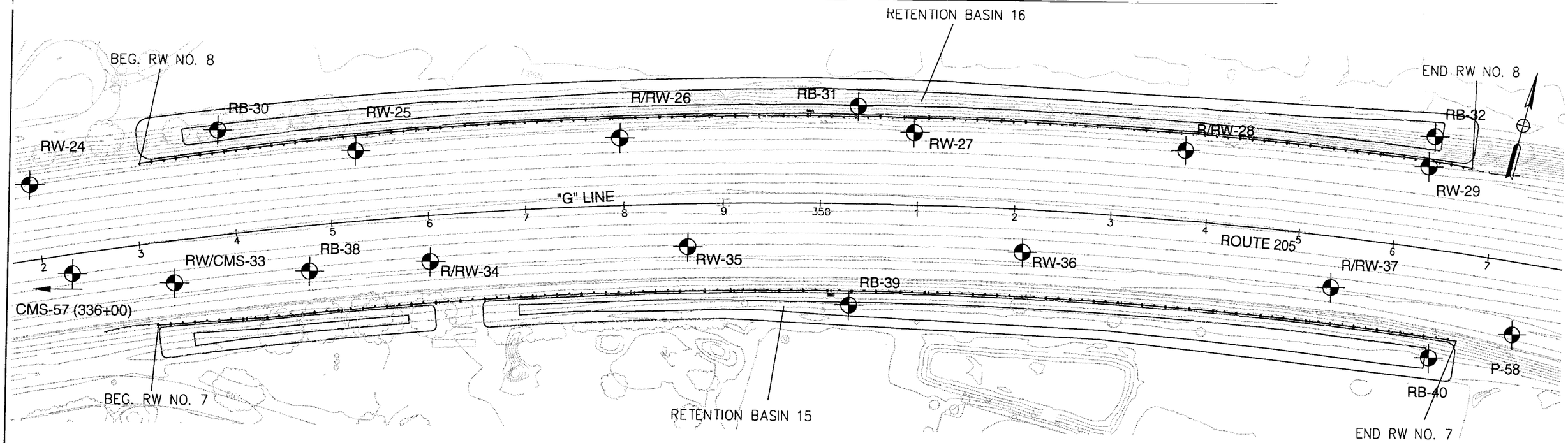
SITE PLAN

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

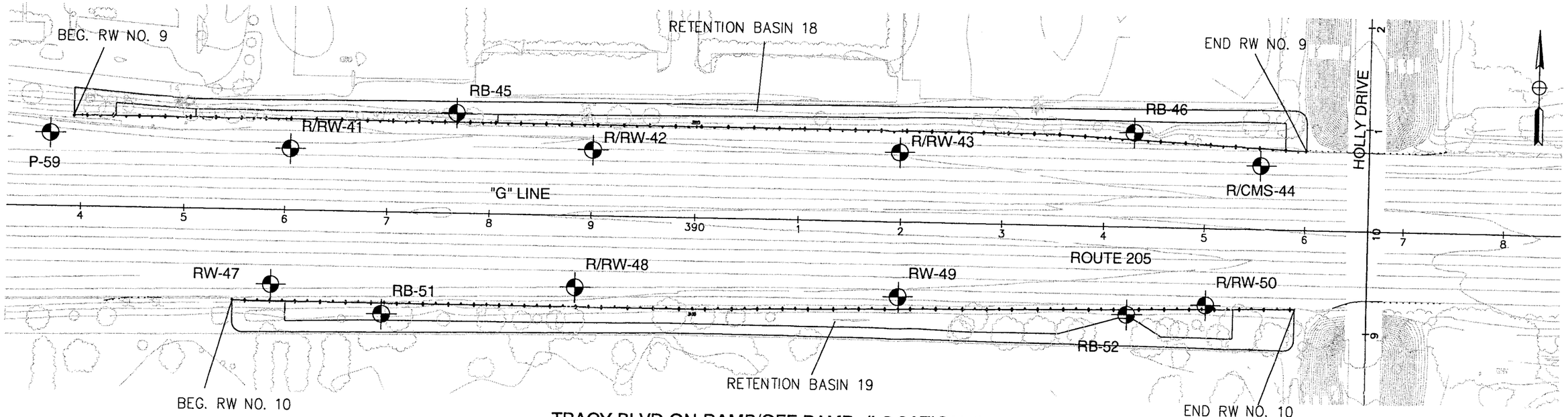
I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

JOB NO.:206144.GDR

PLATE NO: 2B



TRACY BLVD ON-RAMP/OFF-RAMP (LOCATION 3)



TRACY BLVD ON-RAMP/OFF-RAMP (LOCATION 4)

SITE PLAN

LEGEND

RB-1/RW-53 Approx. Boring Location

SCALE 1 inch = 100 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by Rajappan & Meyer Consulting Engineers, Inc.

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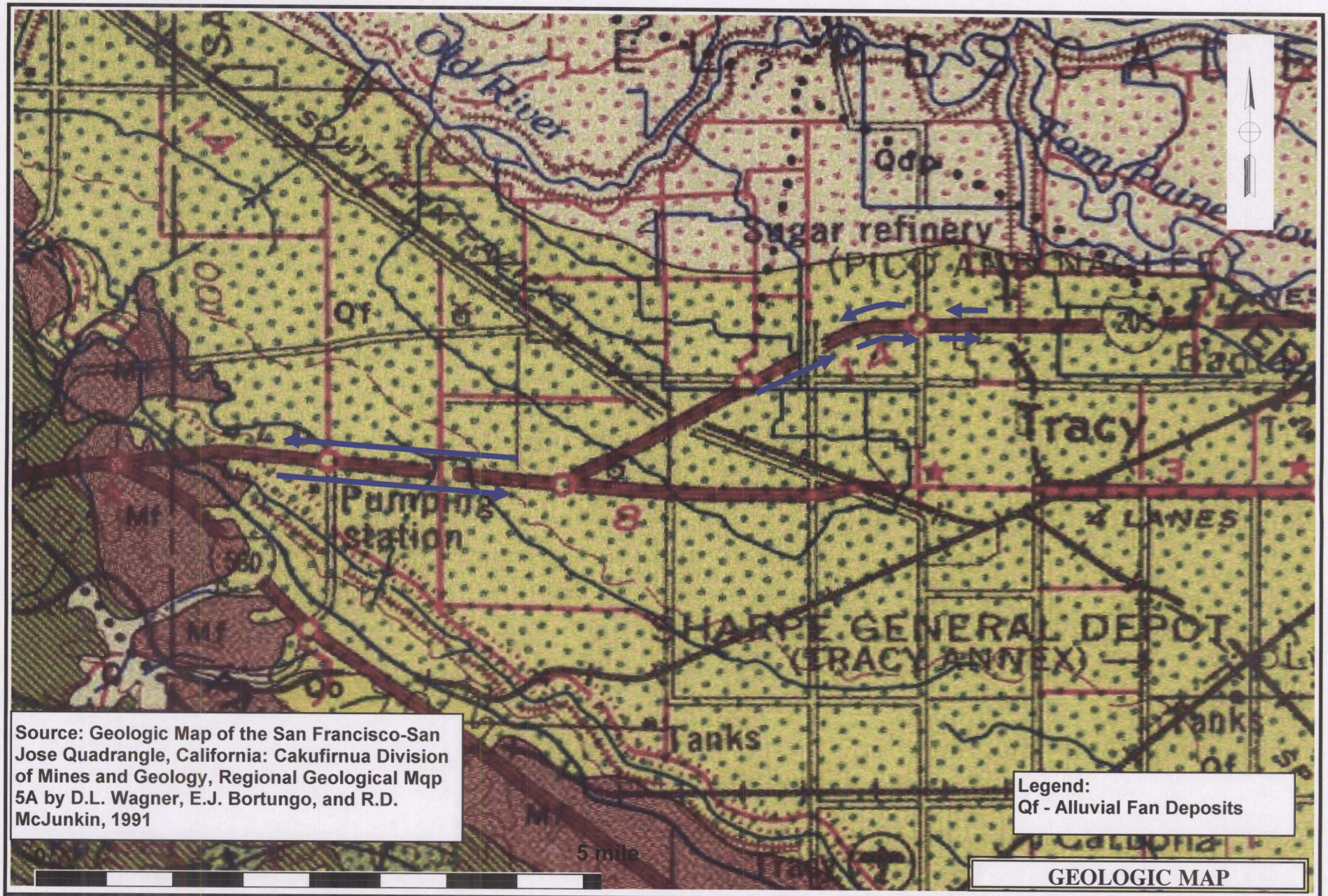
MATERIALS ENGINEERING

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

JOB NO.:206144.GDR | PLATE NO: 2C



Source: Geologic Map of the San Francisco-San Jose Quadrangle, California: Cakufirnua Division of Mines and Geology, Regional Geological Mqp 5A by D.L. Wagner, E.J. Bortungo, and R.D. McJunkin, 1991

Legend:
Qf - Alluvial Fan Deposits

GEOLOGIC MAP

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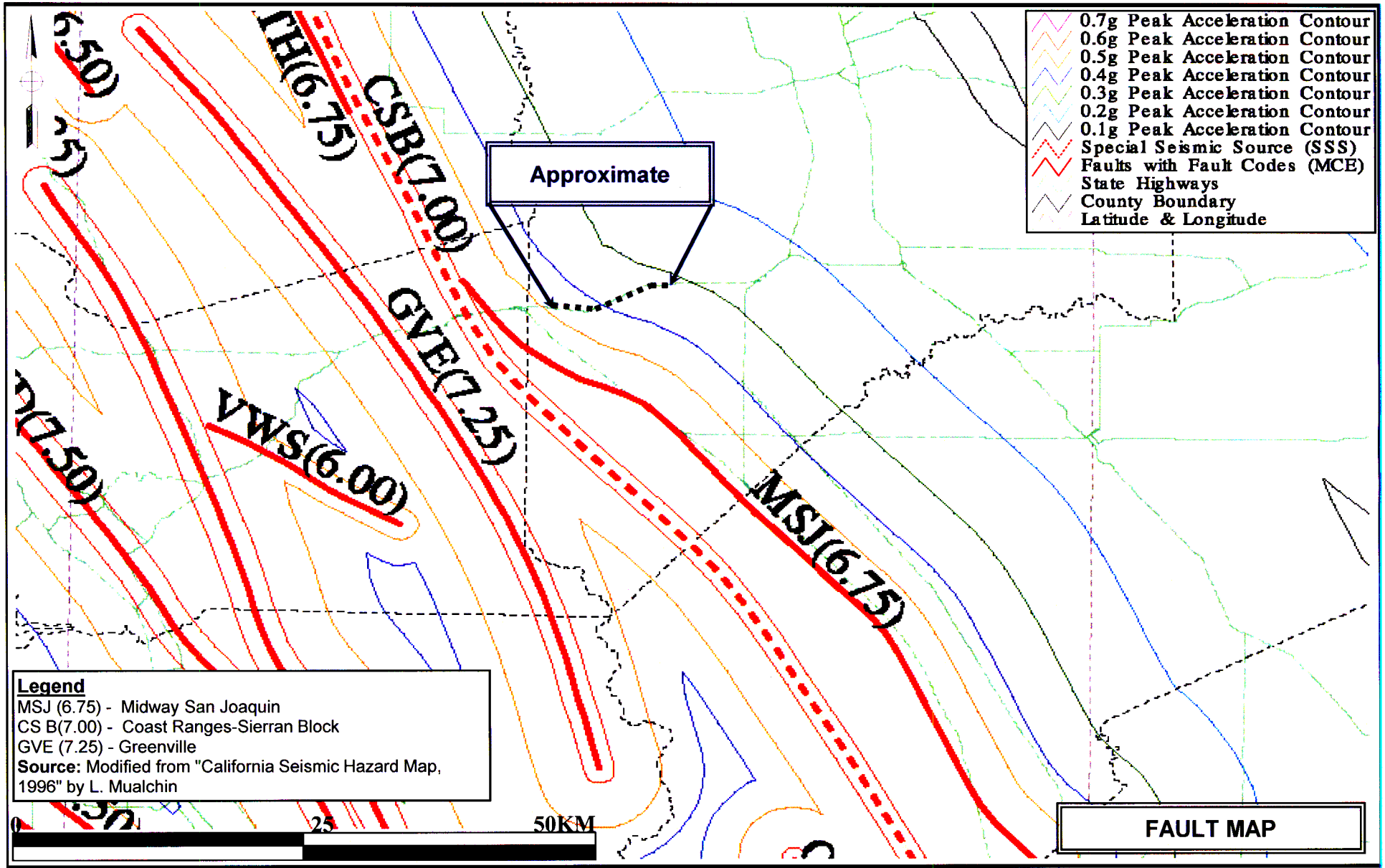
I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

JOB NO.: 206144.GDR

PLATE NO.: 3



PARIKH CONSULTANTS, INC.
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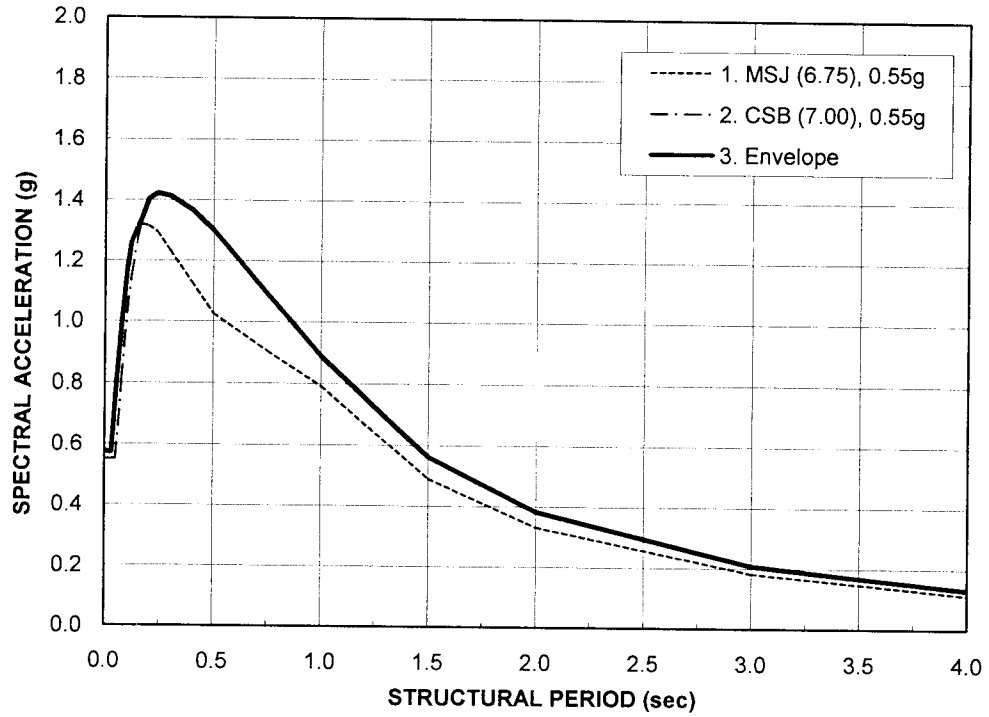
MATERIALS TESTING

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

JOB NO.: 206144.GDR

PLATE NO.: 4

ARS DESIGN CURVE
I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA



Spectral Data

Period (sec)	MSJ (6.75) Spectral Accel. (g)	CSB (7.00) Spectral Accel. (g)
0.010	0.575	0.550
0.020	0.574	0.550
0.030	0.573	0.550
0.050	0.774	0.550
0.075	0.984	0.806
0.100	1.167	1.025
0.120	1.260	1.148
0.150	1.313	1.280
0.170	1.321	1.345
0.200	1.315	1.404
0.240	1.294	1.422
0.300	1.231	1.414
0.400	1.128	1.369
0.500	1.024	1.301
0.750	0.904	1.090
1.000	0.792	0.889
1.500	0.490	0.561
2.000	0.333	0.384
3.000	0.183	0.208
4.000	0.113	0.131

1. Caltrans SDC (v 1.4, June 2006), Figure B.7,
   Governing Fault: Midway San Joaquin
   (Mw = 6.75, Soil Profile Type D, PBA = 0.55 g)
   with the following modifications:
   (1) No change of Sa for structural periods < 0.5 sec
   (2) 20% increase of Sa for structural periods ≥ 1 sec
   (3) Linear interpolation for structural periods between 0.5 and 1 sec

2. Caltrans SDC (v 1.4, June 2006), Figure B.8,
   Governing Fault: Coast Ranges-Sierran Block
   (Mw = 7.00, Soil Profile Type D, PBA = 0.55 g)
   with no modifications.
   The peak bedrock acceleration has been selected
   to account for the reverse fault effect.

3. Recommended Design Curve = Envelope of above two curves

APPENDIX A

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)

DIST	COUNTY	ROUTE	POST MILE	SHEET NO	TOTAL SHEETS
10	SJ	205	1.93/2.67		

REGISTERED ENGINEER-GEOTECHNICAL DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp 12/31/09
GEOTECHNICAL
STATE OF CALIFORNIA

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

ENGINEERING SERVICES	GEOTECHNICAL SERVICES
PREPARED BY	O. GOUTHIER
CHECKED BY	F. WANG

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

CU 06241
EA 10-0Q2701

BRIDGE NO.
POST MILE

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

SOIL LEGEND
LOG OF TEST BORINGS

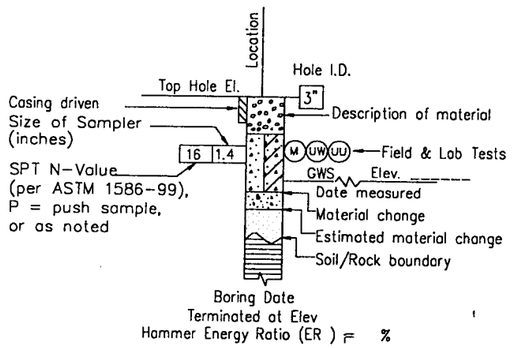
REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

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

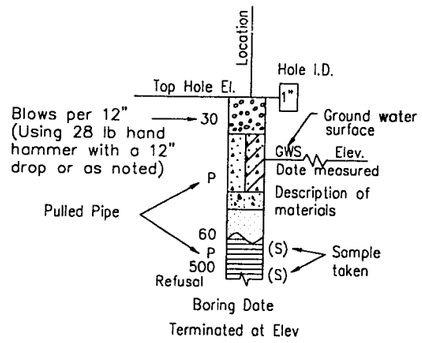
BOREHOLE IDENTIFICATION		
Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)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

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

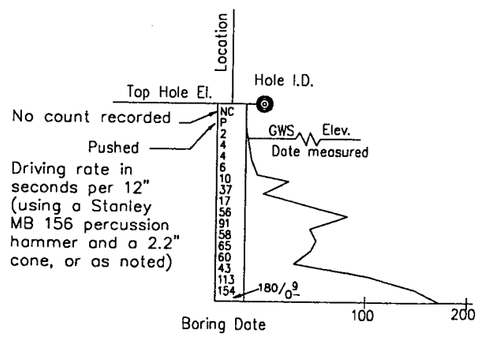
PLASTICITY OF FINE-GRAINED SOILS	
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the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



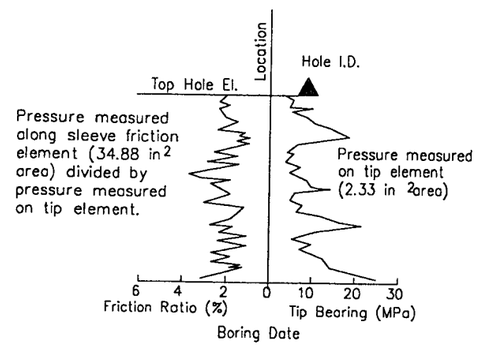
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

POST MILE	TOTAL PROJECT	NO	SHEETS
10 SJ 205	1.93/2.67		

REGISTERED ENGINEER-GEOTECHNICAL DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/09
GEOTECHNICAL
STATE OF CALIFORNIA

ENGINEERING SERVICES	GEOTECHNICAL SERVICES
PREPARED BY	O. GOUTHIER
CHECKED BY	F. WANG

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

CU 06241
EA 10-002701

BRIDGE NO.
POST MILE

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

SOIL LEGEND
LOG OF TEST BORINGS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	SHEET TOTAL
10	SJ	205	1.9/R7.9	----	----

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

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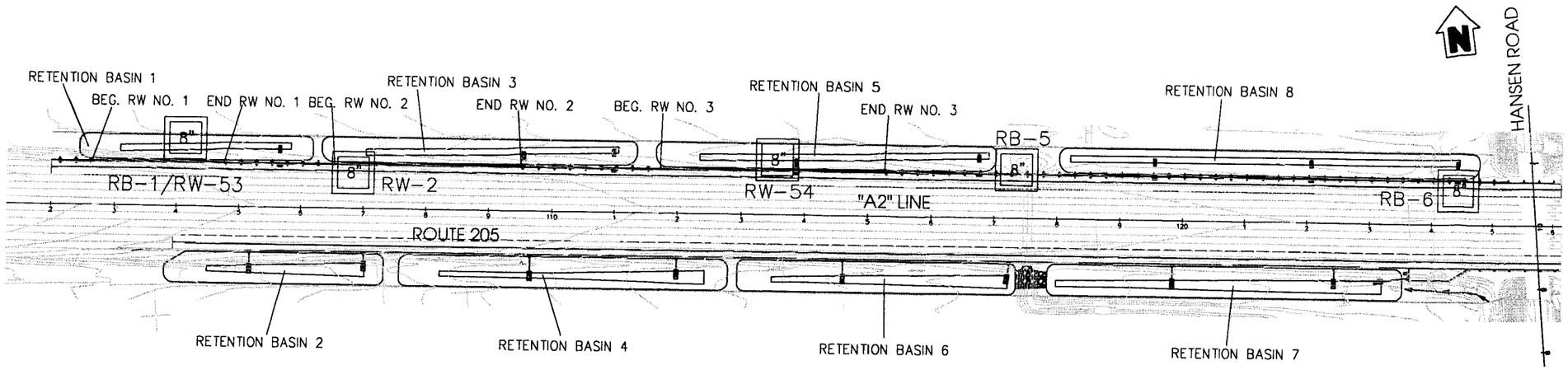
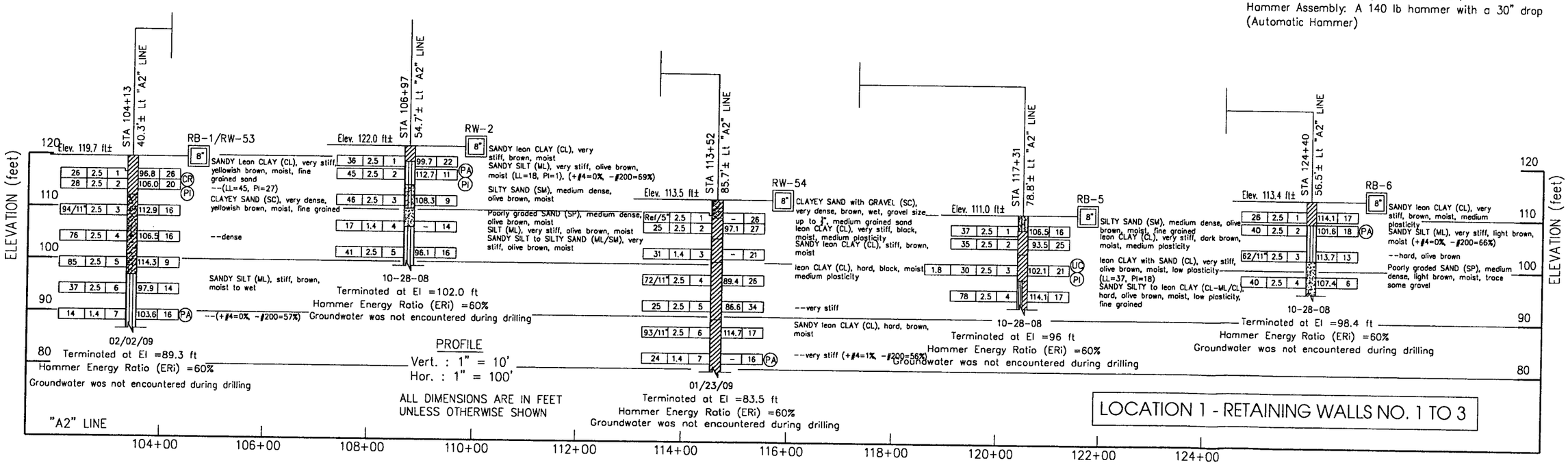
GEOTECHNICAL
STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=100'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



LOCATION 1 - RETAINING WALLS NO. 1 TO 3

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	W. BALLISI FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: OCTOBER 2008 – FEBRUARY 2009		

BRIDGE NO. –
POST MILES –

I-205 AUXILIARY LANE PROJECT

LOG OF TEST BORINGS 1 OF 10

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06241
EA 10-0Q2701

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES										SHEET	OF
5-1-2009	06-26-09									–	–

DIST	COUNTY	ROUTE	POST MILES	SHEET NO	TOTAL SHEETS
10	SJ	205	1.9/R7.9		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

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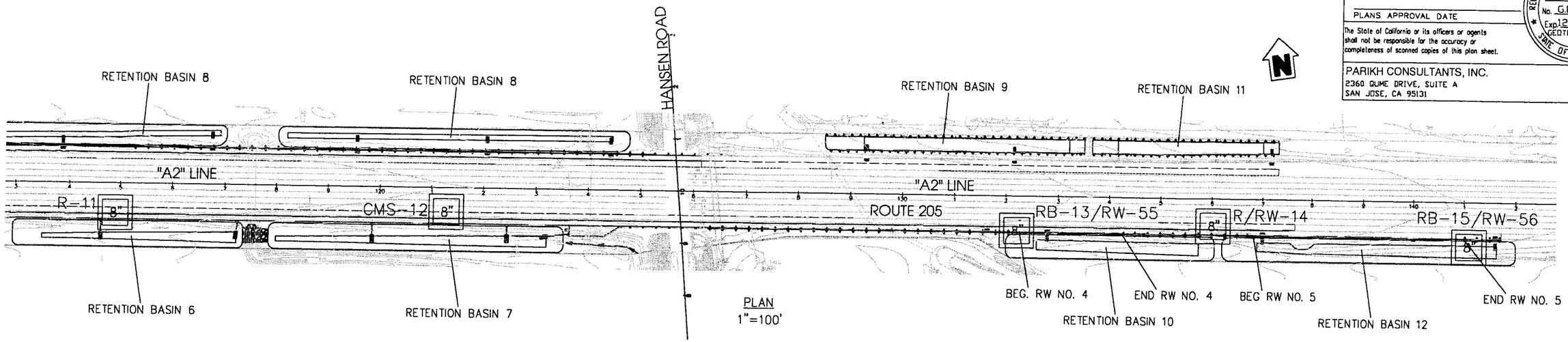
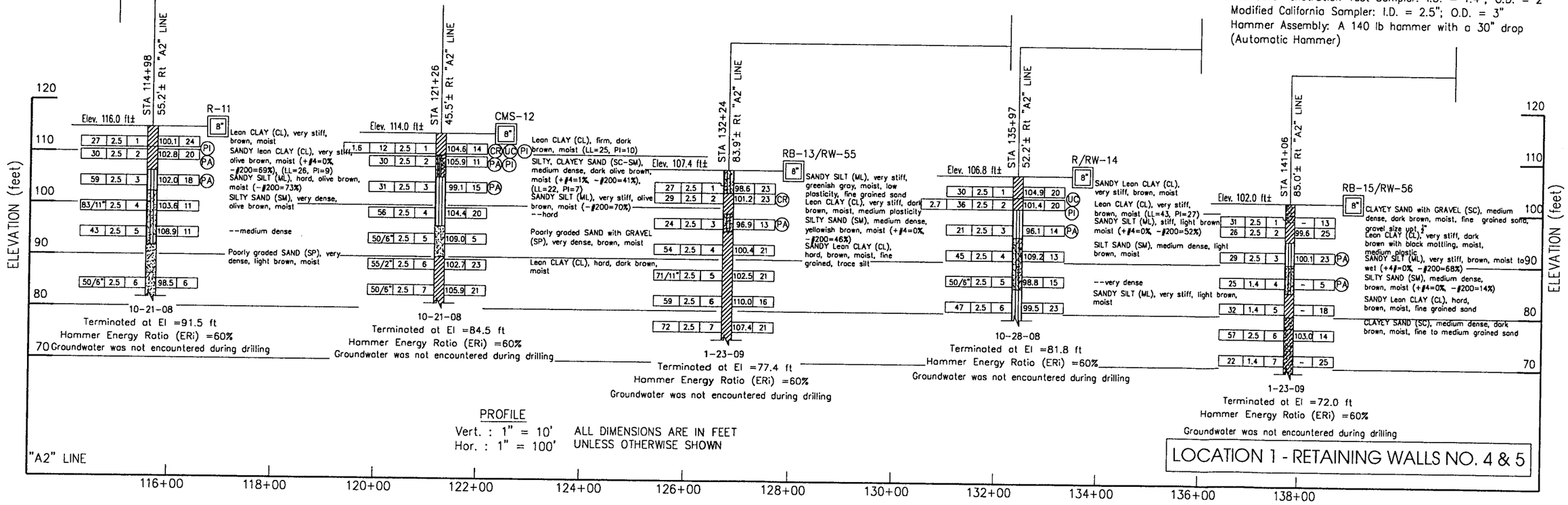
REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp 12/31/09
GEOTECHNICAL
STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=100'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 100'

ALL DIMENSIONS ARE IN FEET
UNLESS OTHERWISE SHOWN

LOCATION 1 - RETAINING WALLS NO. 4 & 5

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	W. BALLISI	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCTOBER 2008 – FEBRUARY 2009		PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

CU 06241
EA 10-002701

I-205 AUXILIARY LANE PROJECT

LOG OF TEST BORINGS 2 OF 10

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 05-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES									SHEET	OF
5-1-2009	08-26-09								–	–

DIST	COUNTY	ROUTE	POST MILES	SHEET NO	TOTAL SHEETS
10	SJ	205	1.9/R7.9		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

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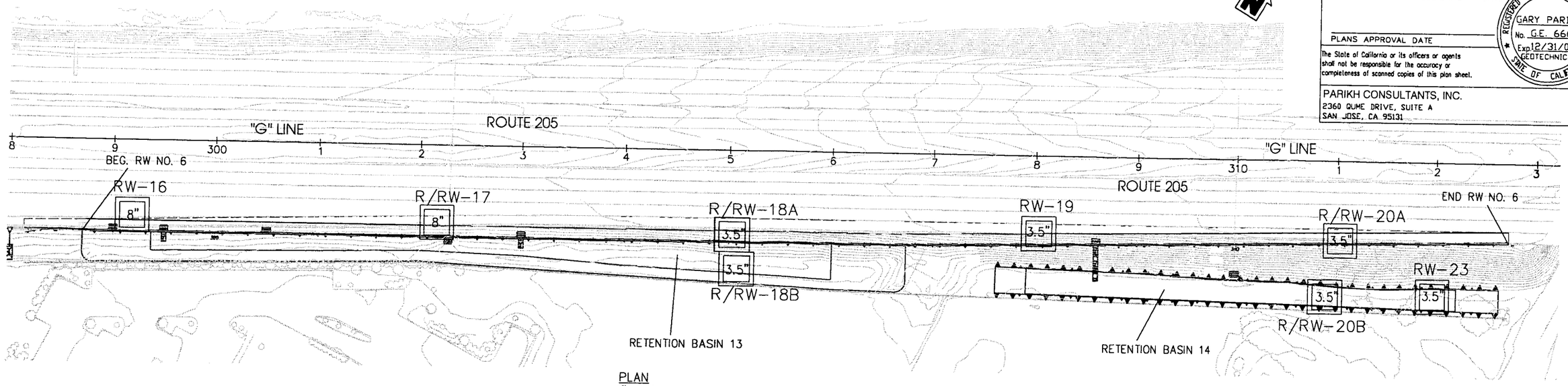
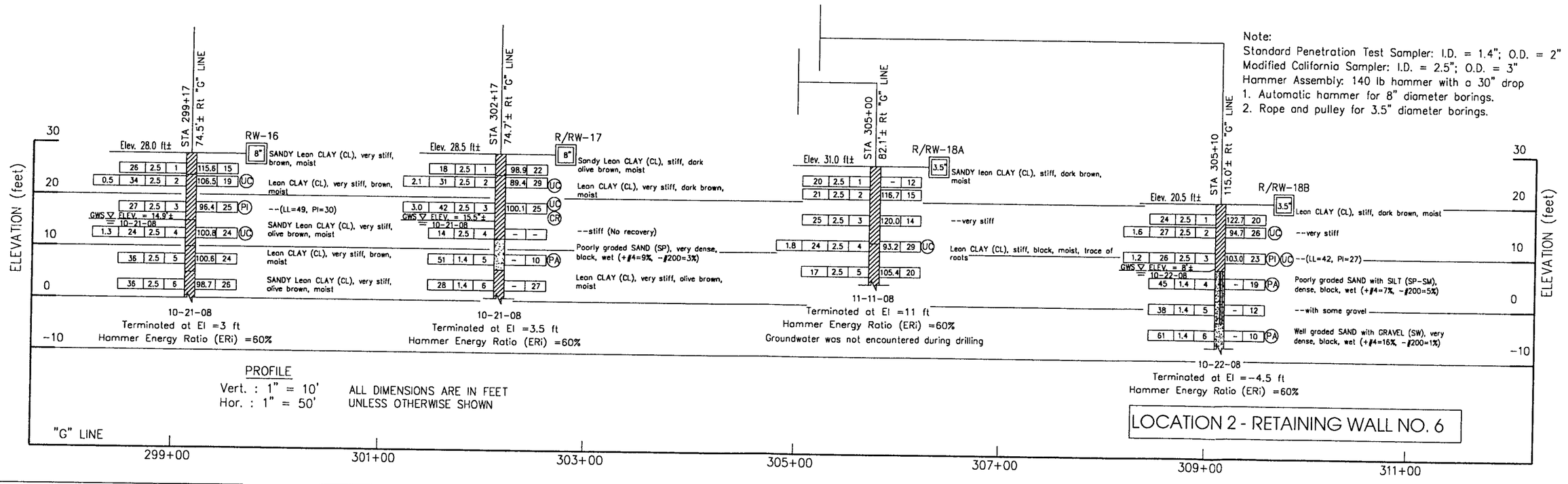
REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp 12/31/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: 140 lb hammer with a 30" drop
1. Automatic hammer for 8" diameter borings.
2. Rope and pulley for 3.5" diameter borings.

LOCATION 2 - RETAINING WALL NO. 6

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	W. BALLISI	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCTOBER 2008 - FEBRUARY 2009		PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-205 AUXILIARY LANE PROJECT

LOG OF TEST BORINGS 3 OF 10

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 05-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06241
EA 10-0Q2701

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES: 5-1-2008 | 08-26-09 | SHEET | OF

DIST	COUNTY	ROUTE	POST MILES	SHEET NO.	TOTAL SHEETS
10	SJ	205	1.9/R7.9	---	---

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/09
GEOTECHNICAL
STATE OF CALIFORNIA

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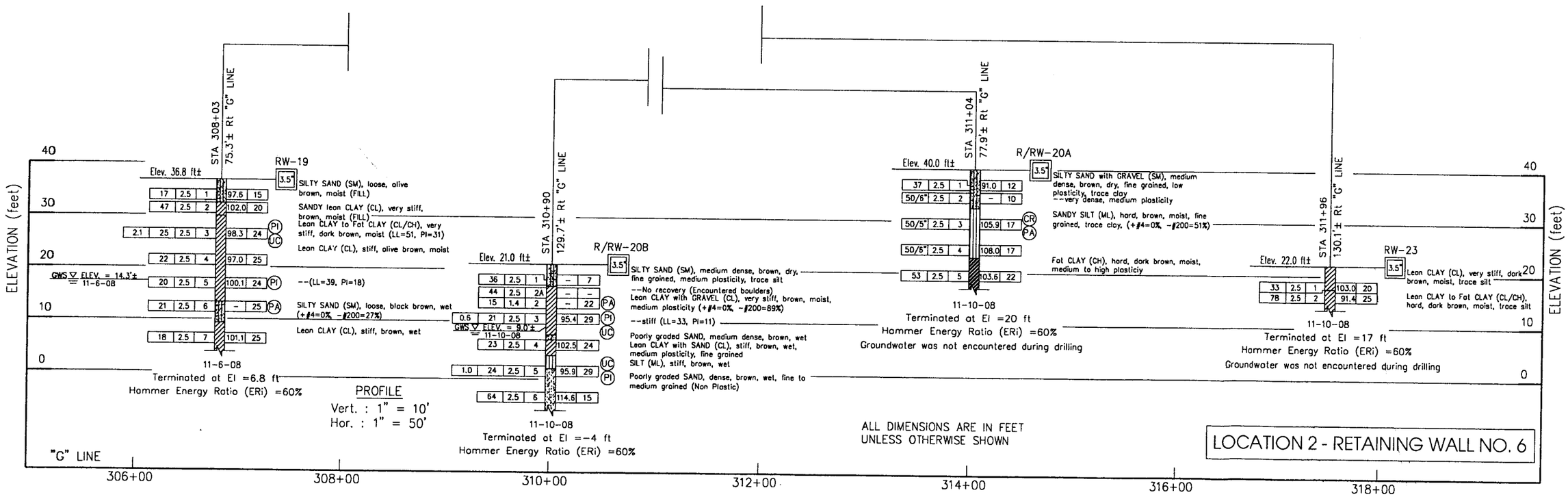
SAN JOSE, CA 95131

(SEE LOG OF TEST BORINGS, SHEET 3 OF 10, FOR BORING LOCATIONS)

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: 140 lb hammer with a 30" drop
1. Automatic hammer for 8" diameter borings.
2. Rope and pulley for 3.5" diameter borings.



DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	W. BALLISI	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCTOBER 2008 – FEBRUARY 2009		PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-205 AUXILIARY LANE PROJECT
LOG OF TEST BORINGS 4 OF 10

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06241
EA 10-0Q2701

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES								SHEET	OF
5-1-2009	06-26-09							–	–

DIST	COUNTY	ROUTE	POST MILES	SHEET NO	TOTAL SHEETS
10	SJ	205	1.9/R7.9	---	---

GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/09
GEOTECHNICAL
STATE OF CALIFORNIA

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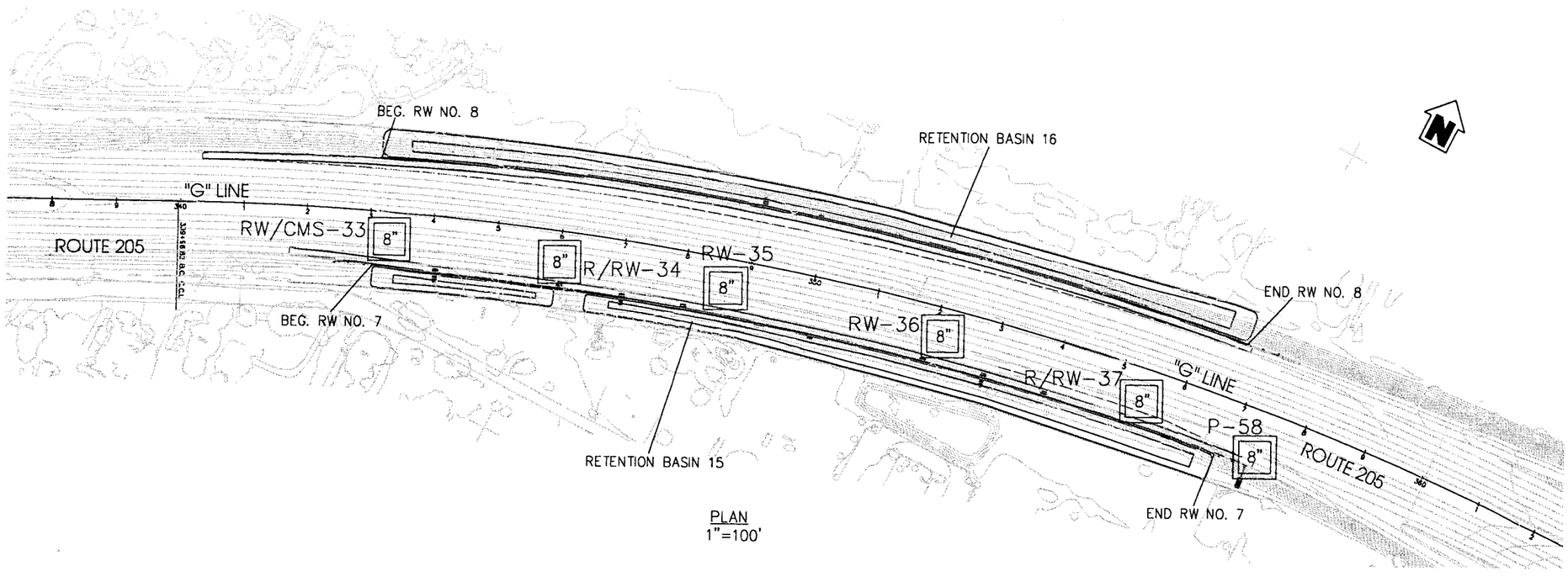
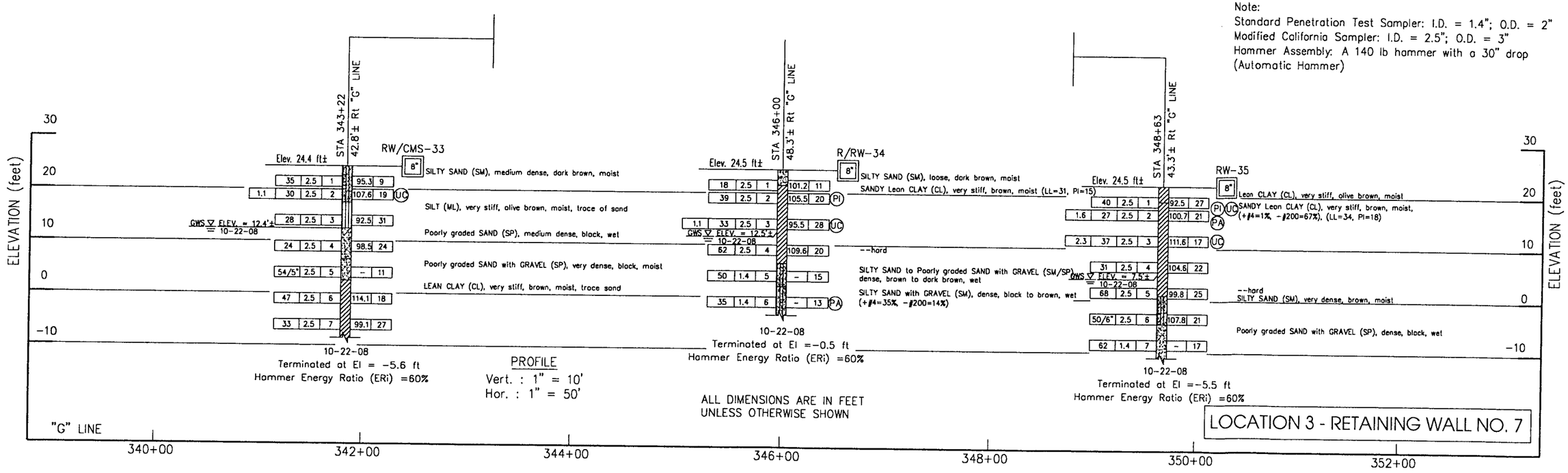


PLAN
1"=100'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET
UNLESS OTHERWISE SHOWN

LOCATION 3 - RETAINING WALL NO. 7

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	BRIDGE NO. –	I-205 AUXILIARY LANE PROJECT
SIGN OFF DATE	CHECKED BY	F. WANG	F. WANG PROJECT ENGINEER	POST MILES –	LOG OF TEST BORINGS 5 OF 10
OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)		W. BALLISI FIELD INVESTIGATION BY: DATE: OCTOBER 2008 – FEBRUARY 2009	CU 06241 EA 10-0Q2701	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES 5-1-2009 08-28-09

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DIST	COUNTY	ROUTE	POST MILES	SHEET NO	TOTAL SHEETS
10	SJ	205	1.9/R7.9		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/09
GEOTECHNICAL
STATE OF CALIFORNIA

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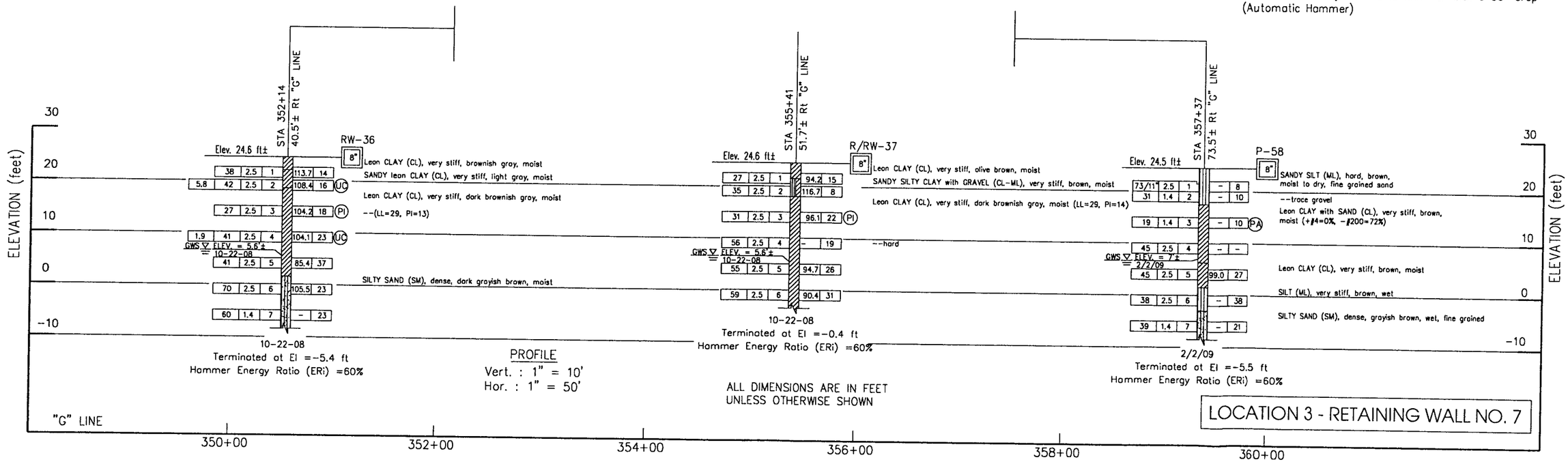
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE LOG OF TEST BORINGS, SHEET 5 OF 10, FOR BORING LOCATIONS)

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET
UNLESS OTHERWISE SHOWN

LOCATION 3 - RETAINING WALL NO. 7

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	W. BALLISI FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER	BRIDGE NO. –	I-205 AUXILIARY LANE PROJECT
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: OCTOBER 2008 – FEBRUARY 2009			POST MILES –	LOG OF TEST BORINGS 6 OF 10

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 05-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06241
EA 10-0Q2701

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES										SHEET	OF
5-1-2009	05-26-09									–	–

DIST	COUNTY	ROUTE	POST MILES	SHEET	TOTAL
10	SJ	205	1.9/R7.9		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

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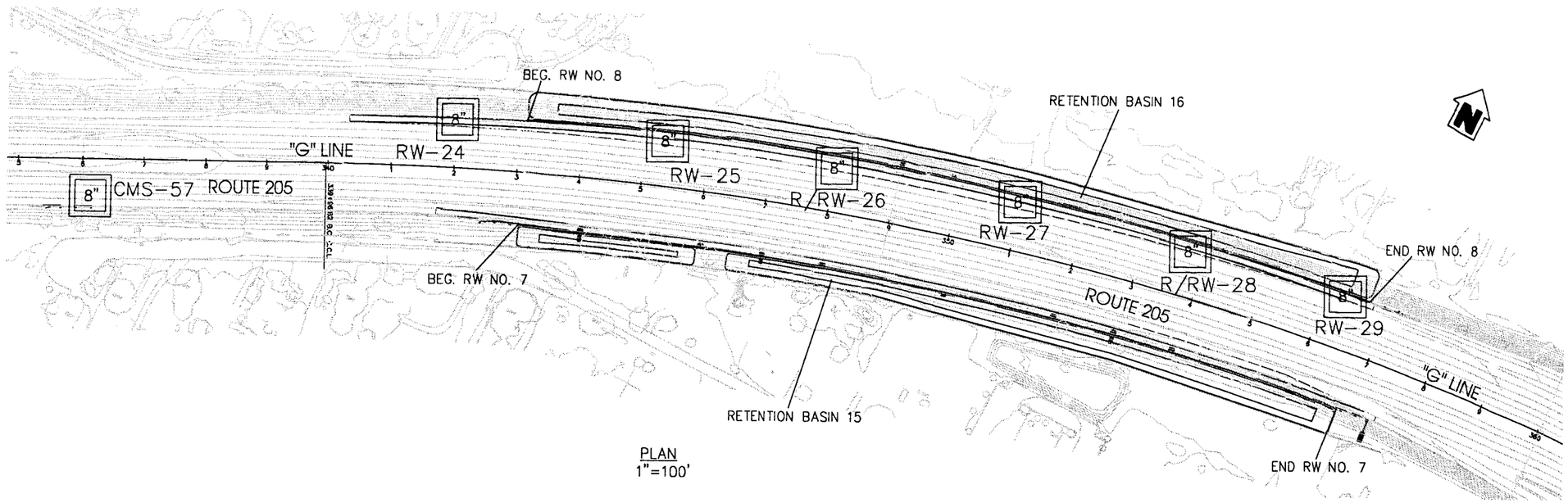
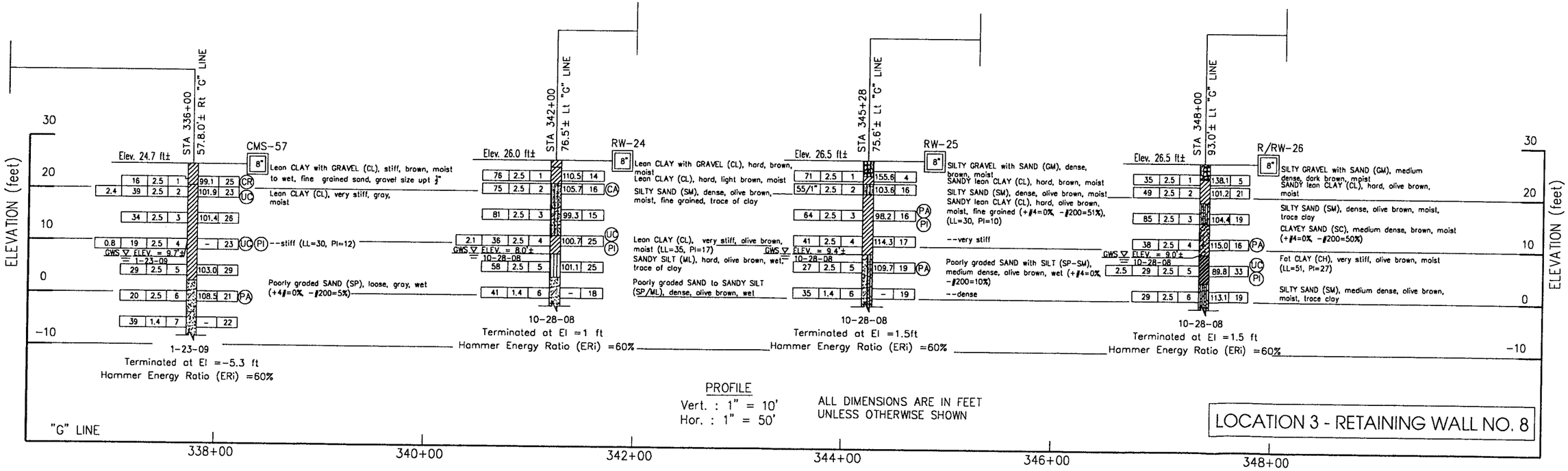
REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/09
GEOTECHNICAL
STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=100'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Automatic Hammer)



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET
UNLESS OTHERWISE SHOWN

LOCATION 3 - RETAINING WALL NO. 8

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	W. BALLISI	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCTOBER 2008 – FEBRUARY 2009		PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-205 AUXILIARY LANE PROJECT

LOG OF TEST BORINGS 7 OF 10

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06241
EA 10-0Q2701

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES									SHEET	OF
5-1-2009	08-26-09								–	–

DIST	COUNTY	ROUTE	POST MILES	SHEET	TOTAL SHEETS
10	SJ	205	1.9/R7.9	----	----

GEOTECHNICAL PROFESSIONAL DATE

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp 12/31/09
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STATE OF CALIFORNIA

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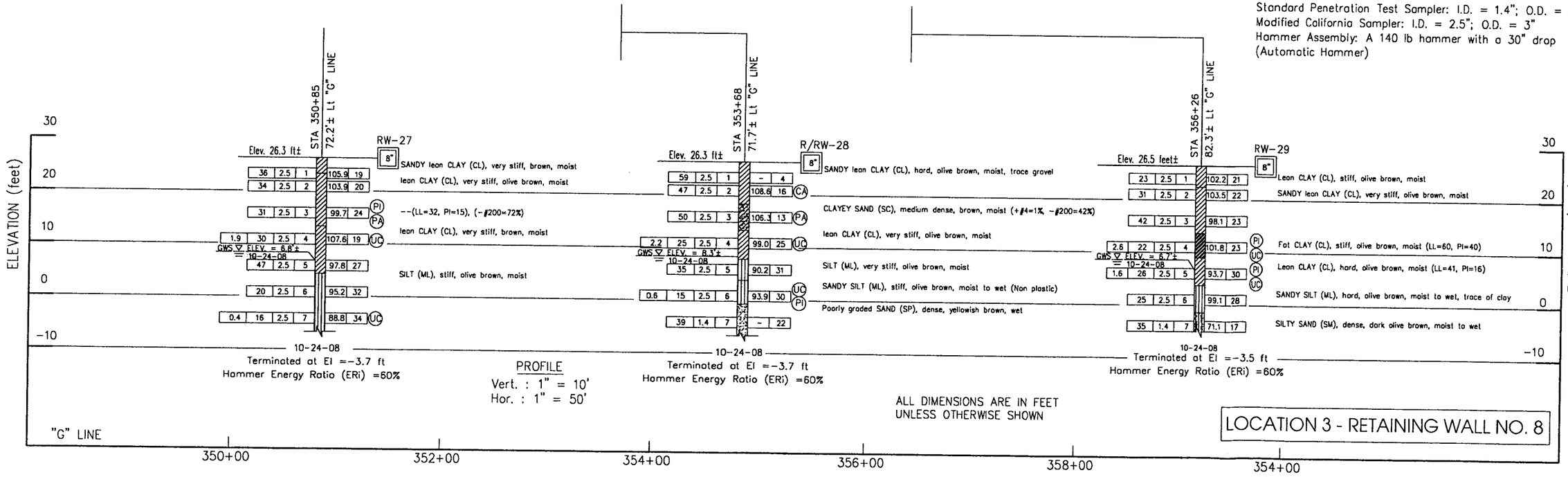
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE LOG OF TEST BORINGS, SHEET 7 OF 10, FOR BORING LOCATIONS)

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	W. BALLISI	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCTOBER 2008 - FEBRUARY 2009		PROJECT ENGINEER

BRIDGE NO. -
POST MILES -

I-205 AUXILIARY LANE PROJECT

LOG OF TEST BORINGS 8 OF 10

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06241
EA 10-0Q2701

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES								SHEET	OF
5-1-2009	08-26-09							-	-

DIST	COUNTY	ROUTE	POST MILES	SHEET	TOTAL
10	SJ	205	1.9/R7.9		

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GARY PARIKH
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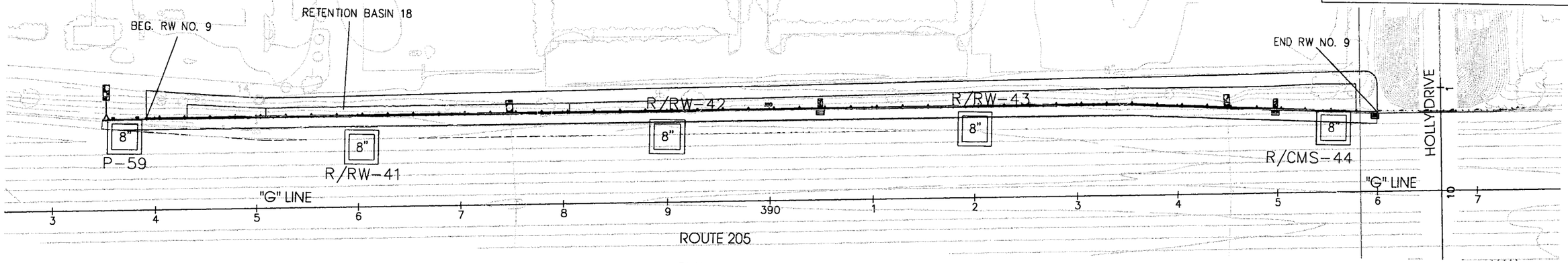
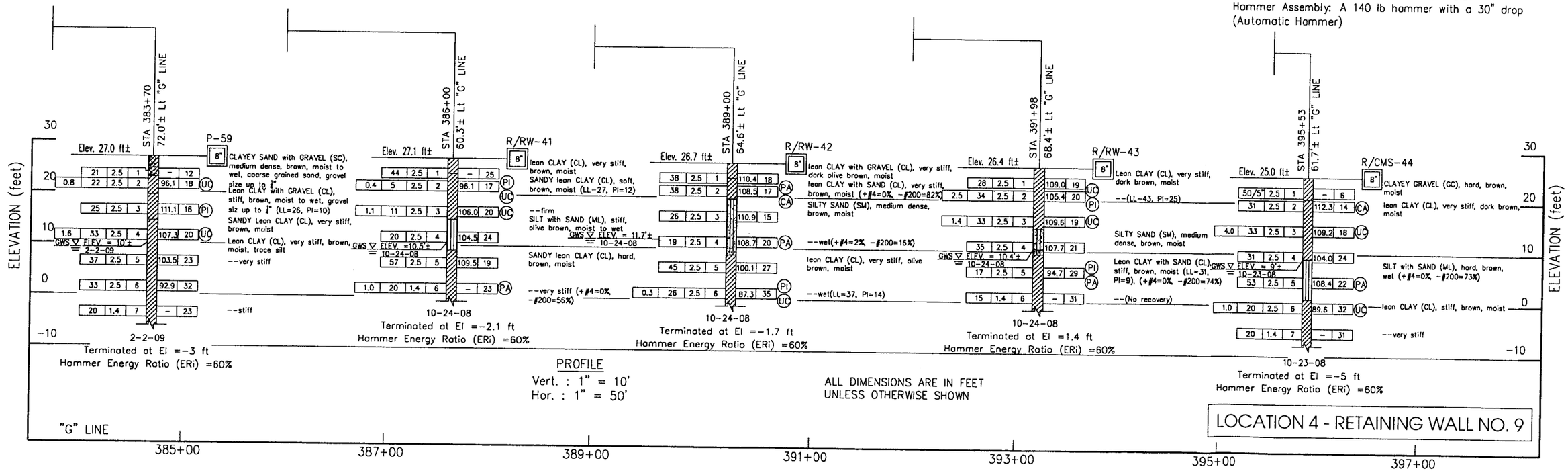
GEOTECHNICAL
STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=50'

Note:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

LOCATION 4 - RETAINING WALL NO. 9

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	W. BALLISI	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCTOBER 2008 - FEBRUARY 2009		PROJECT ENGINEER

BRIDGE NO. -
POST MILES -

I-205 AUXILIARY LANE PROJECT

LOG OF TEST BORINGS 9 OF 10

CU 06241
EA 10-0Q2701

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES								SHEET	OF
5-1-2009	09-28-09							-	-

DIST	COUNTY	ROUTE	POST MILES	SHEET	TOTAL
10	SJ	205	1.9/R7.9		

GEOTECHNICAL PROFESSIONAL DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp 12/31/09
GEOTECHNICAL
STATE OF CALIFORNIA

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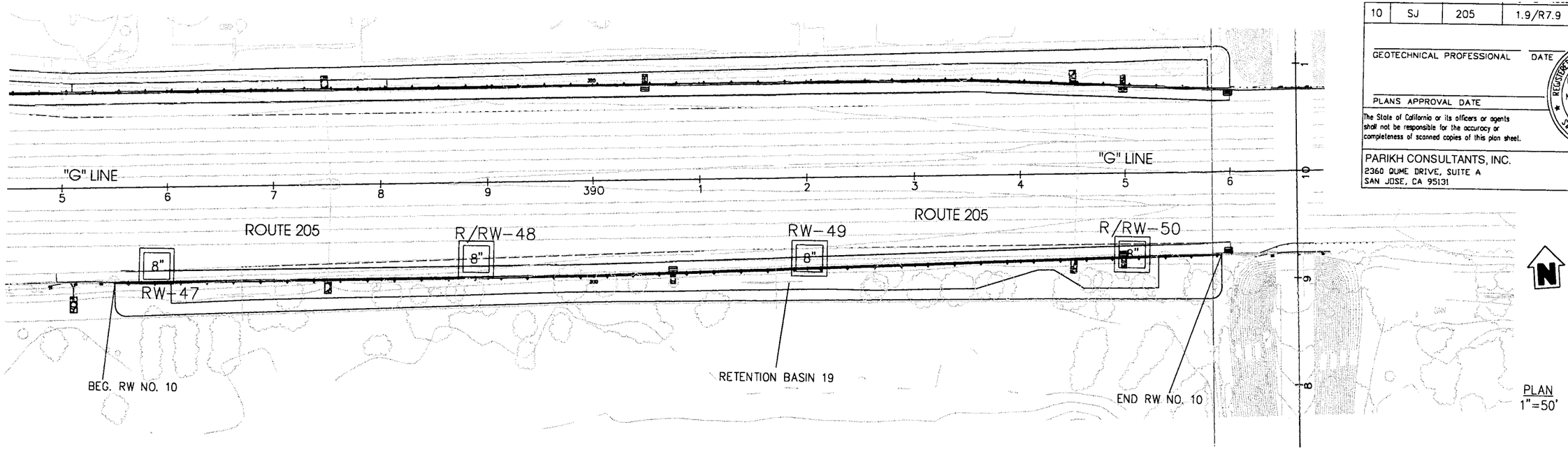
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



Note:
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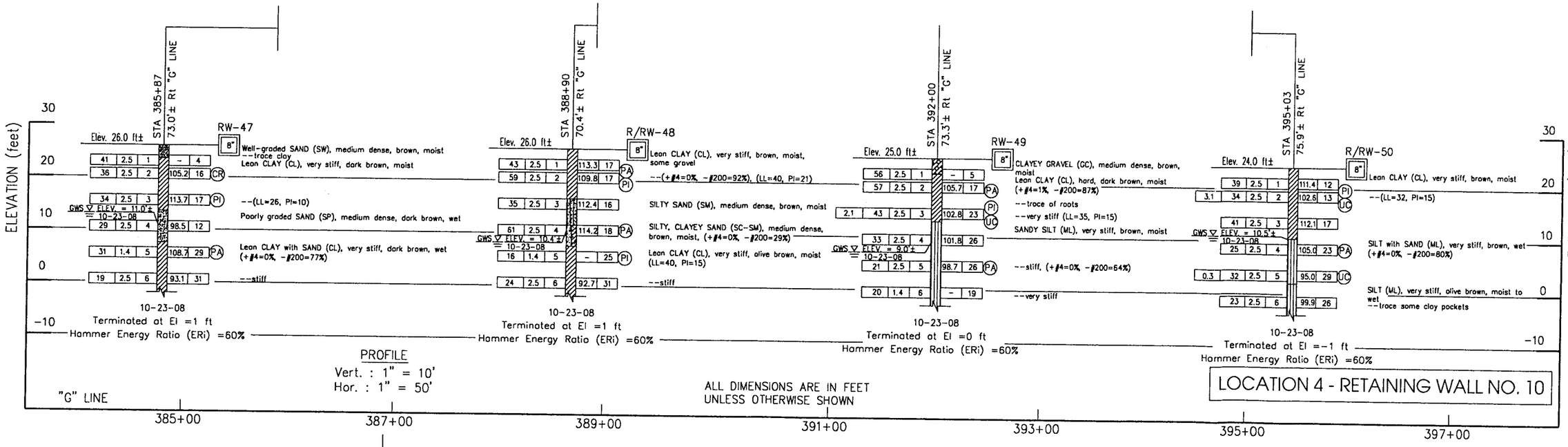
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)



DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	W. BALLISI	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCTOBER 2008 – FEBRUARY 2009		PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-205 AUXILIARY LANE PROJECT

LOG OF TEST BORINGS 10 OF 10

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

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 06241
EA 10-0Q2701

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES								SHEET	OF
5-1-2009	08-26-09							–	–

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests
The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented in "Log of Test Borings", Appendix A.

Moisture-Density
The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths In "Log of Test Borings", Appendix A.

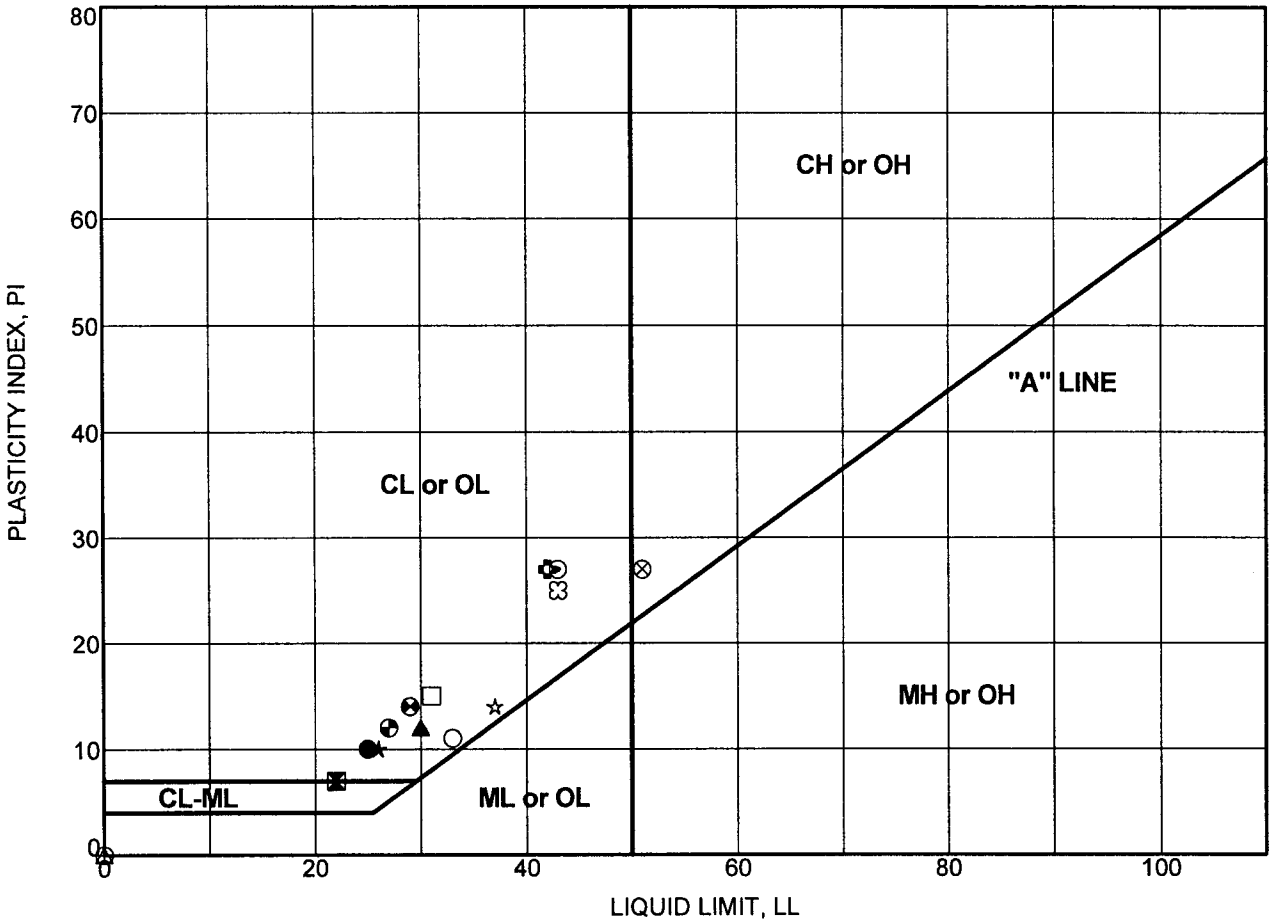
Atterberg Limits
The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on" Plasticity Chart", Plate No. B-2A thru Plate B-2C, Appendix B.

Grain Size Classification
Grain size classification tests (ASTM Test Method D422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on "Grain Size Distribution Curves", Plate B-3A to Plate B-3K, Appendix B.

Unconfined Compression Tests
Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in general accordance with ASTM Test Method D 2166-91. The results are presented in "Log of Test Borings", Appendix A.

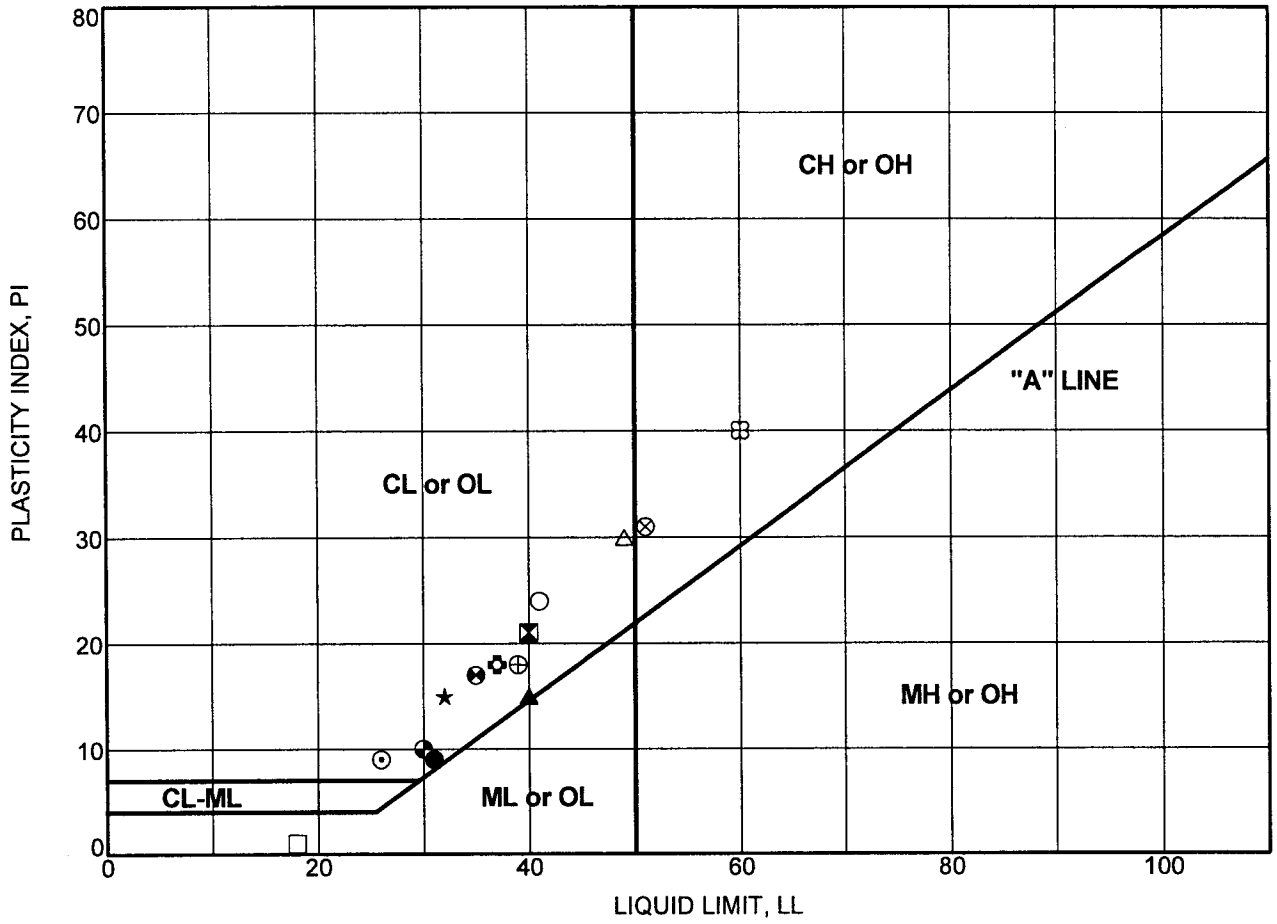
Corrosion Tests
Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643. The tests were performed by Sunland Analytical. The test results are presented on Plate B-4A thru Plate B-4Q, Appendix B.

R-value Tests
R-value tests were performed on representative bulk samples for pavement design. The tests were performed according to California Test Method 301. The test results are presented on Plates B-5A thru Plate B-5E.



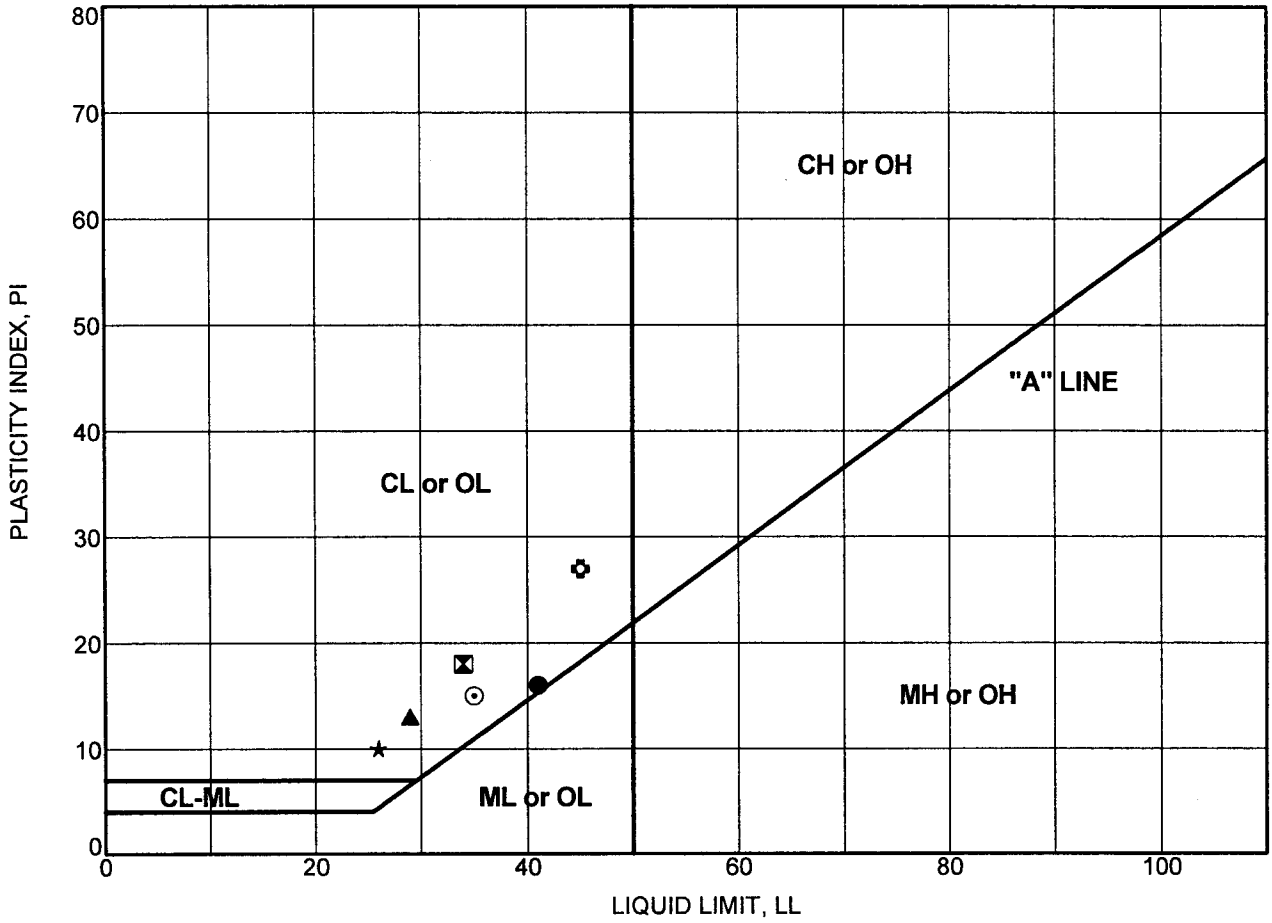
PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
CMS-12	MC-1	2.0	●	14	25	15	10	LEAN CLAY (CL)
CMS-12	MC-2	4.5	⊠	11	22	15	7	CLAYEY SAND (SC)
CMS-57	MC-4	14.5	▲	23	30	18	12	LEAN CLAY (CL)
P-59	MC-2	4.5	★	18	26	16	10	LEAN CLAY (CL)
R/RW-14	MC-2	4.5	⊙	20	43	16	27	LEAN CLAY (CL)
R/RW-18B	MC-3	9.5	✿	23	42	15	27	LEAN CLAY (CL)
R/RW-20B	MC-3	9.5	○	29	33	22	11	LEAN CLAY WITH GRAVEL (CL)
R/RW-20B	MC-5	19.5	△	29	NP	NP	NP	SILT (ML)
R/RW-26	MC-5	19.5	⊗	33	51	24	27	FAT CLAY (CH)
R/RW-28	MC-6	24.5	⊕	30	NP	NP	NP	SANDY SILT (ML)
R/RW-34	MC-2	4.5	□	20	31	16	15	SANDY LEAN CLAY (CL)
R/RW-37	MC-3	9.5	⊛	22	29	15	14	LEAN CLAY (CL)
R/RW-41	MC-2	4.5	◕	17	27	15	12	LEAN CLAY (CL)
R/RW-42	MC-6	24.5	☆	23	37	23	14	LEAN CLAY (CL)
R/RW-43	MC-2	4.5	⊠	20	43	18	25	LEAN CLAY (CL)



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
R/RW-43	MC-5	19.5	●	29	31	22	9	LEAN CLAY WITH SAND (CL)
R/RW-48	MC-2	4.5	⊠	17	40	19	21	LEAN CLAY (CL)
R/RW-48	SPT-5	19.5	▲	25	40	25	15	LEAN CLAY (CL)
R/RW-50	MC-2	4.5	★	13	32	17	15	LEAN CLAY (CL)
R-11	MC-2	4.5	⊙	20	26	17	9	SANDY LEAN CLAY (CL)
RB- 5	MC-3	9.5	✿	21	37	19	18	SANDY LEAN CLAY (CL)
RB-52	MC-1	4.5	○	20	41	17	24	LEAN CLAY (CL)
RW-16	MC-3	9.5	△	25	49	19	30	LEAN CLAY (CL)
RW-19	MC-3	9.5	⊗	24	51	20	31	LEAN CLAY (CL)/FAT CLAY (CH)
RW-19	MC-5	19.0	⊕	24	39	21	18	LEAN CLAY (CL)
RW-2	MC-1	4.5	□	11	18	17	1	SANDY SILT (ML)
RW-24	MC-4	14.5	⊖	25	35	18	17	LEAN CLAY (CL)
RW-25	MC-3	9.5	◔	16	30	20	10	SANDY LEAN CLAY (CL)
RW-27	MC-3	9.5	☆	24	32	17	15	SANDY LEAN CLAY (CL)
RW-29	MC-4	14.5	⊠	23	60	20	40	FAT CLAY (CH)



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
RW-29	MC-5	19.5	●	30	41	25	16	LEAN CLAY (CL)
RW-35	MC-2	4.5	⊠	21	34	16	18	SANDY LEAN CLAY (CL)
RW-36	MC-3	9.5	▲	18	29	16	13	LEAN CLAY (CL)
RW-47	MC-3	9.5	★	17	26	16	10	LEAN CLAY (CL)
RW-49	MC-3	9.5	⊙	23	35	20	15	LEAN CLAY (CL)
RW-53	MC-2	4.5	✿	20	45	18	27	LEAN CLAY (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

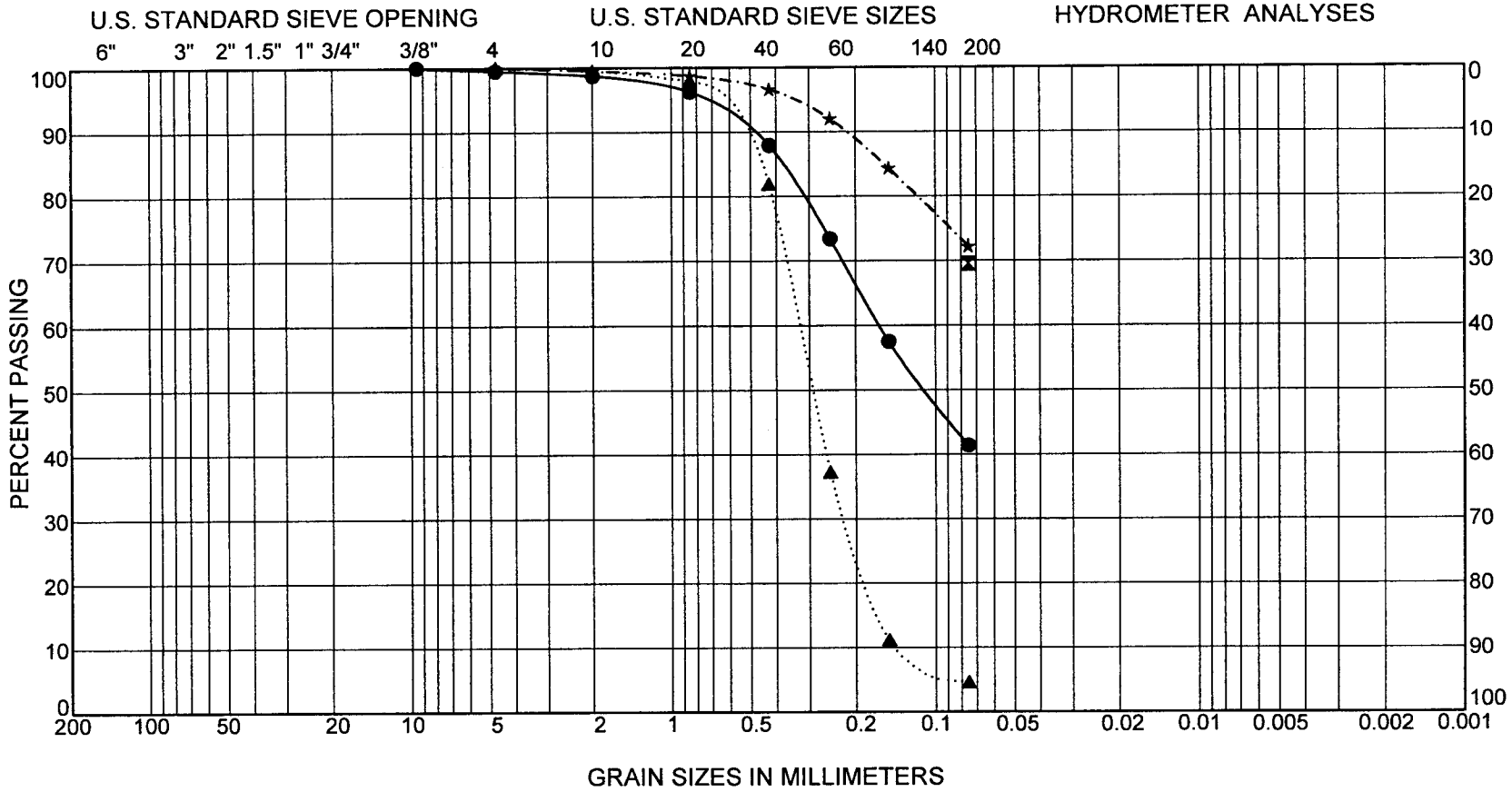
JOB NO: 206144.GDR

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE NO: B-3A

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
CMS-12	MC-2	4.5	●	22	7	CLAYEY SAND (SC)
CMS-12	MC-3	9.5	⊠			SANDY SILT (ML)
CMS-57	MC-6	24.5	▲			POORLY-GRADED SAND (SP)
P-58	MC-3	9.5	★			LEAN CLAY WITH SAND (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

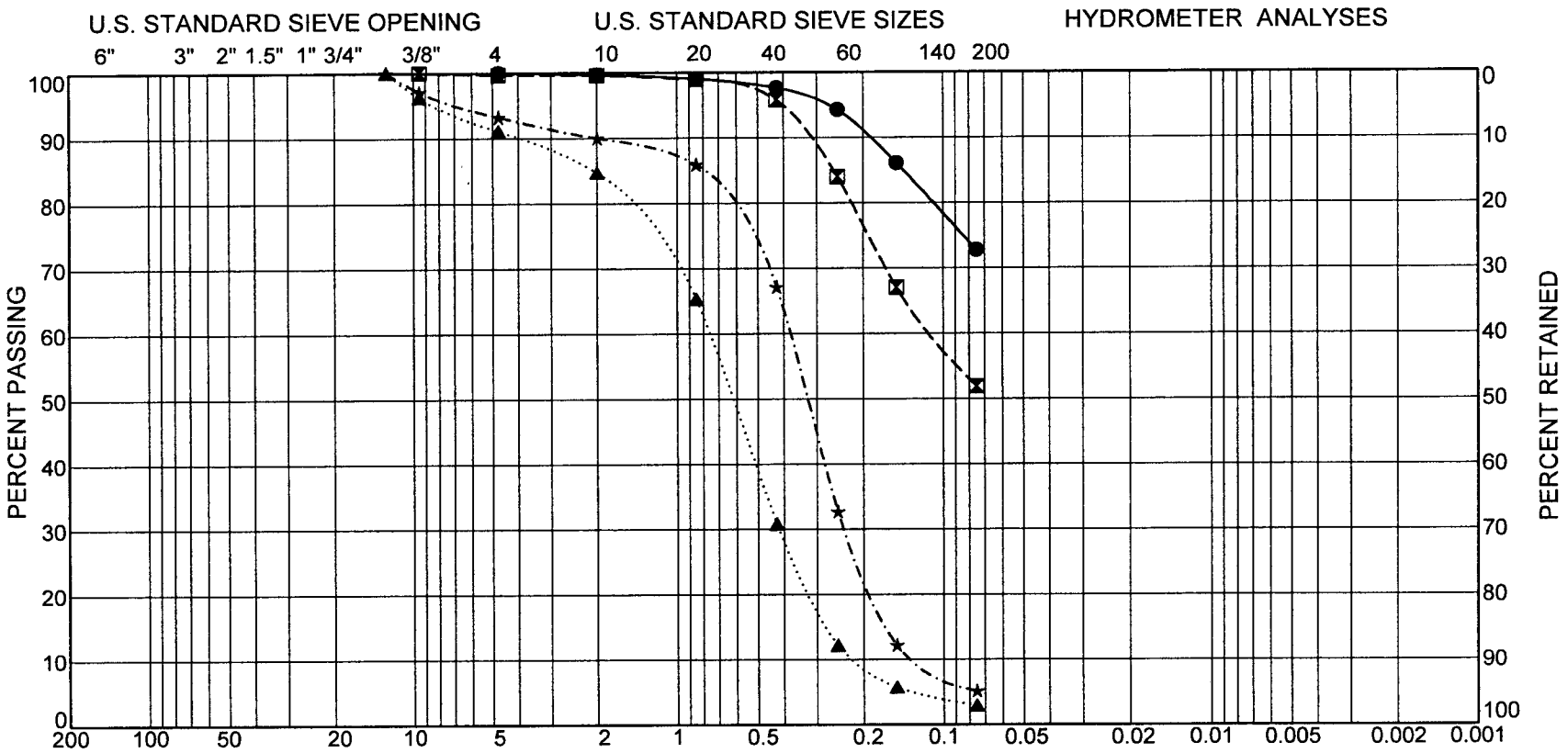
JOB NO: 206144.GDR

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE NO: B-3B

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

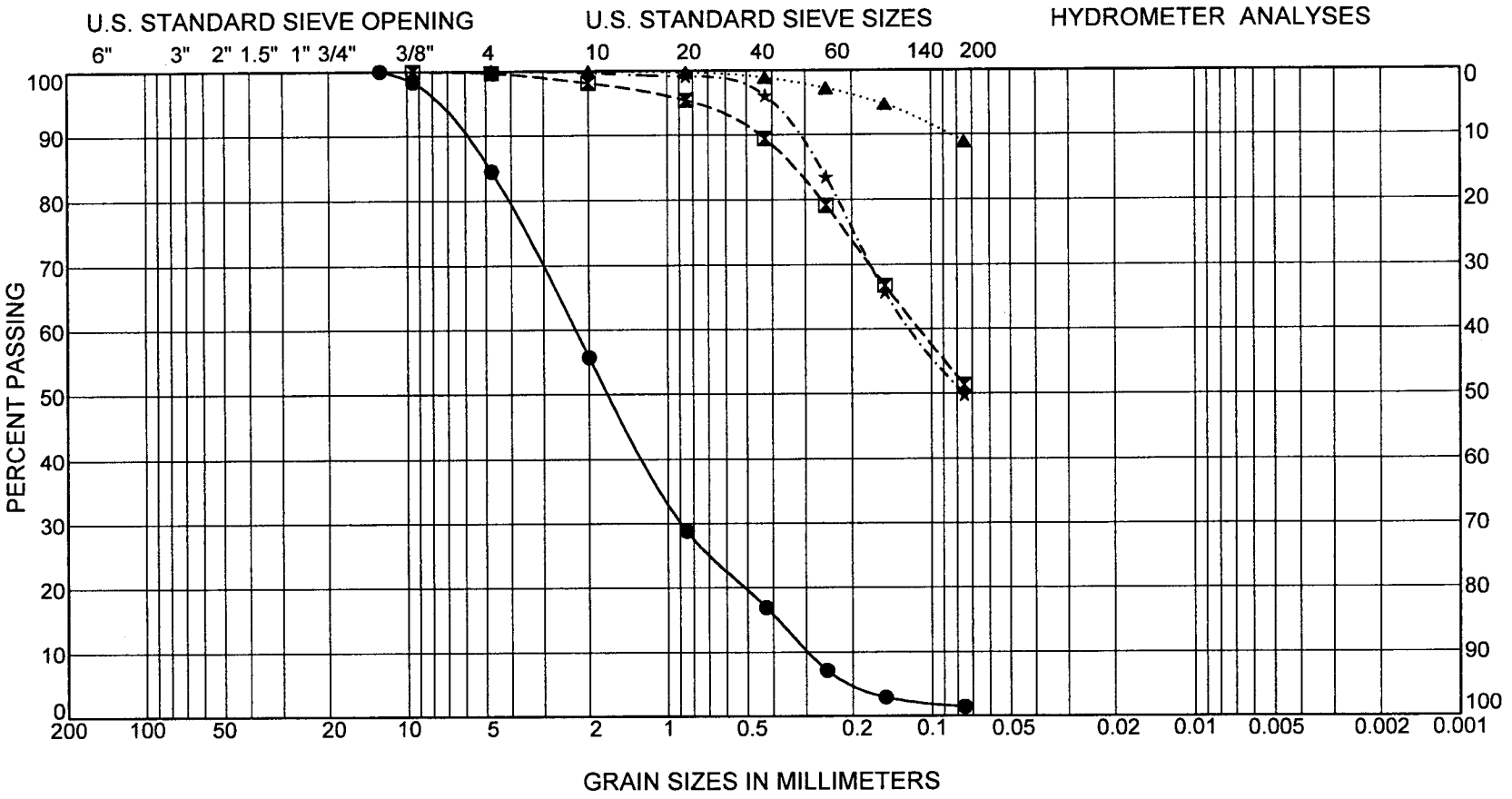


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R/CMS-44	MC-5	19.5	●			SILT WITH SAND (ML)
R/RW-14	MC-3	9.5	⊠			SANDY SILT (ML)
R/RW-17	SPT-5	19.5	▲			POORLY-GRADED SAND (SP)
R/RW-18B	SPT-4	14.5	★			POORLY-GRADED SAND WITH SILT (SP-SM)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R/RW-18B	SPT-6	24.5	●			WELL-GRADED SAND WITH GRAVEL (SW)
R/RW-20A	MC-3	9.5	⊠			SANDY SILT (ML)
R/RW-20B	SPT-2	6.5	▲			LEAN CLAY (CL)
R/RW-26	MC-4	14.5	★			CLAYEY SAND (SC)

JOB NO: 206144.GDR

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE NO: B-3C

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

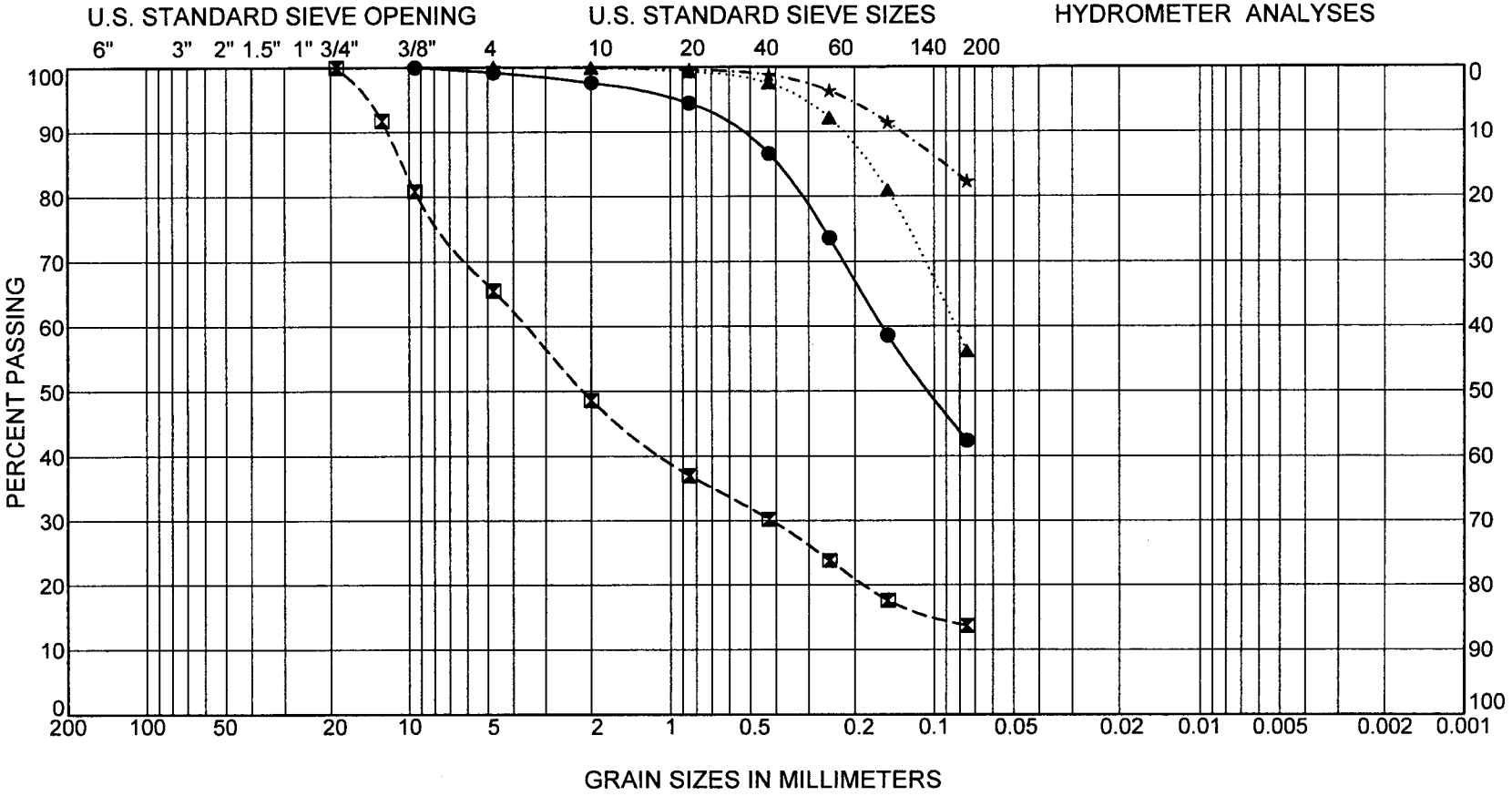
JOB NO: 206144.GDR

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE NO: B-3D

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R/RW-28	MC-3	9.5	●			CLAYEY SAND (SC)
R/RW-34	SPT-6	24.5	⊠			SILTY SAND WITH GRAVEL (SM)
R/RW-41	SPT-6	24.5	▲			SANDY LEAN CLAY (CL)
R/RW-42	MC-2	4.5	★			LEAN CLAY WITH SAND (CL)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

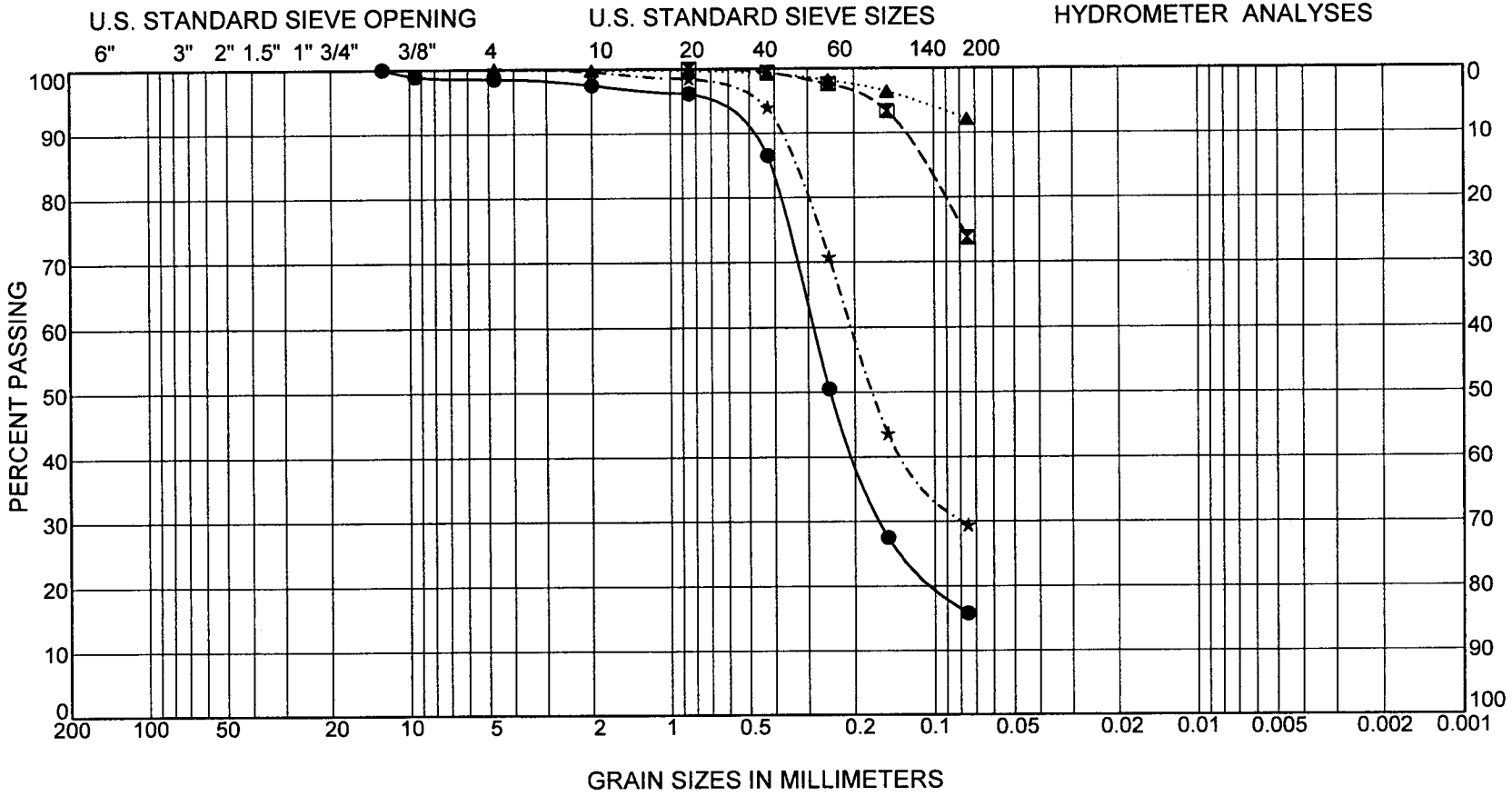
JOB NO: 206144.GDR

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE NO: B-3E

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

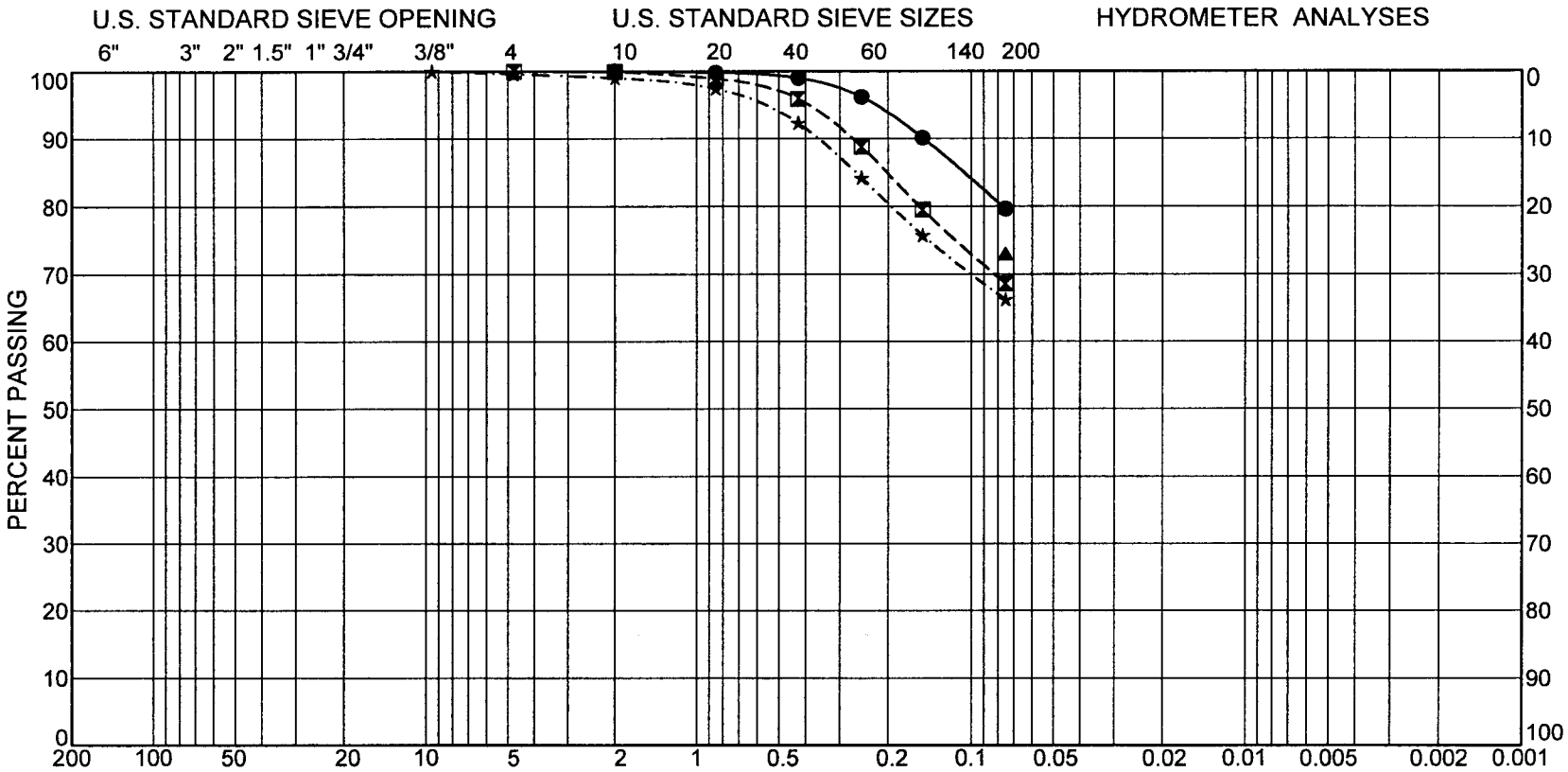


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R/RW-42	MC-4	14.5	●			SILTY SAND (SM)
R/RW-43	MC-5	19.5	⊠	31	9	LEAN CLAY WITH SAND (CL)
R/RW-48	MC-2	4.5	▲	40	21	LEAN CLAY (CL)
R/RW-48	MC-4	14.5	★			SILTY CLAYEY SAND (SC)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R/RW-50	MC-4	14.5	●			SILT WITH SAND (ML)
R-11	MC-2	4.5	⊠	26	9	SANDY LEAN CLAY (CL)
R-11	MC-3	9.5	▲			SANDY SILT (ML)
RB- 6	MC-2	4.5	★			SANDY SILT (ML)

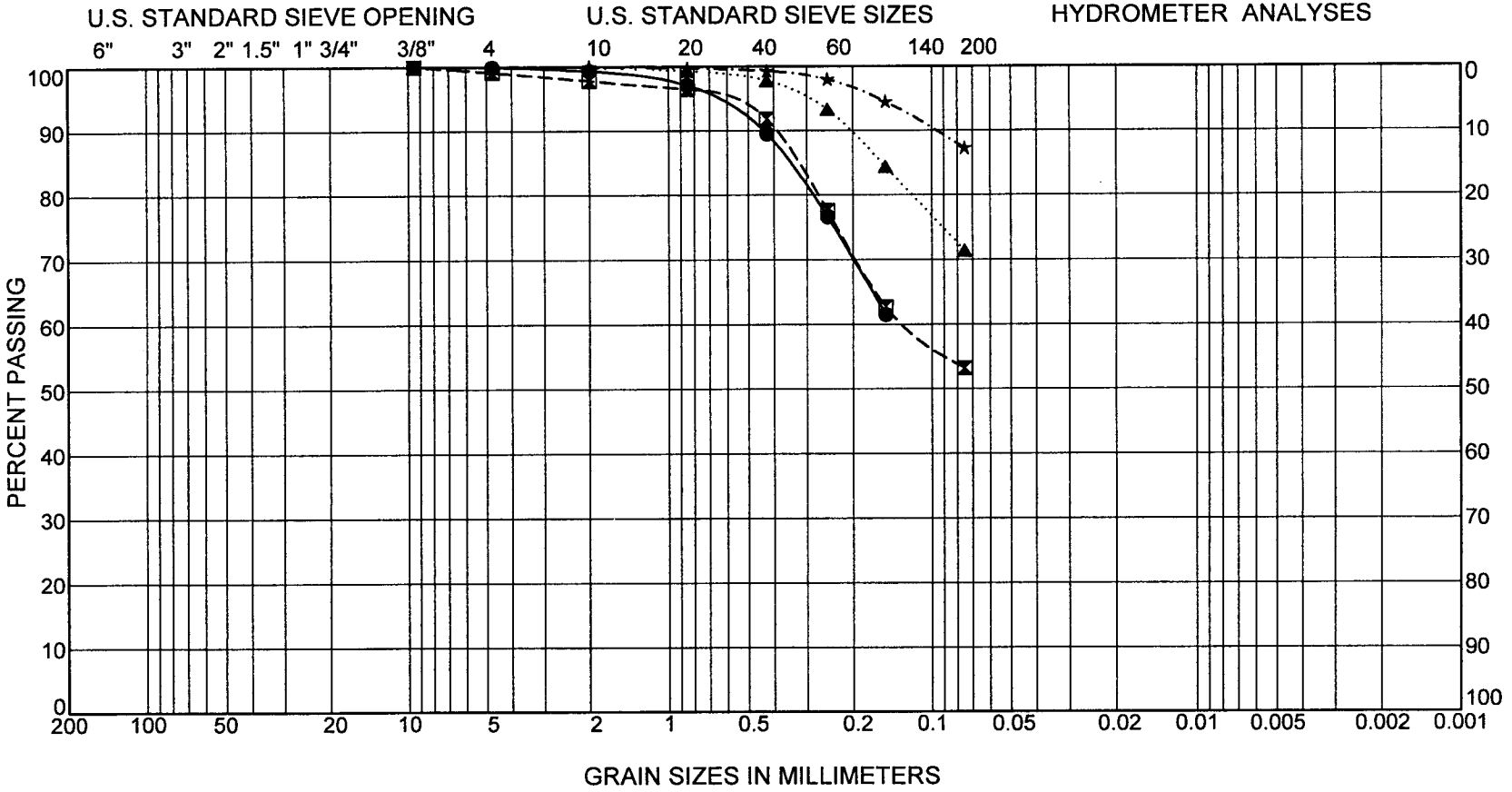
JOB NO: 206144.GDR

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE NO: B-3F

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
RB-30	MC-1	4.5	●			SANDY LEAN CLAY (CL)
RB-31	MC-1	4.5	⊠			SANDY LEAN CLAY (CL)
RB-45	MC-1	4.5	▲			LEAN CLAY WITH SAND (CL)
RB-51	MC-1	4.5	★			LEAN CLAY (CL)

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MATERIALS ENGINEERING

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

JOB NO: 206144.GDR

PLATE NO: B-3G

PARIKH CONSULTANTS, INC.
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MATERIALS ENGINEERING

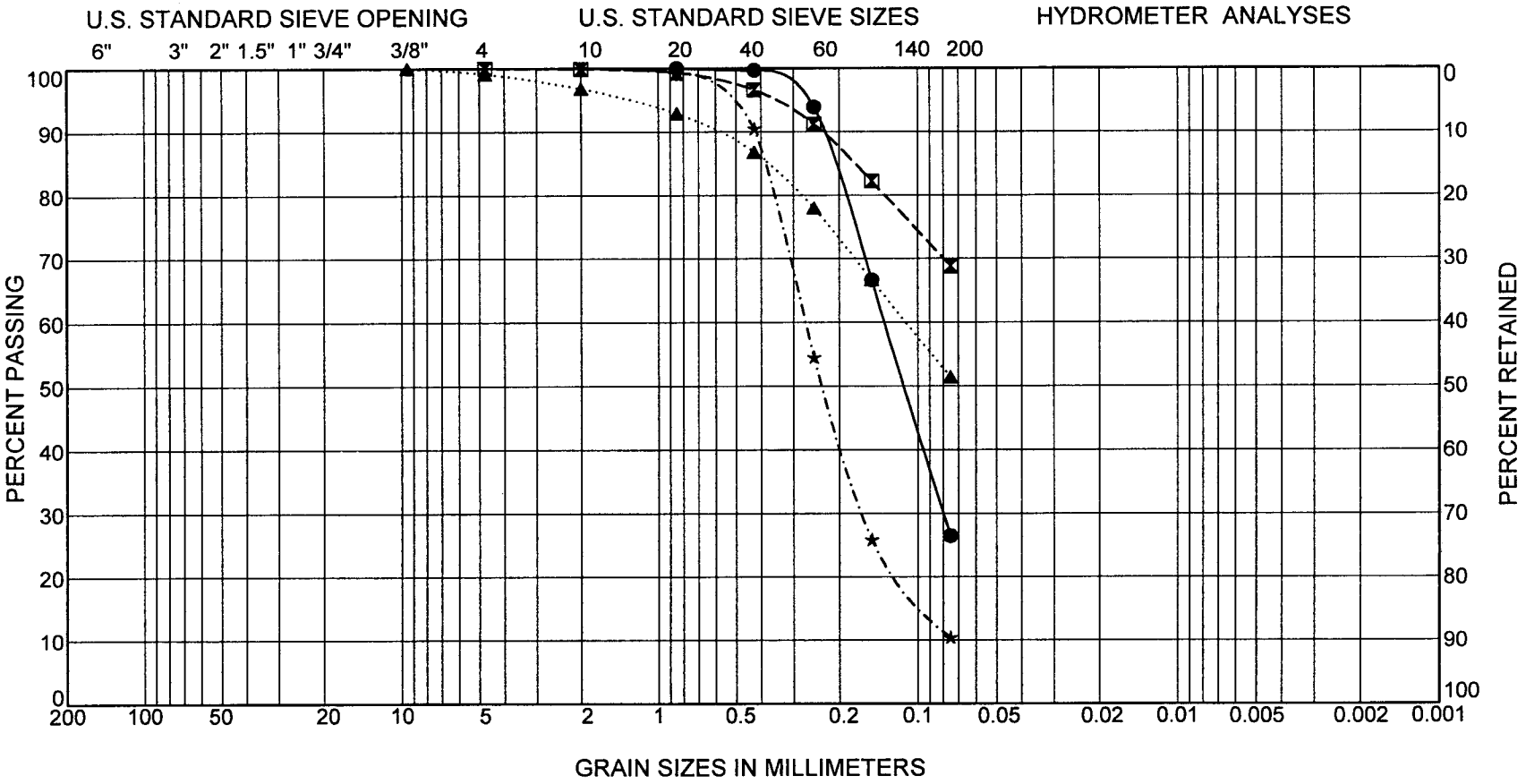
JOB NO: 206144.GDR

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE NO: B-3H

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	

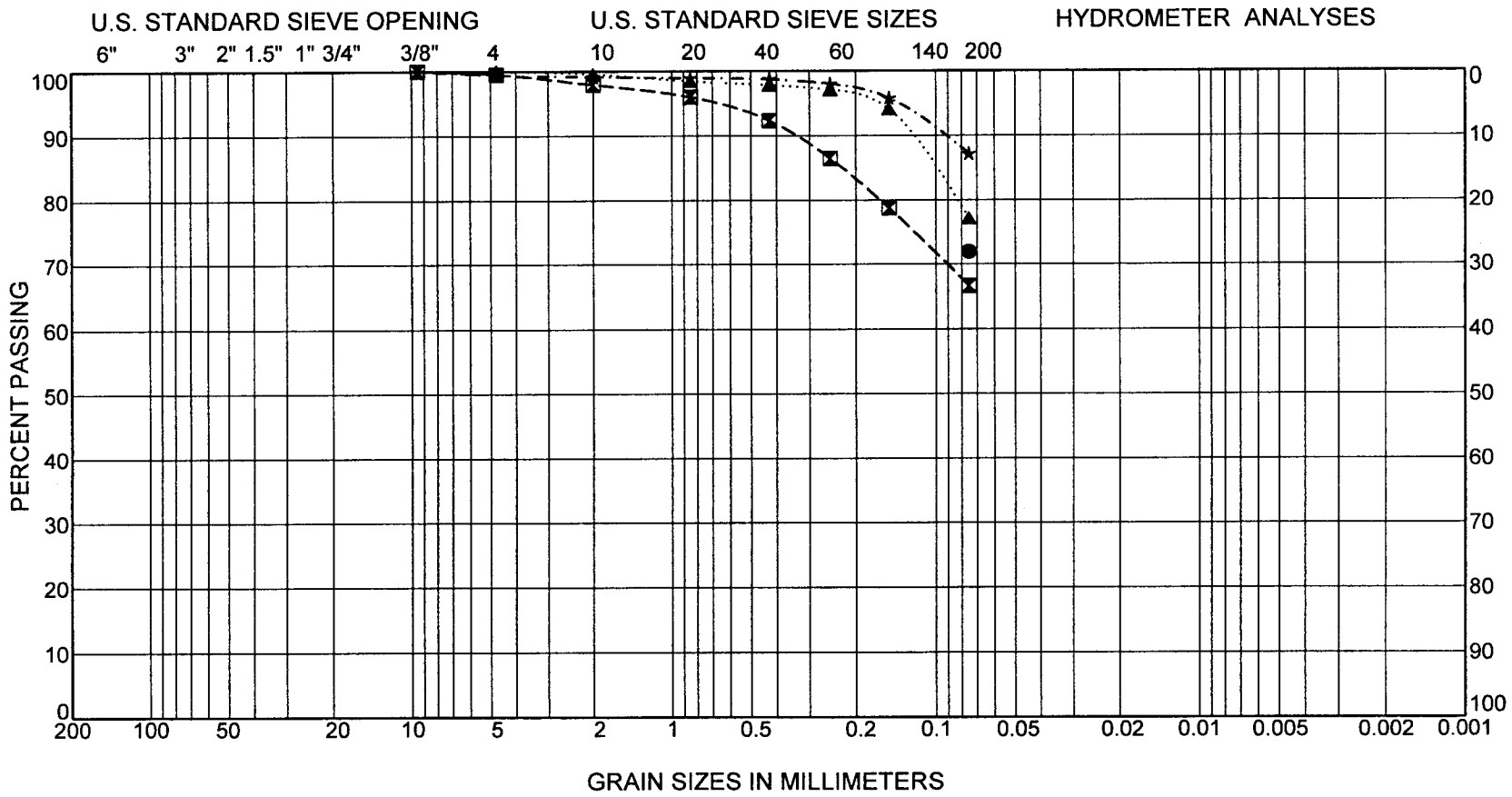


Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
RW-19	MC-6	23.5	●			SILTY SAND (SM)
RW-2	MC-1	4.5	⊠	18	1	SANDY SILT (ML)
RW-25	MC-3	9.5	▲	30	10	SANDY LEAN CLAY (CL)
RW-25	SPT-6	24.5	★			POORLY-GRADED SAND WITH SILT (SP-SM)

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
RW-27	MC-3	9.5	●	32	15	SANDY LEAN CLAY (CL)
RW-35	MC-2	4.5	⊠	34	18	SANDY LEAN CLAY (CL)
RW-47	SPT-5	19.5	▲			LEAN CLAY WITH SAND (CL)
RW-49	MC-2	4.5	★			LEAN CLAY (CL)

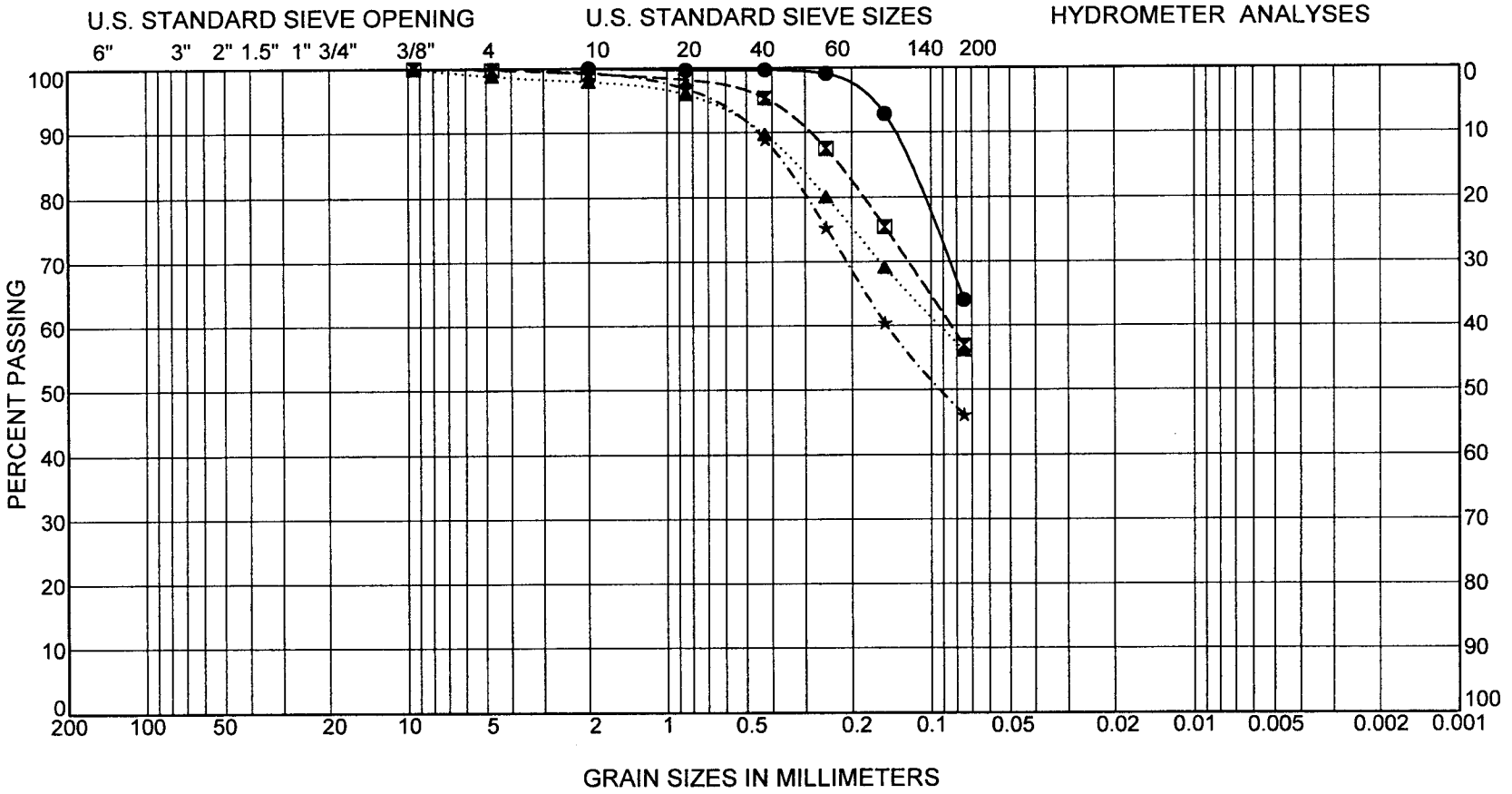
JOB NO: 206144.GDR

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE NO: B-3I

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
RW-49	MC-5	19.5	●			SANDY SILT (ML)
RW-53	MC-7	29.5	⊠			SANDY SILT (ML)
RW-54	MC-7	29.5	▲			SANDY LEAN CLAY (CL)
RW-55	MC-3	9.5	★			SILTY SAND (SM)

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I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

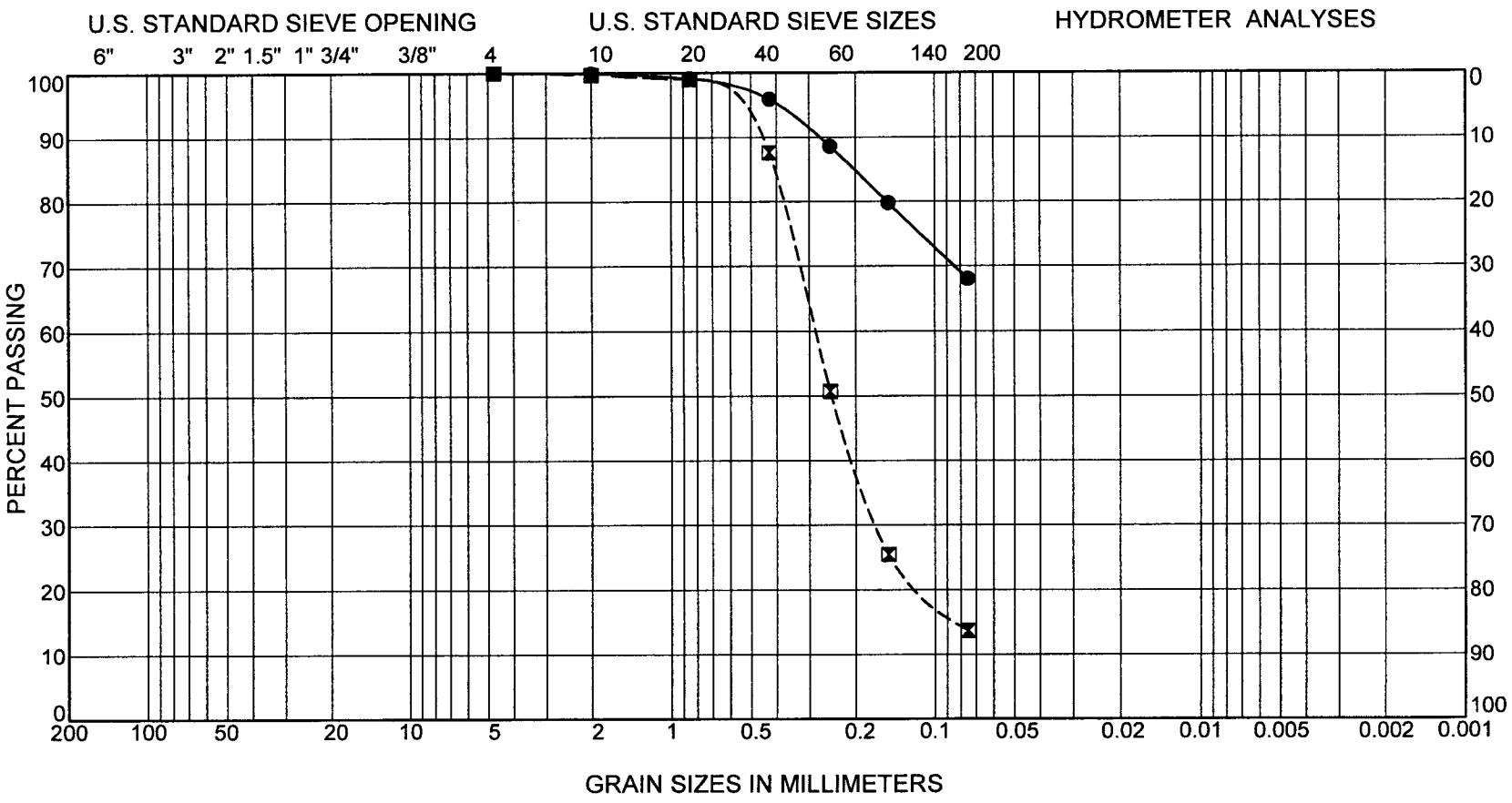
JOB NO: 206144.GDR

PLATE NO: B-3J

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
RW-56	MC-3	9.5	●			SANDY SILT (ML)
RW-56	MC-4	14.5	⊠			SILTY SAND (SM)

JOB NO: 206144.GDR

I-205 AUXILIARY LANES PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

PLATE NO: B-3K

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/12/2008
Date Submitted 11/07/2008

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, CA 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR Site ID : RB 52 #1@4.5".
Thank you for your business.

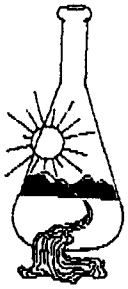
* For future reference to this analysis please use SUN # 54750-109995.

EVALUATION FOR SOIL CORROSION

Soil pH	8.02	
Minimum Resistivity	0.62 ohm-cm (x1000)	
Chloride	16.3 ppm	00.00163 %
Sulfate	27.3 ppm	00.00273 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4A



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/09/2009
Date Submitted 01/06/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR, RTE 205 Site ID : RW47 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 54956-110445.

EVALUATION FOR SOIL CORROSION

Soil pH	6.81	
Minimum Resistivity	1.37 ohm-cm (x1000)	
Chloride	11.6 ppm	00.00116 %
Sulfate	25.5 ppm	00.00255 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4B

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/09/2009
Date Submitted 01/06/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR, RTE 205 Site ID : RWCMS44 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 54956-110447.

EVALUATION FOR SOIL CORROSION

Soil pH	7.50	
Minimum Resistivity	1.45 ohm-cm (x1000)	
Chloride	11.1 ppm	00.00111 %
Sulfate	37.5 ppm	00.00375 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4C

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/09/2009
Date Submitted 01/06/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR, RTE 205 Site ID : RW4R, #2@4.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 54956-110450.

EVALUATION FOR SOIL CORROSION

Soil pH	7.56	
Minimum Resistivity	0.46 ohm-cm (x1000)	
Chloride	130.9 ppm	00.01309 %
Sulfate	254.9 ppm	00.02549 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4D

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/09/2009
Date Submitted 01/06/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR, RTE 205 Site ID : R/RW37 #1@2'.
Thank you for your business.

* For future reference to this analysis please use SUN # 54956-110451.

EVALUATION FOR SOIL CORROSION

Soil pH	7.67	
Minimum Resistivity	1.69 ohm-cm (x1000)	
Chloride	11.1 ppm	00.00111 %
Sulfate	4.3 ppm	00.00043 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4E

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/09/2009
Date Submitted 01/06/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR, RTE 205 Site ID : R/RW28 #2@4.5'.
Thank you for your business.

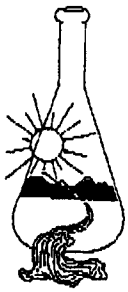
* For future reference to this analysis please use SUN # 54956-110446.

EVALUATION FOR SOIL CORROSION

Soil pH	8.13		
Minimum Resistivity	0.62 ohm-cm (x1000)		
Chloride	189.2 ppm	00.01892	%
Sulfate	88.0 ppm	00.00880	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4F



Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/09/2009
Date Submitted 01/06/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR, RTE 205 Site ID : RW26 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 54956-110453.

EVALUATION FOR SOIL CORROSION

Soil pH	8.35	
Minimum Resistivity	0.99 ohm-cm (x1000)	
Chloride	15.8 ppm	00.00158 %
Sulfate	66.4 ppm	00.00664 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4G

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/09/2009
Date Submitted 01/06/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR, RTE 205 Site ID : RW24 #2@4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 54956-110452.

EVALUATION FOR SOIL CORROSION

Soil pH	7.99	
Minimum Resistivity	0.32 ohm-cm (x1000)	
Chloride	418.6 ppm	00.04186 %
Sulfate	351.7 ppm	00.03517 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4H

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/09/2009
Date Submitted 01/06/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR, RTE 205 Site ID : RW20A #3@9.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 54956-110449.

EVALUATION FOR SOIL CORROSION

Soil pH	7.90		
Minimum Resistivity	0.48 ohm-cm (x1000)		
Chloride	292.2 ppm	00.02922	%
Sulfate	10.1 ppm	00.00101	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4I

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/12/2008
Date Submitted 11/07/2008

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, CA 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR Site ID : RW 17 #3@19.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 54750-109994.

EVALUATION FOR SOIL CORROSION

Soil pH	7.99	
Minimum Resistivity	0.67 ohm-cm (x1000)	
Chloride	35.5 ppm	00.00355 %
Sulfate	38.7 ppm	00.00387 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4J

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/09/2009
Date Submitted 01/06/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR, RTE 205 Site ID : CMS12 #1@2'.
Thank you for your business.

* For future reference to this analysis please use SUN # 54956-110448.

EVALUATION FOR SOIL CORROSION

Soil pH	6.88	
Minimum Resistivity	2.60 ohm-cm (x1000)	
Chloride	6.3 ppm	00.00063 %
Sulfate	1.8 ppm	00.00018 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4K

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/25/2009
Date Submitted 02/19/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR/I-205 Site ID : RW-53#2 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55148-110818.

EVALUATION FOR SOIL CORROSION

Soil pH	7.12	
Minimum Resistivity	1.29 ohm-cm (x1000)	
Chloride	11.9 ppm	00.00119 %
Sulfate	30.0 ppm	00.00300 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4L

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/25/2009
Date Submitted 02/19/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR/I-205 Site ID : RW-55#2 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55148-110817.

EVALUATION FOR SOIL CORROSION

Soil pH	7.11	
Minimum Resistivity	1.18 ohm-cm (x1000)	
Chloride	13.0 ppm	00.00130 %
Sulfate	37.2 ppm	00.00372 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4M

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/25/2009
Date Submitted 02/19/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR/I-205 Site ID : CMS-57#1 @ 3.0'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55148-110820.

EVALUATION FOR SOIL CORROSION

Soil pH	8.16		
Minimum Resistivity	0.94 ohm-cm (x1000)		
Chloride	9.5 ppm	00.00095	%
Sulfate	70.5 ppm	00.00705	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4O

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/25/2009
Date Submitted 02/19/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR/I-205 Site ID : P-58#2 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55148-110821.

EVALUATION FOR SOIL CORROSION

Soil pH	7.72	
Minimum Resistivity	1.55 ohm-cm (x1000)	
Chloride	20.7 ppm	00.00207 %
Sulfate	18.5 ppm	00.00185 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4P

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 02/25/2009
Date Submitted 02/19/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206144.GDR/I-205 Site ID : P-59#2 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 55148-110819.

EVALUATION FOR SOIL CORROSION

Soil pH	7.52		
Minimum Resistivity	1.88 ohm-cm (x1000)		
Chloride	6.6 ppm	00.00066	%
Sulfate	33.4 ppm	00.00334	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO.: B-4Q

R-value Test Report (Caltrans 301)

Job No.:	157-266	**Date:**	12/01/08	**Initial Moisture,**	14.4%
Client:	Parikh Consultants	**Tested**	MD	**R-value by Stabilometer**	<5
Project:	Rte 205 - 206144.GDR	**Reduced**	RU		
Sample	R-4	**Checked**	DC	**Expansion Pressure**	psf
Soil Type:	Brown CLAY				

Specimen Number	A	B	C	D
Exudation Pressure, psi	547			
Prepared Weight, grams	1200			
Final Water Added, grams/cc	93			
Weight of Soil & Mold, grams	3071			
Weight of Mold, grams	2101			
Height After Compaction, in.	2.36			
Moisture Content, %	23.3			
Dry Density, pcf	100.9			
Expansion Pressure, psf	81.7			
Stabilometer @ 1000				
Stabilometer @ 2000	130			
Turns Displacement	3.2			
R-value	14			

Remarks:

Soil extruded from the mold giving a false exudation pressure. Per Caltrans, the R-Value test was terminated and an R-Value of less than 5 was reported.

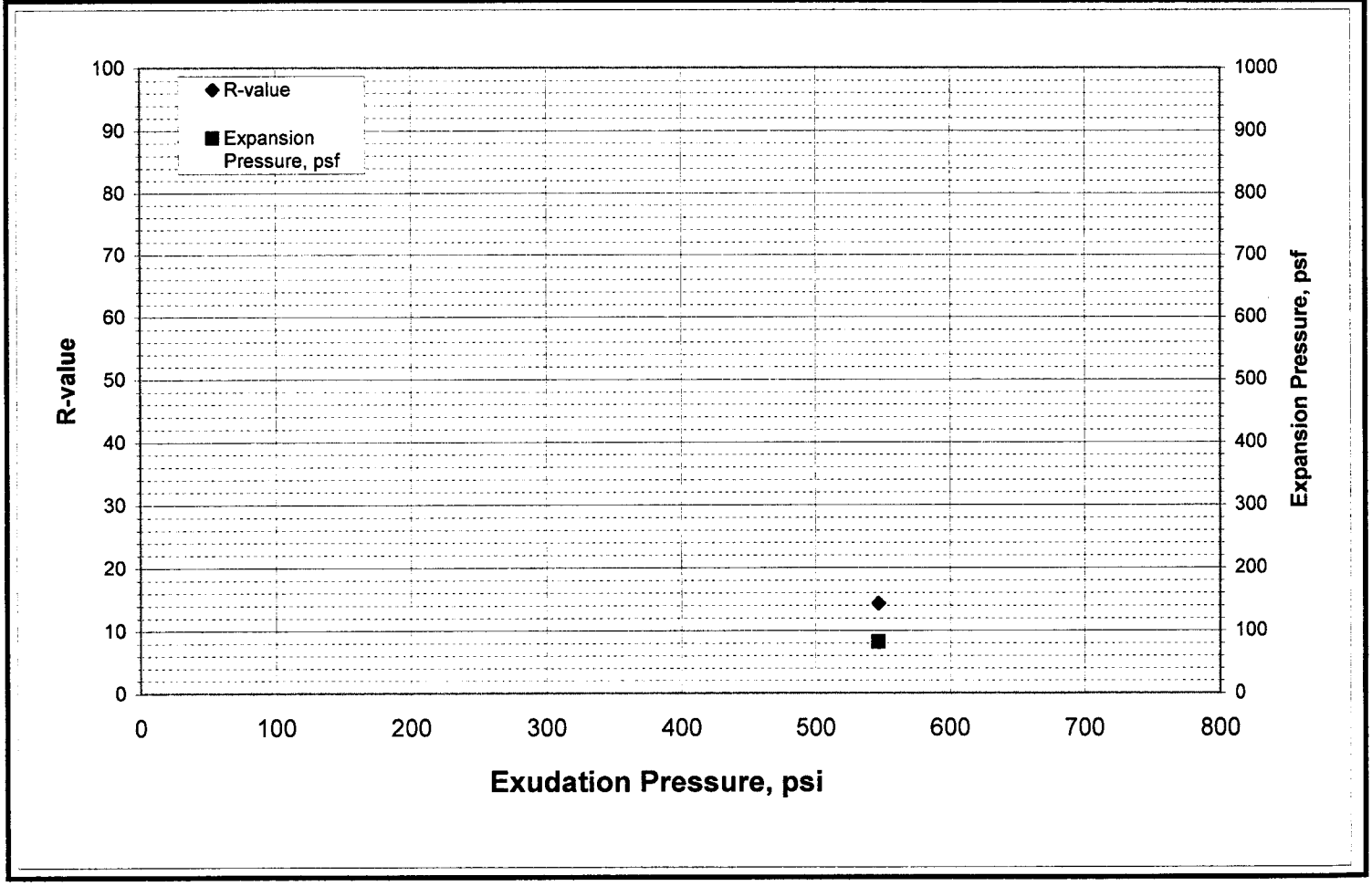


PLATE NO.: B-5A

R-value Test Report (Caltrans 301)

Job No.:	157-266	**Date:**	12/01/08	**Initial Moisture,**	14.4%
Client:	Parikh Consultants	**Tested**	MD	**R-value by Stabilometer**	<5
Project:	Rte 205 - 206144.GDR	**Reduced**	RU		
Sample	RB-8	**Checked**	DC	**Expansion Pressure**	psf
Soil Type:	Brown Sandy CLAY				

Specimen Number	A	B	C	D
Exudation Pressure, psi	663			
Prepared Weight, grams	1200			
Final Water Added, grams/cc	93			
Weight of Soil & Mold, grams	3078			
Weight of Mold, grams	2104			
Height After Compaction, in.	2.41			
Moisture Content, %	23.3			
Dry Density, pcf	99.3			
Expansion Pressure, psf	172.0			
Stabilometer @ 1000				
Stabilometer @ 2000	130			
Turns Displacement	3.4			
R-value	14			

Remarks:

Soil extruded from the mold giving a false exudation pressure. Per Caltrans, the R-Value test was terminated and an R-Value of less than 5 was reported.

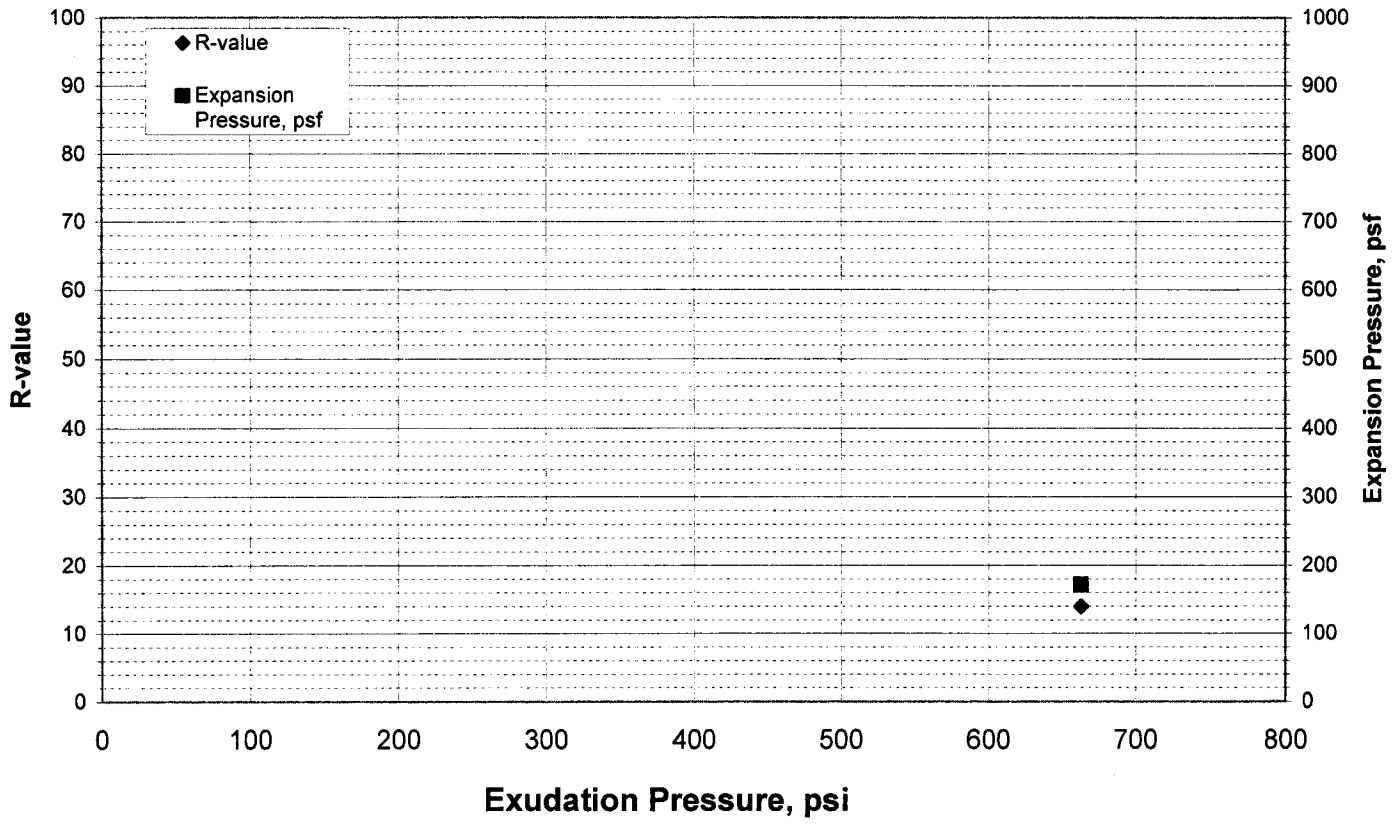


PLATE NO.: B-5B

R-value Test Report (Caltrans 301)

Job No.:	157-266	**Date:**	12/01/08	**Initial Moisture,**	10.6%
Client:	Parikh Consultants	**Tested**	MD	**R-value by Stabilometer**	4
Project:	Rte 205 - 206144.GDR	**Reduced**	RU		
Sample	RB-21	**Checked**	DC	**Expansion Pressure**	115 psf
Soil Type:	Brown Sandy CLAY				

Specimen Number	A	B	C	D
Exudation Pressure, psi	471	157	273	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	93	132	115	
Weight of Soil & Mold, grams	3158	3107	3170	
Weight of Mold, grams	2109	2089	2099	
Height After Compaction, in.	2.55	2.54	2.59	
Moisture Content, %	19.2	22.8	21.2	
Dry Density, pcf	104.5	98.8	103.3	
Expansion Pressure, psf	129.0	77.4	107.5	
Stabilometer @ 1000				
Stabilometer @ 2000	136	152	149	
Turns Displacement	4	4.7	4.44	
R-value	10	3	4	

Remarks:

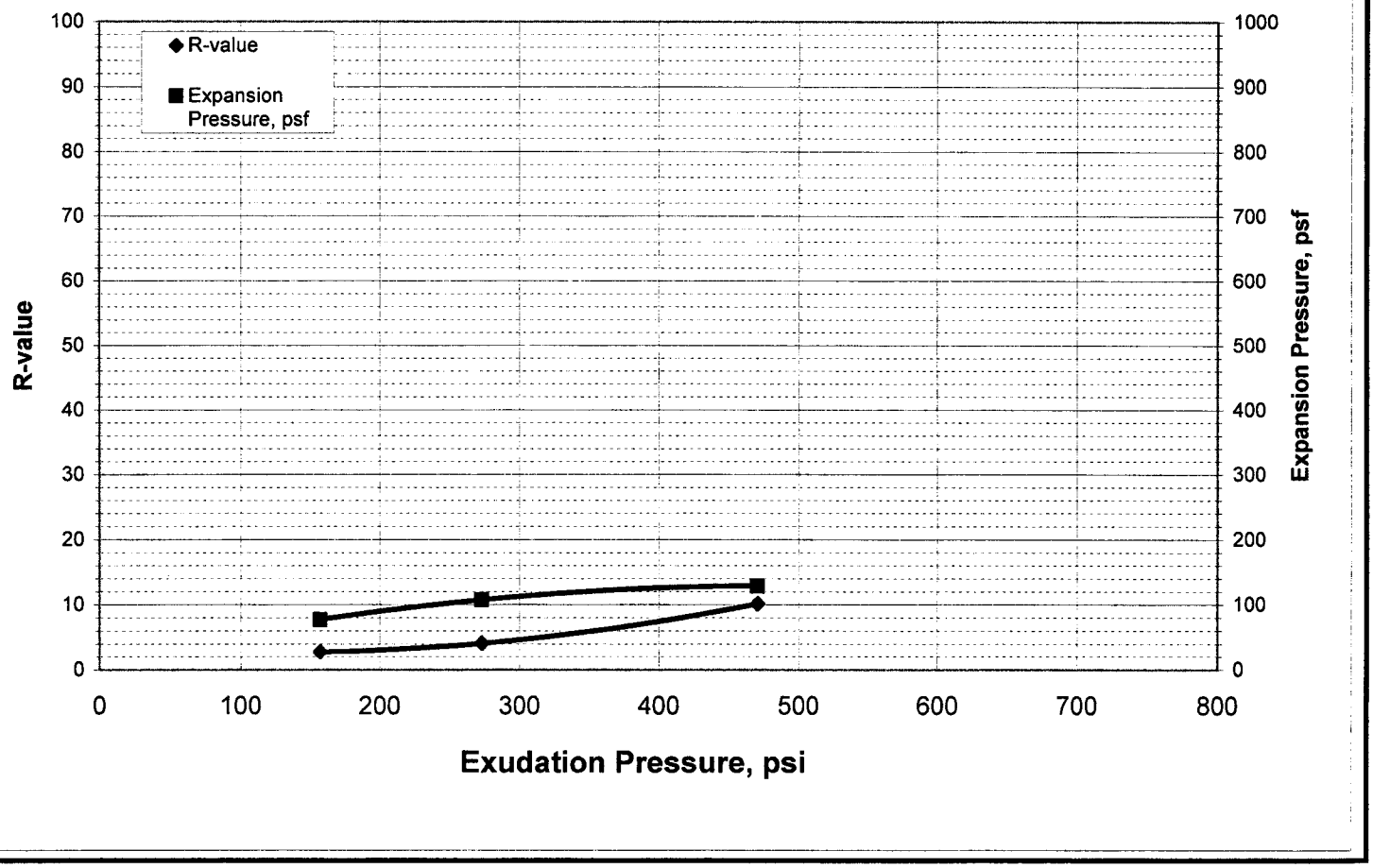


PLATE NO.: B-5C

R-value Test Report (Caltrans 301)

Job No.:	157-266	**Date:**	12/01/08	**Initial Moisture,**	7.6%
Client:	Parikh Consultants	**Tested**	MD	**R-value by Stabilometer**	12
Project:	Rte 205 - 206144.GDR	**Reduced**	RU		
Sample	R1RW-26	**Checked**	DC	**Expansion Pressure**	0 psf
Soil Type:	Brown Clayey SAND				

Specimen Number	A	B	C	D
Exudation Pressure, psi	173	490	318	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	103	32	55	
Weight of Soil & Mold, grams	3175	3262	3192	
Weight of Mold, grams	2079	2107	2081	
Height After Compaction, in.	2.55	2.52	2.5	
Moisture Content, %	16.8	10.5	12.5	
Dry Density, pcf	111.4	125.6	119.6	
Expansion Pressure, psf	0.0	0.0	0.0	
Stabilometer @ 1000				
Stabilometer @ 2000	152	110	132	
Turns Displacement	4.94	3.47	3.56	
R-value	3	25	13	

Remarks:

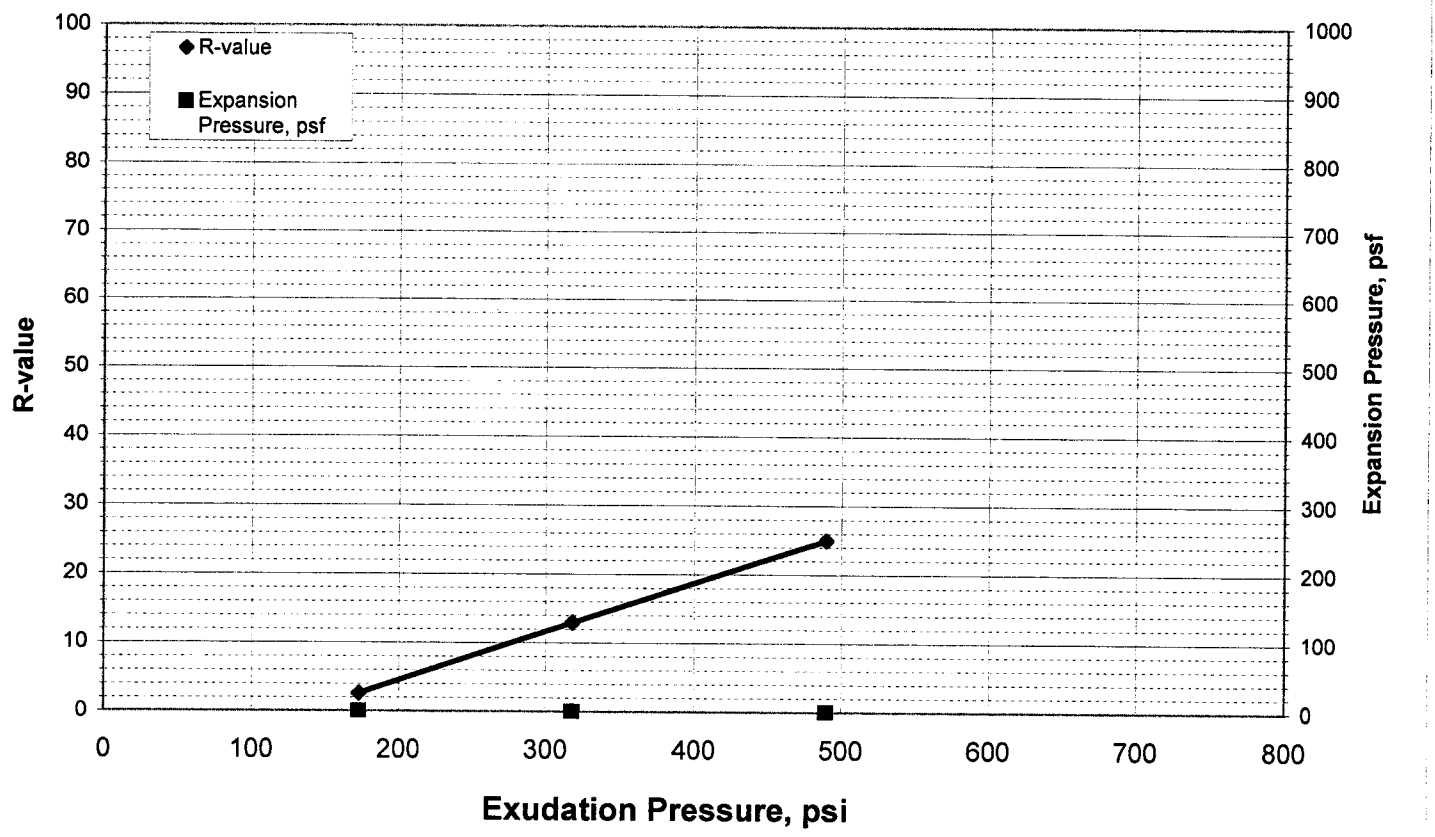


PLATE NO.: B-5D

R-value Test Report (Caltrans 301)

Job No.:	157-266	**Date:**	12/01/08	**Initial Moisture,**	11.2%
Client:	Parikh Consultants	**Tested**	MD	**R-value by Stabilometer**	<5
Project:	Rte 205 - 206144.GDR	**Reduced**	RU		
Sample	RB-52	**Checked**	DC	**Expansion Pressure**	psf
Soil Type:	Brown Sandy CLAY, trace Gravel				

Specimen Number	A	B	C	D
Exudation Pressure, psi	350	302	177	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	84	103	124	
Weight of Soil & Mold, grams	3192	3053	3033	
Weight of Mold, grams	2107	2106	2091	
Height After Compaction, in.	2.56	2.3	2.34	
Moisture Content, %	19.0	20.8	22.7	
Dry Density, pcf	107.8	103.2	99.3	
Expansion Pressure, psf	0.0	0.0	0.0	
Stabilometer @ 1000				
Stabilometer @ 2000	140	148	156	
Turns Displacement	3.55	3.95	4.3	
R-value	9	5	1	

Remarks:

Soil extruded from the mold giving a false exudation pressure (exudation pressure for Specimen C is greater than the reported value). Per Caltrans, the R-Value test was terminated and an R-Value of less than 5 was reported.

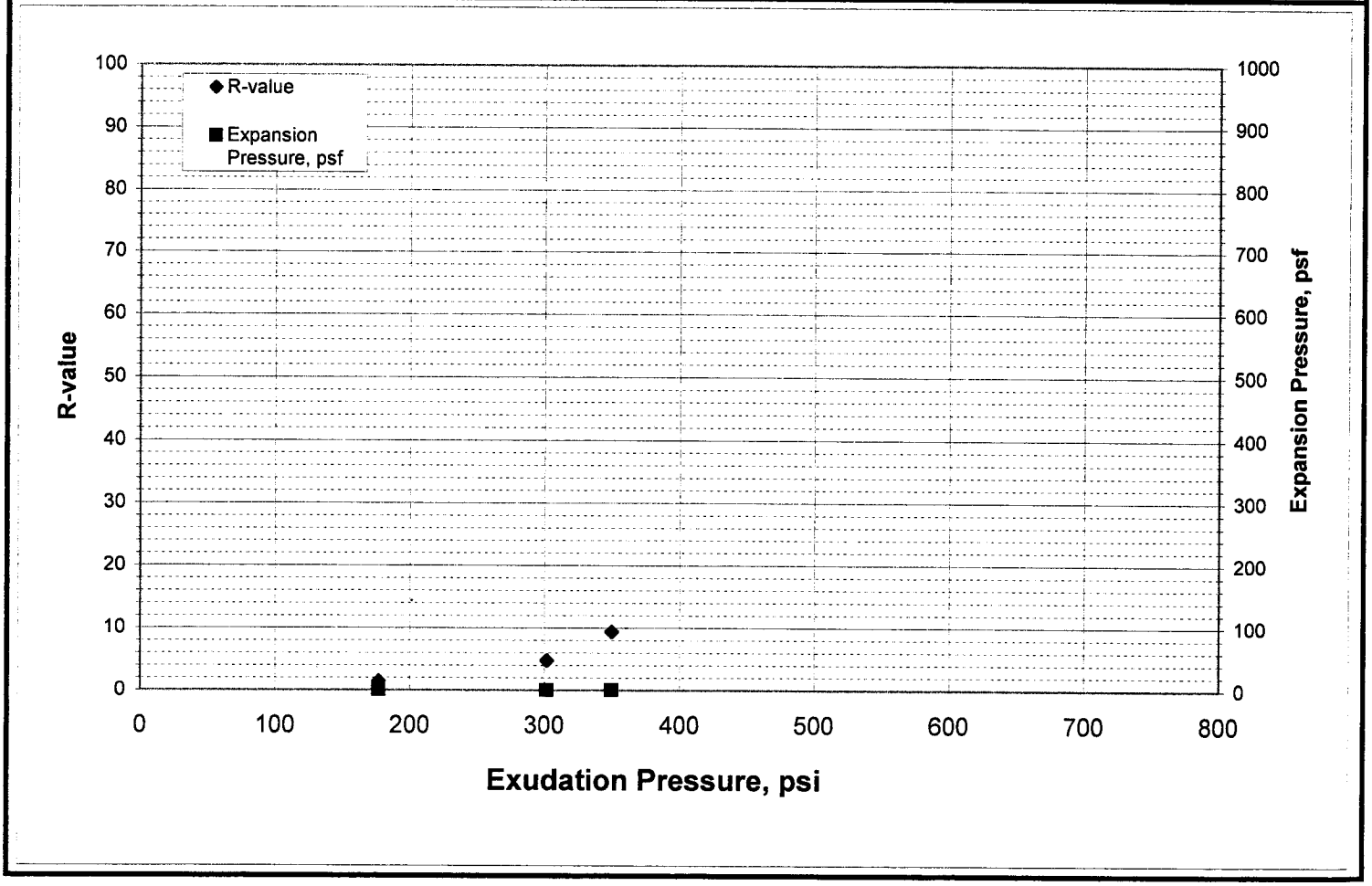


PLATE NO.: B-5E

APPENDIX C

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE-205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....CMS-12,2 FT

TEST SAMPLE NO.....1

OPERATOR.....OKSAN

TEST DATE.....01/09/2009

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 6.9 , WATER pH = 0.0 , SOIL pH = 6.9

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 2600 , WATER = 0 , SOIL = 2600

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK		GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
Gage	& in					
18	0.052	21	29	36	46	71
16	0.064	27	35	42	52	77
14	0.079	34	42	49	59	84
12	0.109	46	54	61	71	96
10	0.138	59	67	74	84	109
08	0.168	72	80	87	97	122

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
MAXIMUM W/C RATIO OF 0.45

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RW-17, 19.5 FT

TEST SAMPLE NO.....3

OPERATOR.....OKS

TEST DATE.....11/12/2009

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 8.0 , WATER pH = 0.0 , SOIL pH = 8.0

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 670 , WATER = 0 , SOIL = 670

CHLORIDES, PPM... 35.5 , SULFATES, PPM... 38.7

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	21	29	36	46	71
16 0.064	27	35	42	52	77
14 0.079	33	41	48	58	83
12 0.109	46	54	61	71	96
10 0.138	59	67	74	84	109
08 0.168	72	80	87	97	122

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RW-20A, 9.5 FT

TEST SAMPLE NO.....3

OPERATOR.....OKS

TEST DATE.....01/09/2009

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.9 , WATER pH = 0.0 , SOIL pH = 7.9

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 480 , WATER = 0 , SOIL = 480

CHLORIDES, PPM... 292.2 , SULFATES, PPM... 10.1

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	18	26	33	43	68
16 0.064	24	32	39	49	74
14 0.079	29	37	44	54	79
12 0.109	40	48	55	65	90
10 0.138	51	59	66	76	101
08 0.168	62	70	77	87	112

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RW-24, 4.5 FT

TEST SAMPLE NO.....2

OPERATOR.....OKS

TEST DATE.....01/09/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 8.0 , WATER pH = 0.0 , SOIL pH = 8.0

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 320 , WATER = 0 , SOIL = 320

CHLORIDES, PPM... 418.6 , SULFATES, PPM... 351.7

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	15	23	30	40	65
16 0.064	20	28	35	45	70
14 0.079	25	33	40	50	75
12 0.109	34	42	49	59	84
10 0.138	43	51	58	68	93
08 0.168	53	61	68	78	103

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RW-26, 4.5 FT

TEST SAMPLE NO.....2
OPERATOR.....OKS

TEST DATE.....01/09/09
********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********
CSP SITE pH = 8.4 , WATER pH = 0.0 , SOIL pH = 8.4
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 990 , WATER = 0 , SOIL = 990
CHLORIDES, PPM... 15.8 , SULFATES, PPM... 66.4
****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage	& in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	0.052	24	32	39	49	74
16	0.064	32	40	47	57	82
14	0.079	39	47	54	64	89
12	0.109	54	62	69	79	104
10	0.138	69	77	84	94	119
08	0.168	84	92	99	109	134

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....R/RW-28, 4.5 FT

TEST SAMPLE NO.....#2
OPERATOR.....OKS

TEST DATE.....01/09/09
********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********
CSP SITE pH = 8.1 , WATER pH = 0.0 , SOIL pH = 8.1
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 620 , WATER = 0 , SOIL = 620
CHLORIDES, PPM... 189.2 , SULFATES, PPM... 88
****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK		GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
Gage	& in					
18	0.052	20	28	35	45	70
16	0.064	26	34	41	51	76
14	0.079	32	40	47	57	82
12	0.109	45	53	60	70	95
10	0.138	57	65	72	82	107
08	0.168	69	77	84	94	119

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....R/RW-37, 2 FT

TEST SAMPLE NO.....#1
OPERATOR.....OKS

TEST DATE.....01/09/09
********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********
CSP SITE pH = 7.7 , WATER pH = 0.0 , SOIL pH = 7.7
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1690 , WATER = 0 , SOIL = 1690

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	30	38	45	55	80
16 0.064	40	48	55	65	90
14 0.079	49	57	64	74	99
12 0.109	68	76	83	93	118
10 0.138	86	94	101	111	136
08 0.168	105	113	120	130	155

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RW-42, 4.5 FT

TEST SAMPLE NO.....#2
OPERATOR.....OKS

TEST DATE.....01/09/09
********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********
CSP SITE pH = 7.6 , WATER pH = 0.0 , SOIL pH = 7.6
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 460 , WATER = 0 , SOIL = 460
CHLORIDES, PPM... 130.9 , SULFATES, PPM... 254.9

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	18	26	33	43	68
16 0.064	23	31	38	48	73
14 0.079	29	37	44	54	79
12 0.109	39	47	54	64	89
10 0.138	50	58	65	75	100
08 0.168	61	69	76	86	111

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RWCMS-44, 4.5 FT

TEST SAMPLE NO.....2

OPERATOR.....OKS

TEST DATE.....01/09/09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.5 , WATER pH = 0.0 , SOIL pH = 7.5

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1450 , WATER = 0 , SOIL = 1450

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage	& mm	GALV. 57 g	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	1.3	29	37	44	54	79
16	1.6	37	45	52	62	87
14	2.0	46	54	61	71	96
12	2.8	63	71	78	88	113
10	3.5	81	89	96	106	131
8	4.3	98	106	113	123	148

FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RW-47, 4.5 FT

TEST SAMPLE NO.....#2
OPERATOR.....OKS

TEST DATE.....01/09/09
********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********
CSP SITE pH = 6.8 , WATER pH = 0.0 , SOIL pH = 6.8
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1370 , WATER = 0 , SOIL = 1370

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK		GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
Gage	& in					
18	0.052	16	24	31	41	66
16	0.064	21	29	36	46	71
14	0.079	26	34	41	51	76
12	0.109	36	44	51	61	86
10	0.138	46	54	61	71	96
08	0.168	56	64	71	81	106

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
MAXIMUM W/C RATIO OF 0.45

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...RTE 205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RB-52, 4.5 FT

TEST SAMPLE NO.....#1
OPERATOR.....OKS

TEST DATE.....11/12/2008
********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********
CSP SITE pH = 8.0 , WATER pH = 0.0 , SOIL pH = 8.0
MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 620 , WATER = 0 , SOIL = 620
CHLORIDES, PPM... 16.3 , SULFATES, PPM... 27.3
****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	20	28	35	45	70
16 0.064	26	34	41	51	76
14 0.079	32	40	47	57	82
12 0.109	45	53	60	70	95
10 0.138	57	65	72	82	107
08 0.168	69	77	84	94	119

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

RW-53-2

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...I-205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RW-53

TEST SAMPLE NO.....NO. 2

OPERATOR.....FYW

TEST DATE.....04-08-09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.1 , WATER pH = 0.0 , SOIL pH = 7.1

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1290 , WATER = 0 , SOIL = 1290

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage	& in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	0.052	21	29	36	46	71
16	0.064	27	35	42	52	77
14	0.079	33	41	48	58	83
12	0.109	46	54	61	71	96
10	0.138	59	67	74	84	109
08	0.168	72	80	87	97	122

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...I-205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....RW-55

TEST SAMPLE NO.....NO. 2

OPERATOR.....FYW

TEST DATE.....04-08-09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.1 , WATER pH = 0.0 , SOIL pH = 7.1

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1180 , WATER = 0 , SOIL = 1180

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in		GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	0.052	20	28	35	45	70
16	0.064	26	34	41	51	76
14	0.079	32	40	47	57	82
12	0.109	44	52	59	69	94
10	0.138	57	65	72	82	107
08	0.168	69	77	84	94	119

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

CMS-57-2

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...I-205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....CMS-57

TEST SAMPLE NO.....NO. 1

OPERATOR.....FYW

TEST DATE.....04-08-09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 8.2 , WATER pH = 0.0 , SOIL pH = 8.2

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 940 , WATER = 0 , SOIL = 940

CHLORIDES, PPM... 9.5 , SULFATES, PPM... 70.5

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	24	32	39	49	74
16 0.064	31	39	46	56	81
14 0.079	38	46	53	63	88
12 0.109	53	61	68	78	103
10 0.138	68	76	83	93	118
08 0.168	82	90	97	107	132

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

FOR SULFATE RESISTANT CONCRETE AND RCP
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
DUE TO CORROSIVE CONDITIONS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...I-205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....P-58

TEST SAMPLE NO.....NO. 2

OPERATOR.....FYW

TEST DATE.....04-08-09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.7 , WATER pH = 0.0 , SOIL pH = 7.7

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1550 , WATER = 0 , SOIL = 1550

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	29	37	44	54	79
16 0.064	38	46	53	63	88
14 0.079	47	55	62	72	97
12 0.109	65	73	80	90	115
10 0.138	83	91	98	108	133
08 0.168	101	109	116	126	151

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...I-205

PROJECT ACCOUNT NO.206144.GDR

SAMPLE LOCATION....P-59

TEST SAMPLE NO.....NO. 2

OPERATOR.....FYW

TEST DATE.....04-08-09

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.5 , WATER pH = 0.0 , SOIL pH = 7.5

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1880 , WATER = 0 , SOIL = 1880

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage & in	GALV. 2 oz	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18 0.052	32	40	47	57	82
16 0.064	42	50	57	67	92
14 0.079	51	59	66	76	101
12 0.109	71	79	86	96	121
10 0.138	90	98	105	115	140
08 0.168	109	117	124	134	159

FLOW VEL. <5 fps WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (0.052 in) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

PAVEMENT DESIGN

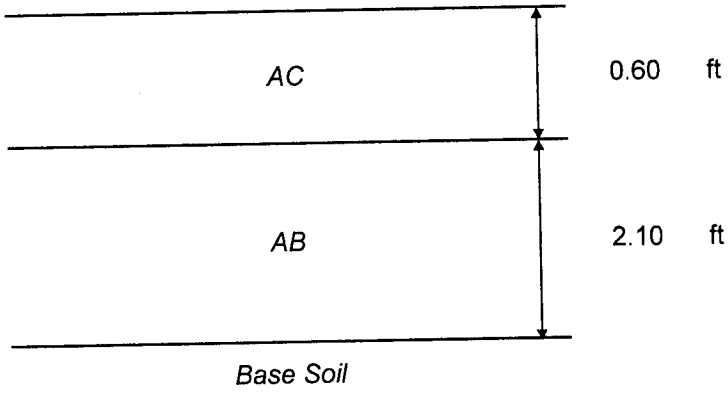
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-205 AUX. LANE PROJECT*
PROJECT NO.: *206144.GDR*

Design Case: AC over AB

Design TI=	***11***		
R_{BS}=	***5***		
R_{AB}=	78		
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS})$ =		3.34	
$GE_{AC} = 0.0032*TI*(100-R_{AB})$ =		0.77	
=>	GE'_{AC} =	0.97	(add 0.2 ft safety factor)
	AC Thickness =	0.56	ft
=>	AC Thickness =	**0.60**	ft (round up to the nearest 0.05 ft)
	$G_{f,AC}$ =	1.78	
	GE_{AC} =	1.07	
$GE_{AB} = GE_{AC+AB} - GE_{AC}$ =		2.28	
	AB thickness=	2.07	ft
=>	AB Thickness=	**2.10**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	2.31	$G_{f,AB}$=1.1

Design Section:



PAVEMENT DESIGN

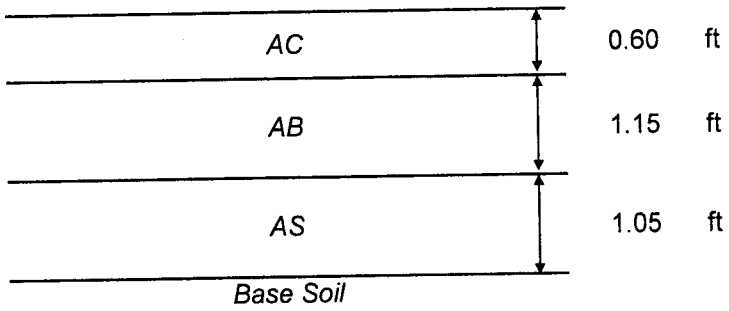
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-205 AUX. LANE PROJECT*
PROJECT NO.: *206144.GDR*

Design Case: AC over AB over AS

Design TI=	***11***		
R_{BS}=	***5***		
R_{AB}=	78		
R_{AS}=	40		
$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$		3.34	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.77	
=>	GE'_{AC}=	0.97	(add 0.2 ft safety factor)
	AC thickness =	0.56	ft
=>	AC Thickness=	**0.60**	ft (round up to the nearest 0.05 ft)
	$G_{f, AC}$=	1.78	
	GE_{AC}=	1.07	
$GE_{AB+AC} = 0.0032*TI*(100-R_{AS}) =$		2.11	
=>	GE_{AC+AB}=	2.31	(add 0.2 ft safety factor)
$GE_{AB} = GE_{AC+AB}-GE_{AC} =$		1.24	
=>	AB thickness=	1.13	
=>	AB Thickness=	**1.15**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.27	$G_{f, AB}$=1.1
$GE_{AS} = GE_{TOTAL}-GE_{AB}-GE_{AC} =$		1.01	
=>	AS Thickness=	**1.05**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

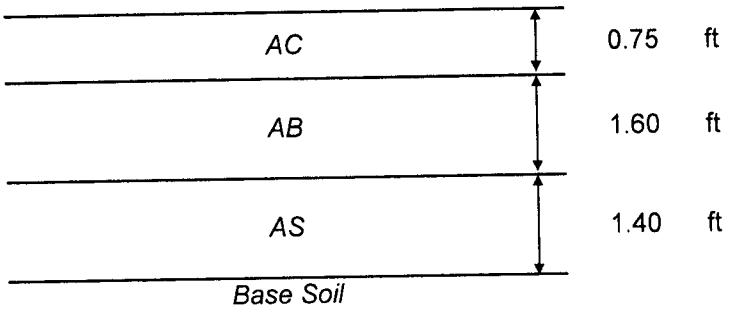
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-205 AUX. LANE PROJECT*
PROJECT NO.: *206144.GDR*

Design Case: AC over AB over AS

Design TI=	***14.5***		
R_{BS}=	***5***		
R_{AB}=	78		
R_{AS}=	40		
$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$		4.41	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		1.02	
=>	GE'_{AC}=	1.22	(add 0.2 ft safety factor)
	AC thickness =	0.74	ft
=>	AC Thickness=	**0.75**	ft (round up to the nearest 0.05 ft)
	$G_{f, AC}$=	1.67	
	GE_{AC}=	1.25	
$GE_{AB+AC} = 0.0032*TI*(100-R_{AS}) =$		2.78	
=>	GE_{AC+AB}=	2.98	(add 0.2 ft safety factor)
$GE_{AB} = GE_{AC+AB}-GE_{AC} =$		1.73	
=>	AB thickness=	1.57	
=>	AB Thickness=	**1.60**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.76	$G_{f, AB}$=1.1
$GE_{AS} = GE_{TOTAL}-GE_{AB}-GE_{AC} =$		1.40	
=>	AS Thickness=	**1.40**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

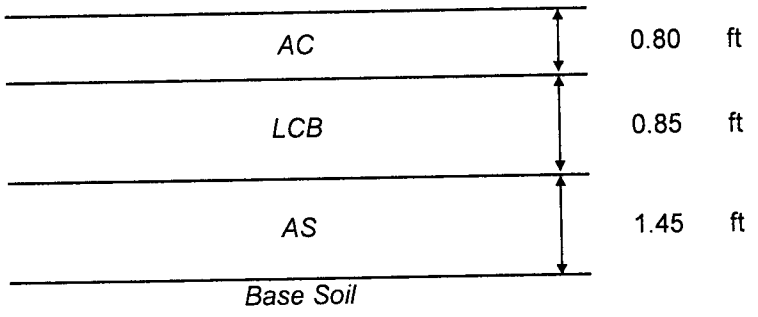
PROJECT NAME: *I-205 AUX. LANE PROJECT*
PROJECT NO.: *206144.GDR*

Design Case: AC over LCB over AS

Design TI=	***14.5***
R_{BS}=	***5***
R_{AB}=	78
R_{AS}=	40

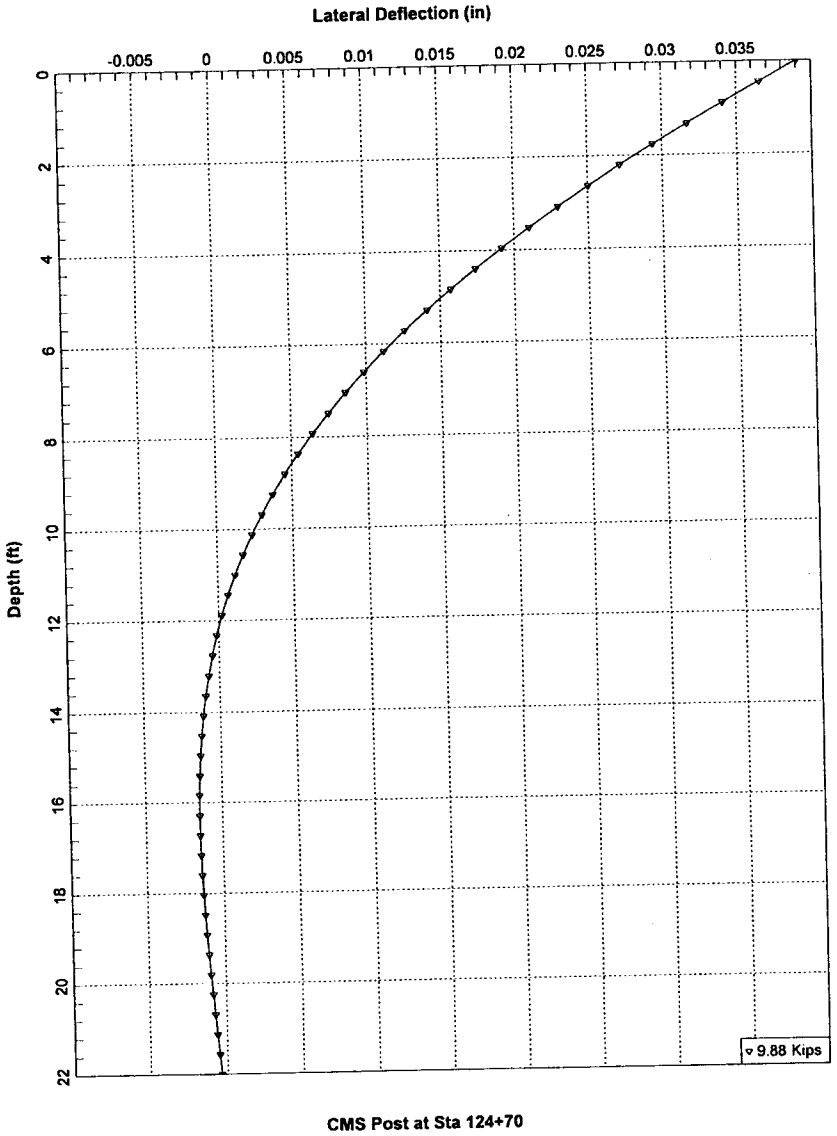
$GE_{TOTAL} = 0.0032*TI*(100-R_{BS})$ =		4.41	
$GE_{AC+LCB} = 0.0032*TI*(100-R_{AS})$ =		2.78	
$GE_{AC} = 0.4*GE_{AC+LCB}$ =		1.11	
=>	GE'_{AC} =	1.31	(add 0.2 ft safety factor)
	AC thickness =	0.78	ft
=>	AC Thickness=	**0.80**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ AC}$=	1.71	
	GE_{AC}=	1.37	
$GE_{LCB} = (GE_{AC+LCB})-GE_{AC}$ =		1.42	
=>	GE_{AC+AB}=	1.62	(add 0.2 ft safety factor)
	$G_{f,\ LCB}$=	1.90	
	LCB thickness=	0.85	
=>	LCB Thickness=	**0.85**	ft (round up to the nearest 0.05 ft)
	GE_{LCB}=	1.62	
$GE_{AS} = GE_{TOTAL}-GE_{LCB}-GE_{AC}$ =		1.43	
=>	AS Thickness=	**1.45**	ft (round up to the nearest 0.05 ft)

Design Section:

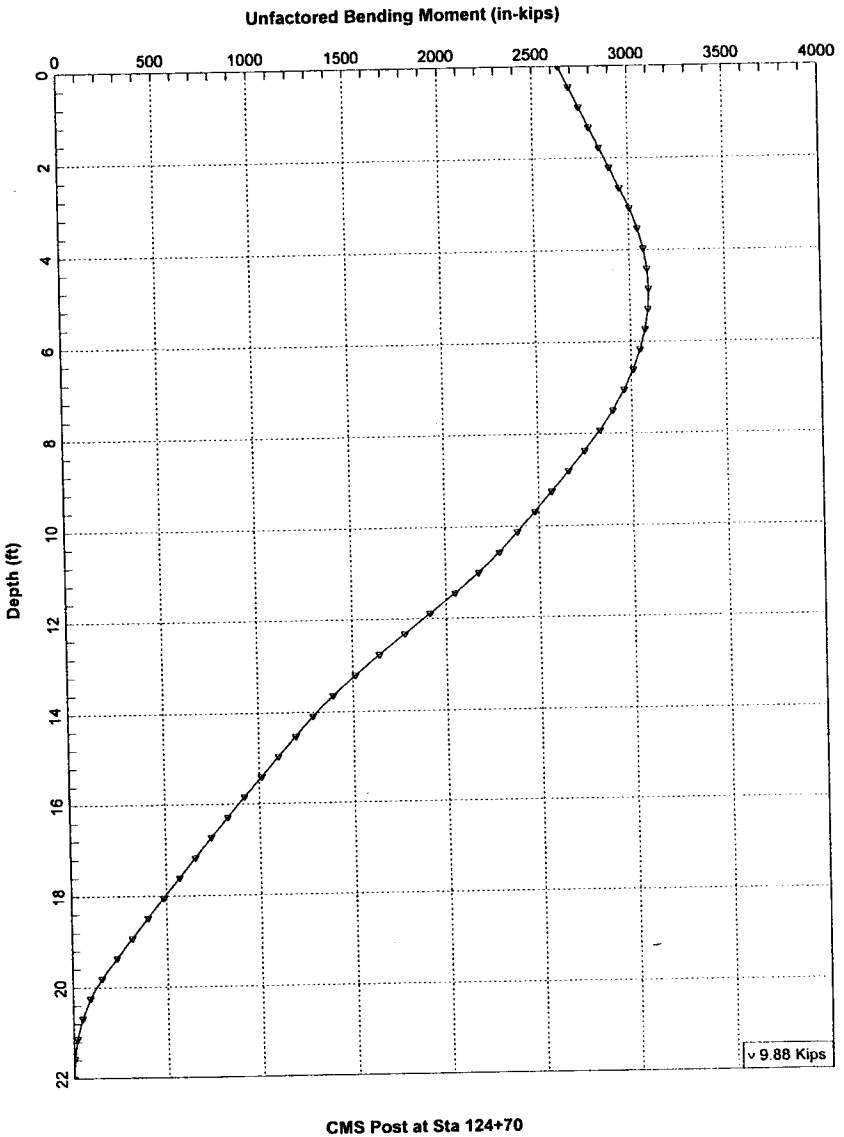


```
LPILEP5
I-205, CMS Post at Sta 124+70
1         1         0         0         0         0
50        2         36        264       0
0         60        318086    2827      3000000
264       60        318086    2827      3000000
5         10        10        0         0
3         36        96        0         0
4         96        126       355.8     355.8
3         126       174       0         0
4         174       234       142.3     142.3
3         234       300       0         0
36        0.072
96        0.072
96        0.072
126       0.072
126       0.072
174       0.072
174       0.072
234       0.072
234       0.072
300       0.072
36        10.42     0         0.0044    0
96        10.42     0         0.0044    0
96        0         38        0         0
126       0         38        0         0
126       20.83     0         0.0032    0
174       20.83     0         0.0032    0
174       0         36        0         0
234       0         36        0         0
234       27.78     0         0.0032    0
300       27.78     0         0.0032    0
0         1         1
1
1         9880      2640000   4140
0
1         1         0
100       1E-5      100
```

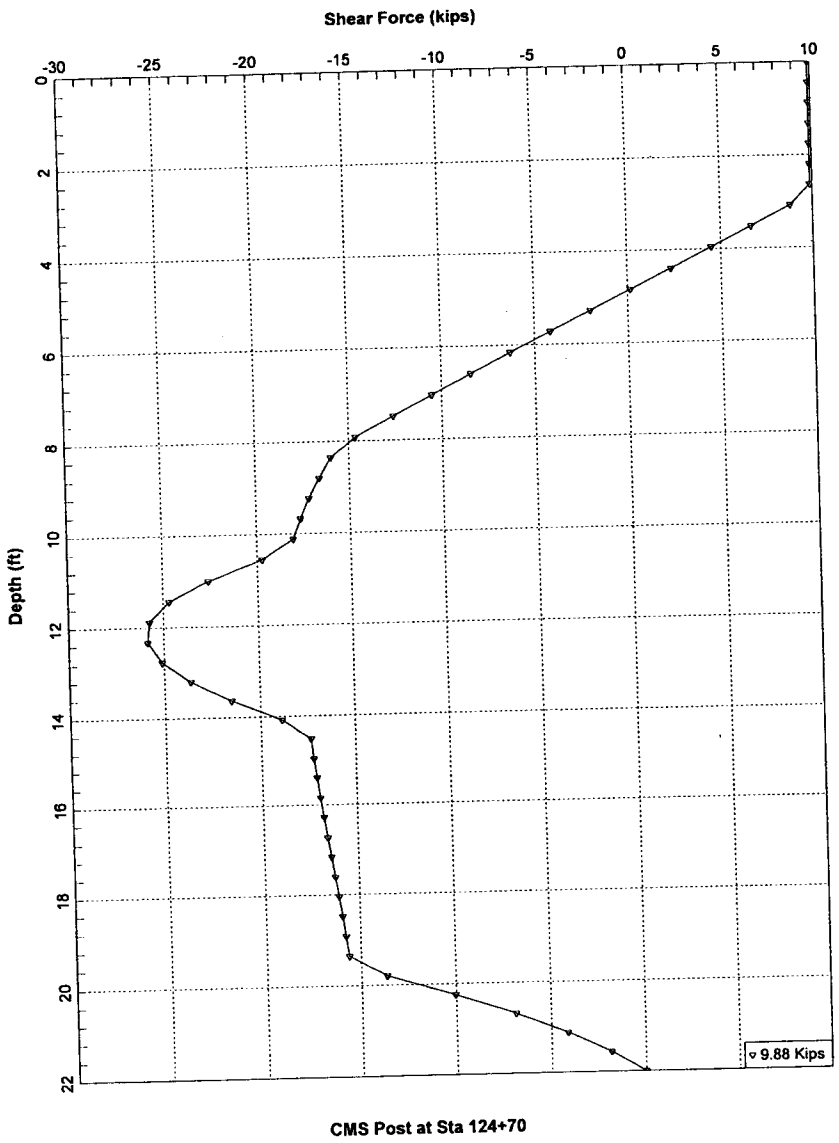
(The location has been revised to Sta. 125+21)



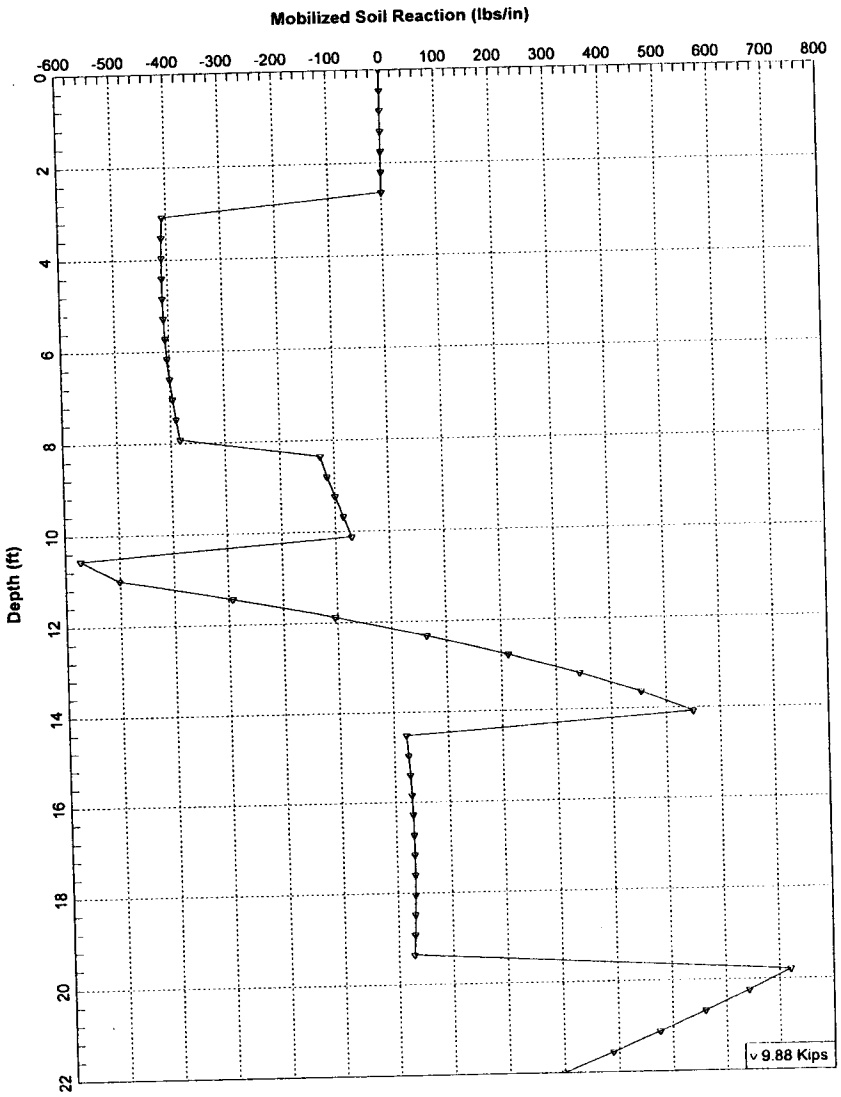
CMS Post at Sta 124+70



CMS Post at Sta 124+70



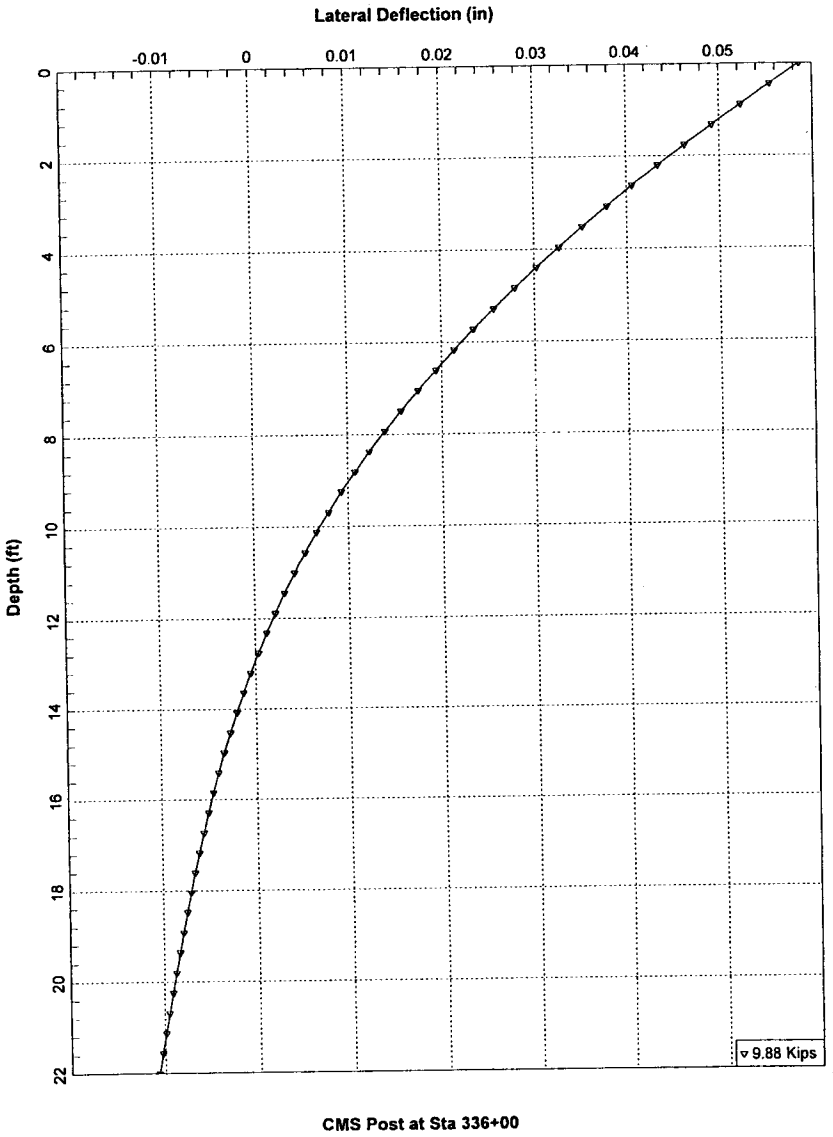
CMS Post at Sta 124+70



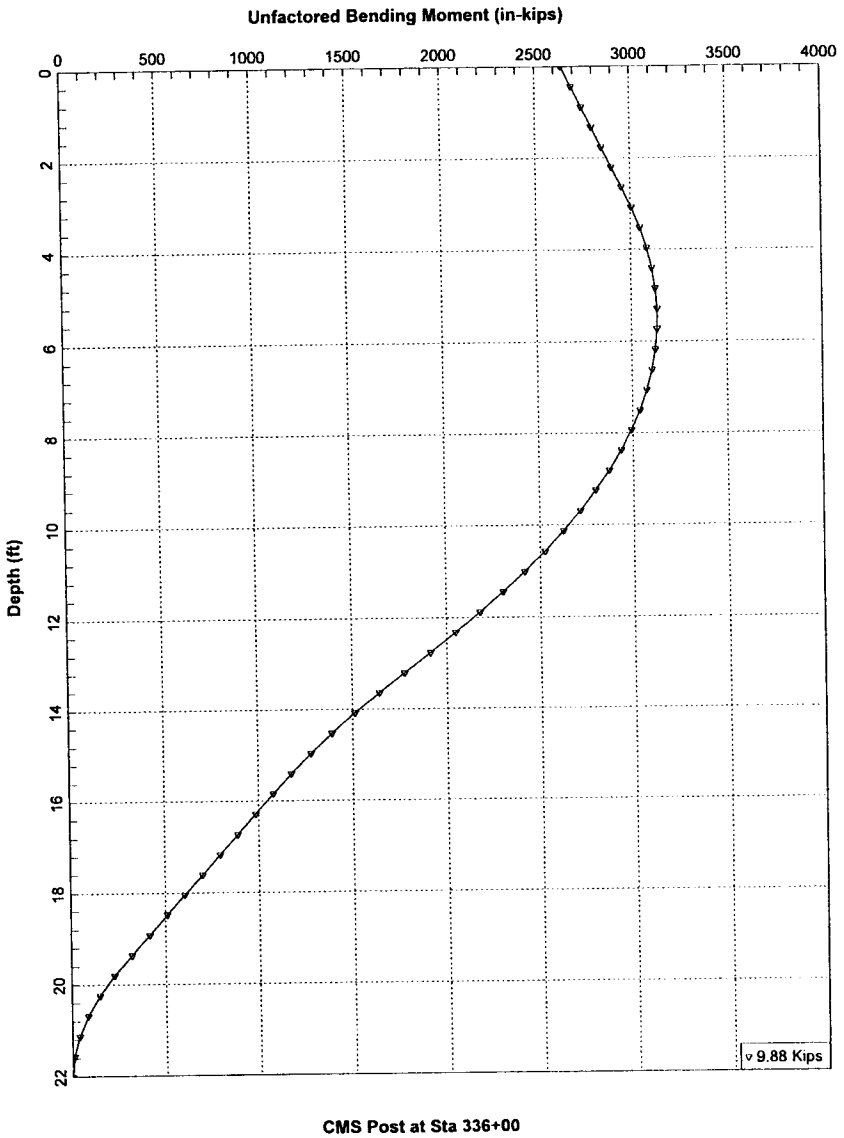
CMS Post at Sta 124+70

```
LPILEP5
I-205, CMS Post at Sta 336+00
1         1         0         0         0         0
50        2         36        264       0
0         60        318086    2827      3000000
264       60        318086    2827      3000000
4         8         8         0         0
3         36        156       0         0
3         156       186       0         0
10        186       234       0         0
4         234       300       197.6     197.6
36        0.072
156       0.072
156       0.036
186       0.036
186       0.036
234       0.036
234       0.036
300       0.036
36        6.94      0         0.0044    0
156       6.94      0         0.0044    0
156       6.94      0         0.0044    0
186       6.94      0         0.0044    0
186       0         0         0         0
234       0         0         0         0
234       0         38        0         0
300       0         38        0         0
0         1         1
1
1         9880      2640000   4140
0
1         1         0
100       1E-5      100
```

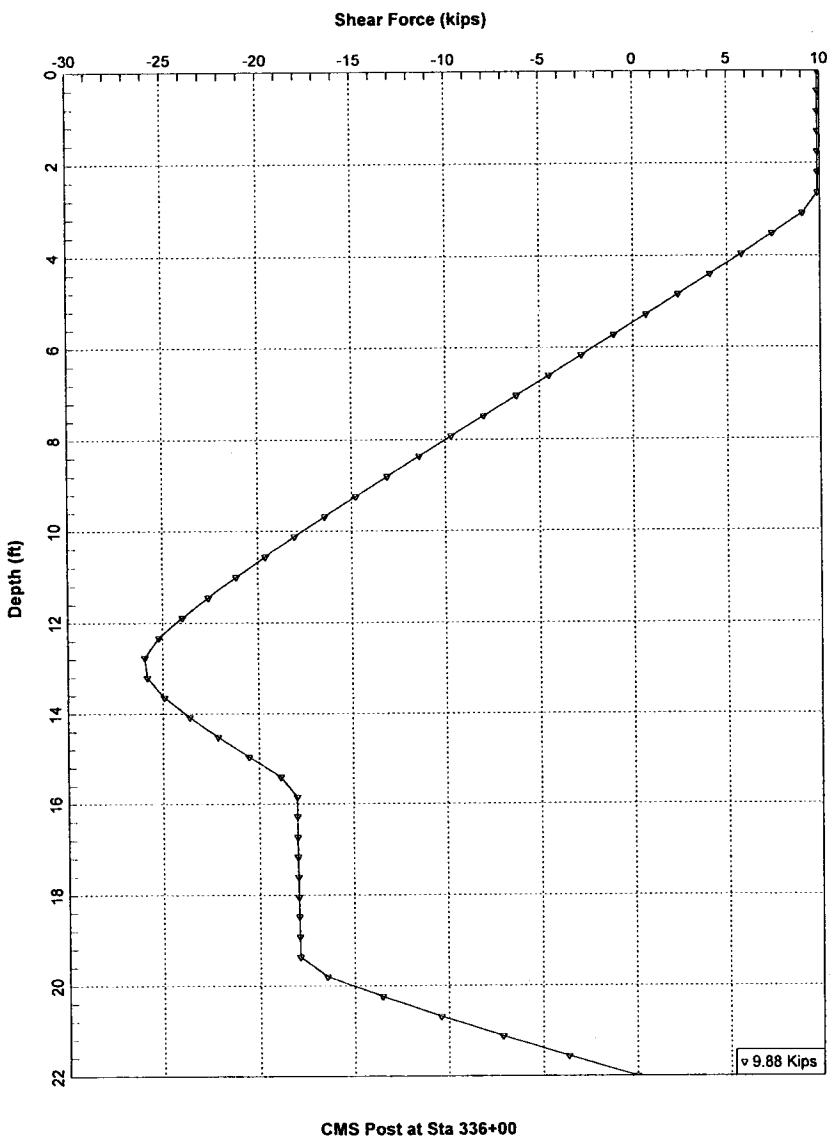
(The location has been revised to Sta. 334+90)



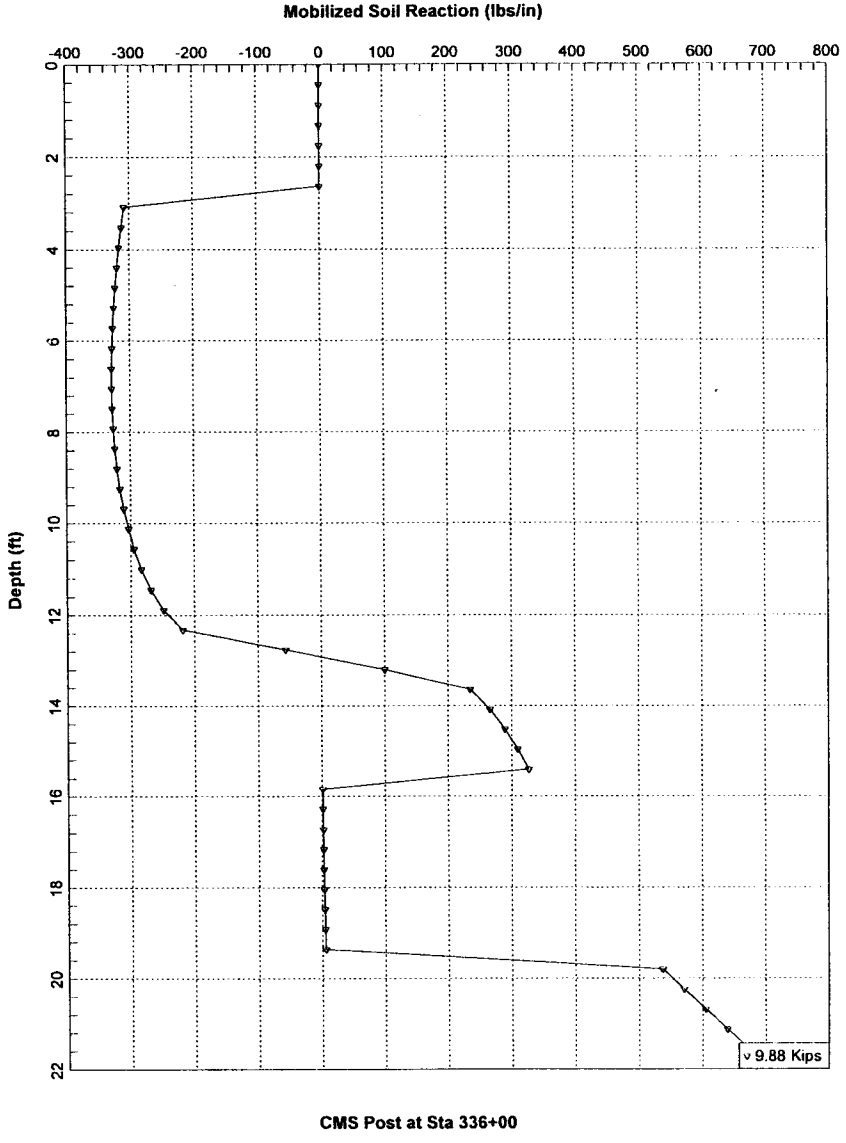
CMS Post at Sta 336+00



CMS Post at Sta 336+00



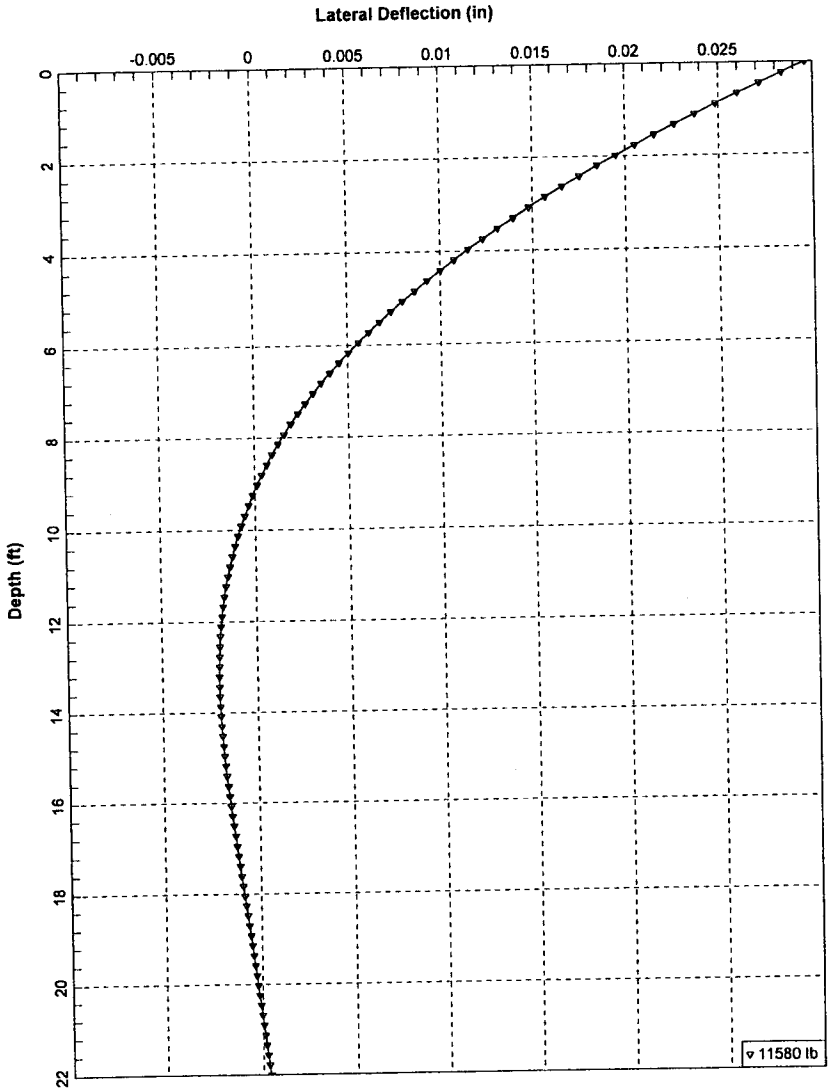
CMS Post at Sta 336+00



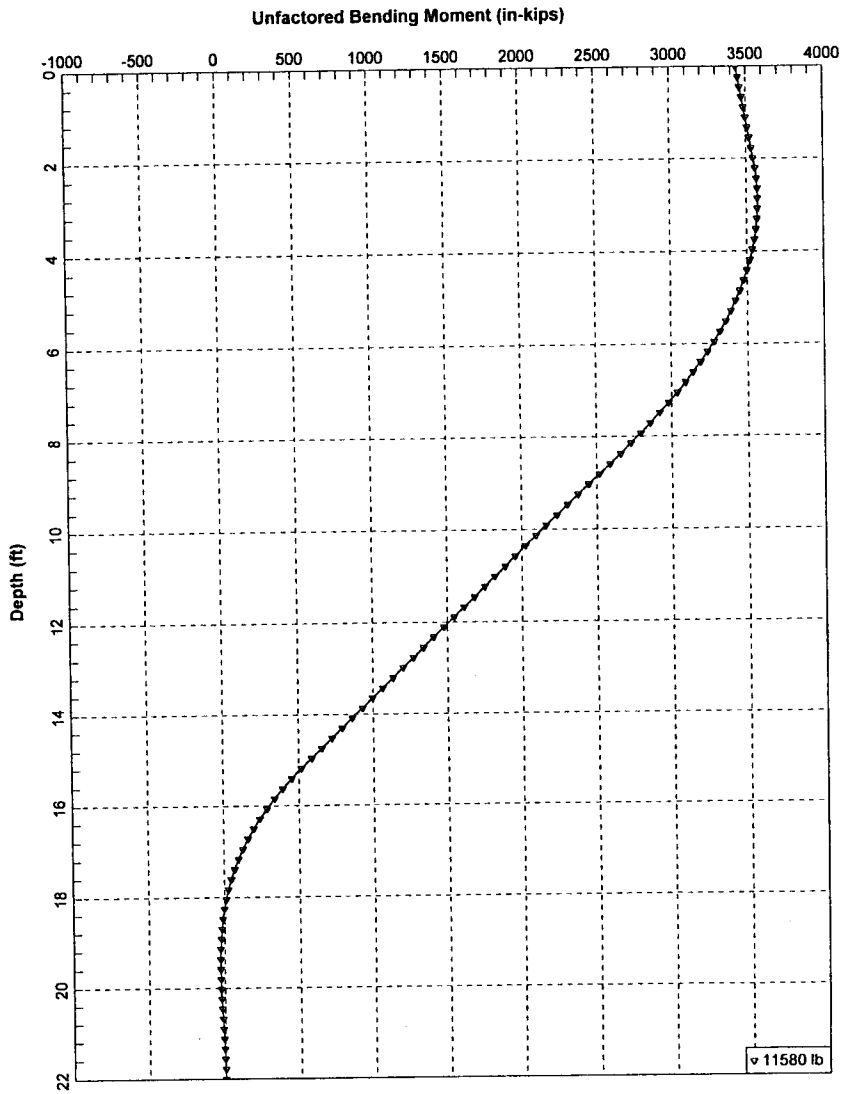
CMS Post at Sta 336+00

Sign Post D at 306+33 (F-4417 lb & M-286516 lb-ft).lpd

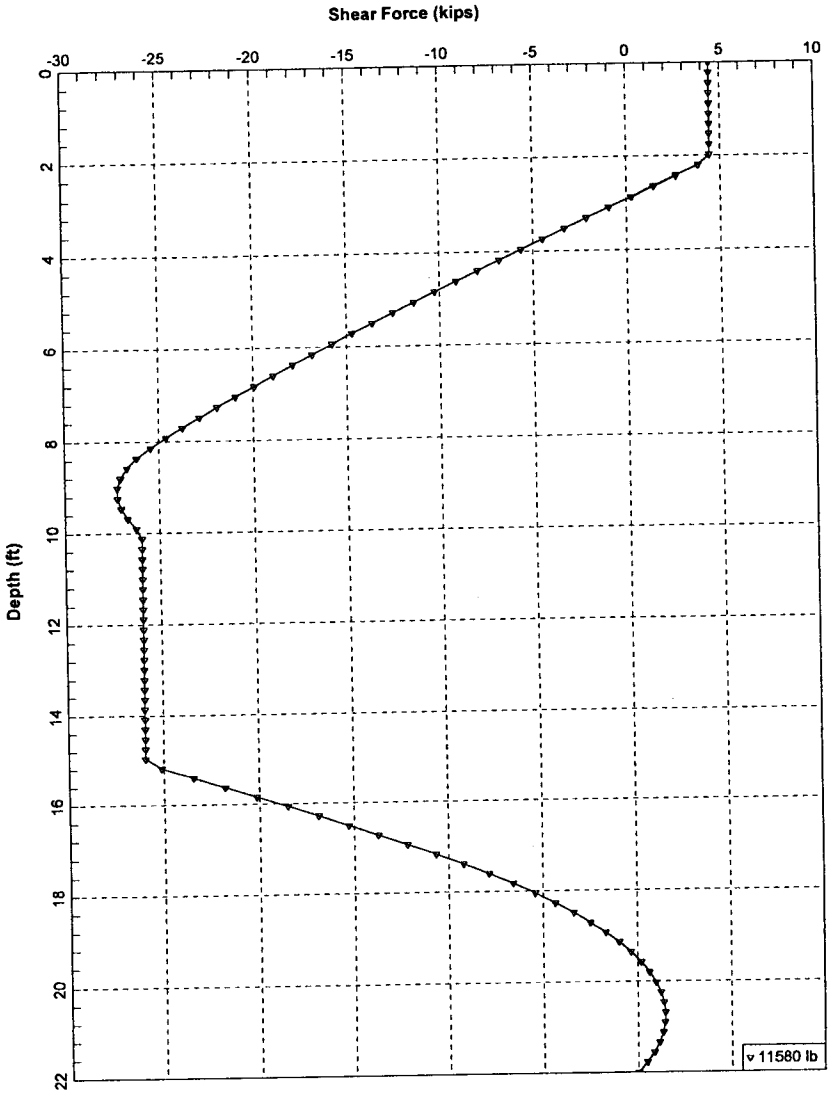
```
LPILEP5
Sign Post "D" at 306+33 (F-4417 lb & M-286516 lb-ft)
1         1         0         0         0         0
100       2         24        264       0
0         60        318086.3            2827.4    3000000
264       60        318086.3            2827.4    3000000
4         8         8         0         0
3         24        120       0         0
10        120       180       0         0
3         180       330       0         0
4         330       360       197.6     197.6
24        0.072
120       0.072
120       0.036
180       0.036
180       0.036
330       0.036
330       0.036
360       0.036
24        12.15     0         0.0044    0
120       12.15     0         0.0044    0
120       0         0         0         0
180       0         0         0         0
180       10.42     0         0.0044    0
330       10.42     0         0.0044    0
330       0         38        0         0
360       0         38        0         0
0         1         0
1
1         4417      3438192   11580
0
1         1         0
100       1E-5      100
```



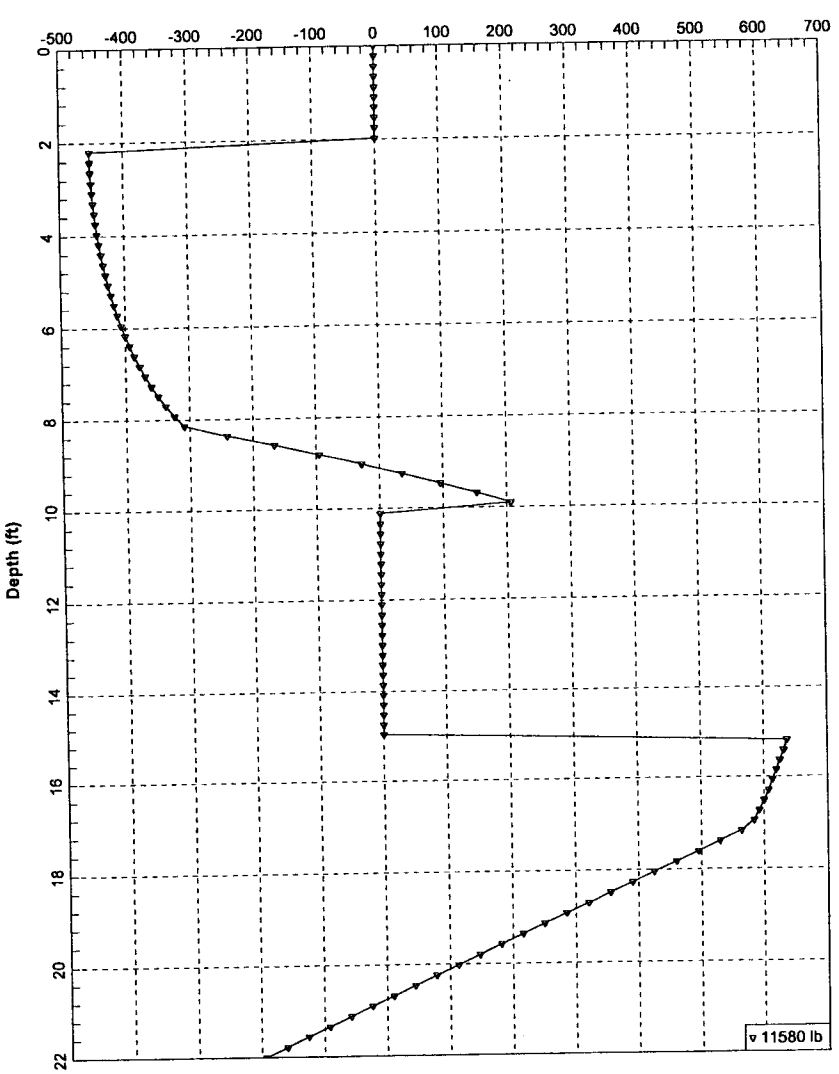
Sign Post "D" at 306+33 (F-4417 lb & 286516 lb-ft)



Sign Post "D" at 306+33 (F-4417 lb & 286516 lb-ft)



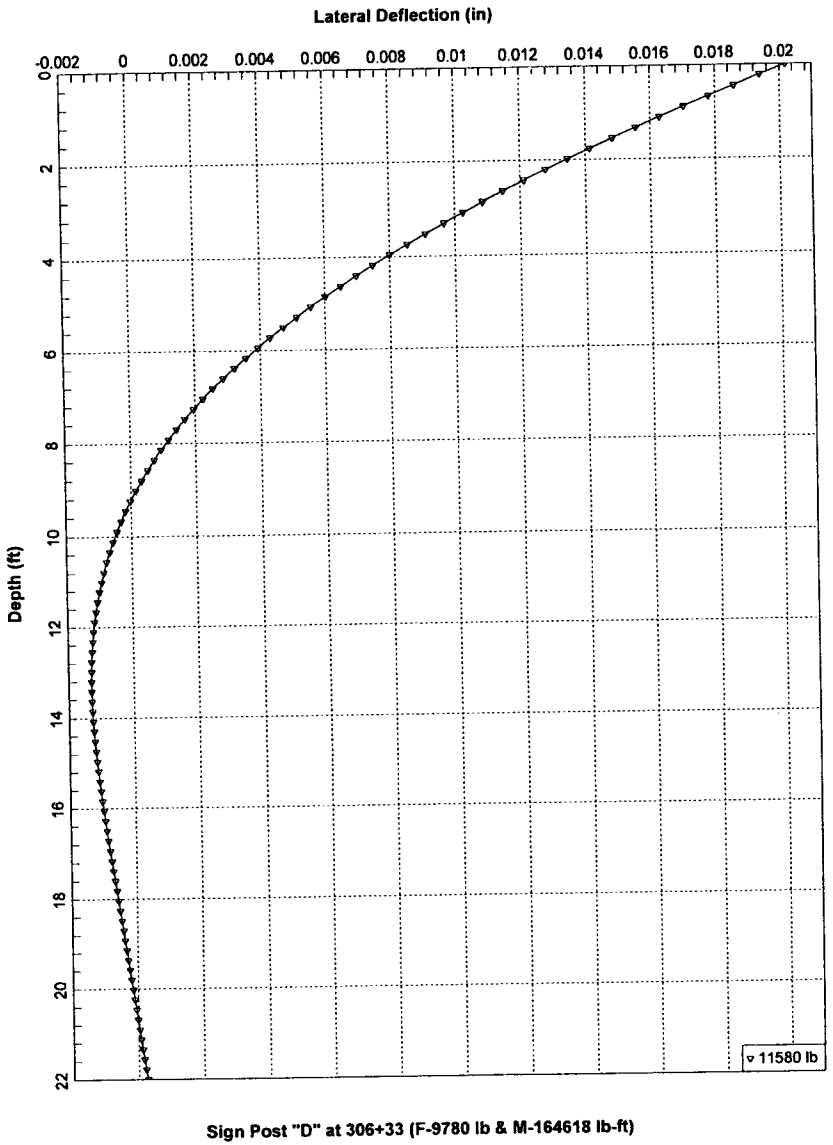
Sign Post "D" at 306+33 (F-4417 lb & 286516 lb-ft)



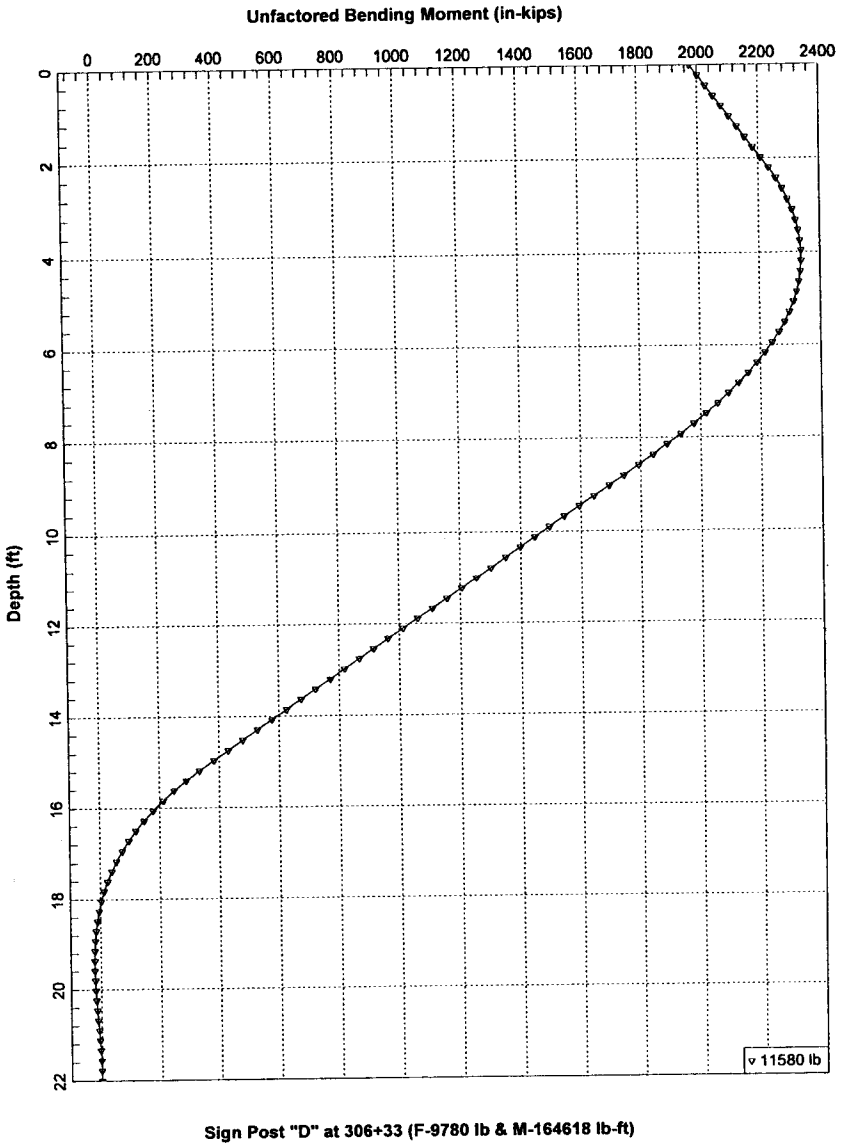
Sign Post "D" at 306+33 (F-4417 lb & 286516 lb-ft)

Sign Post D at 306+33 (F-9780 lb & M-164618 lb-ft).lpd

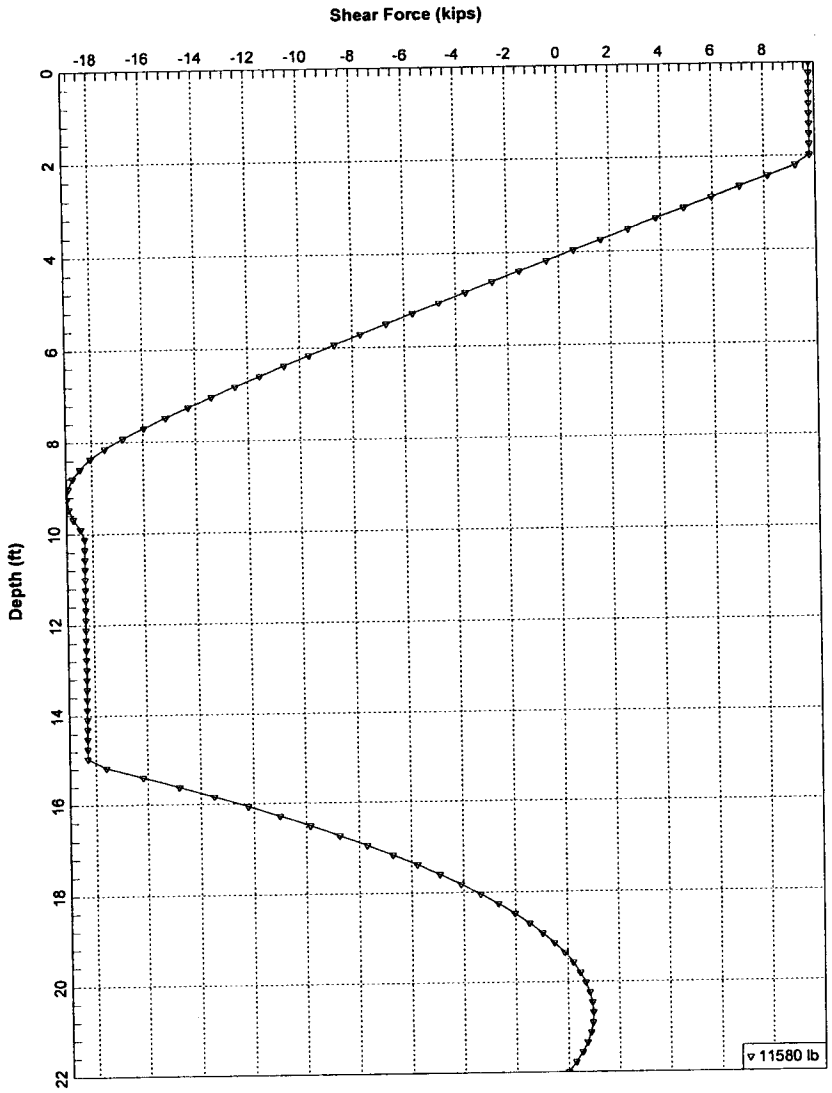
```
LPILEP5
Sign Post "D" at 306+33 (F-9780 lb & M-164618 lb-ft)
1       1       0       0       0       0
100     2       24      264     0
0       60      318086.3        2827.4  3000000
264     60      318086.3        2827.4  3000000
4       8       8       0       0
3       24      120     0       0
10      120     180     0       0
3       180     330     0       0
4       330     360     197.6   197.6
24      0.072
120     0.072
120     0.036
180     0.036
180     0.036
330     0.036
330     0.036
360     0.036
24      12.15   0       0.0044  0
120     12.15   0       0.0044  0
120     0       0       0       0
180     0       0       0       0
180     10.42   0       0.0044  0
330     10.42   0       0.0044  0
330     0       38      0       0
360     0       38      0       0
0       1       0
1
1       9780    1975416 11580
0
1       1       0
100     1E-5    100
```



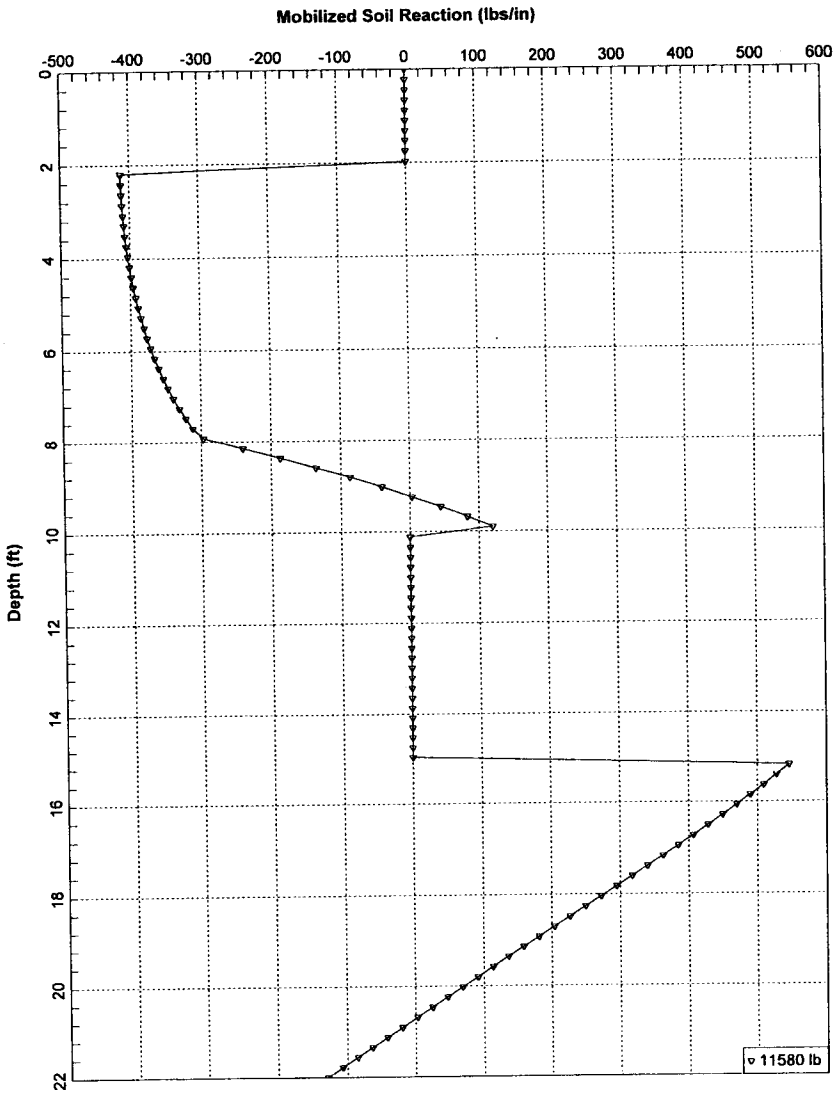
Sign Post "D" at 306+33 (F-9780 lb & M-164618 lb-ft)



Sign Post "D" at 306+33 (F-9780 lb & M-164618 lb-ft)



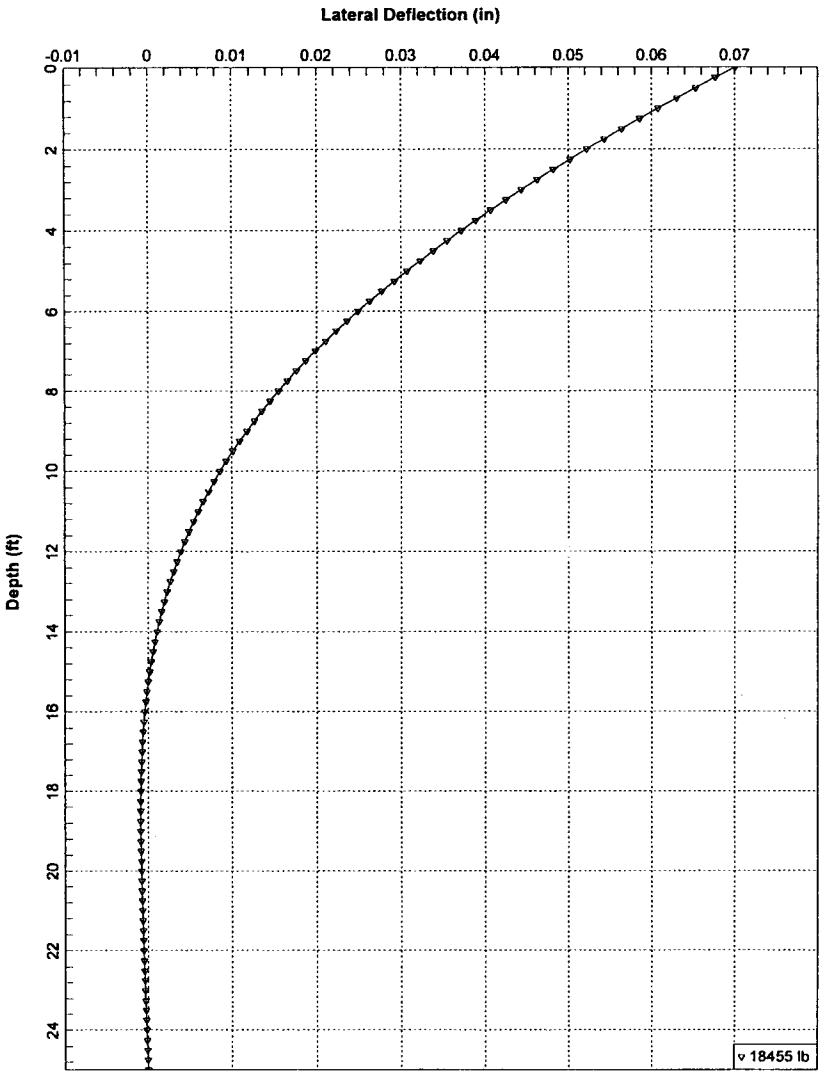
Sign Post "D" at 306+33 (F-9780 lb & M-164618 lb-ft)



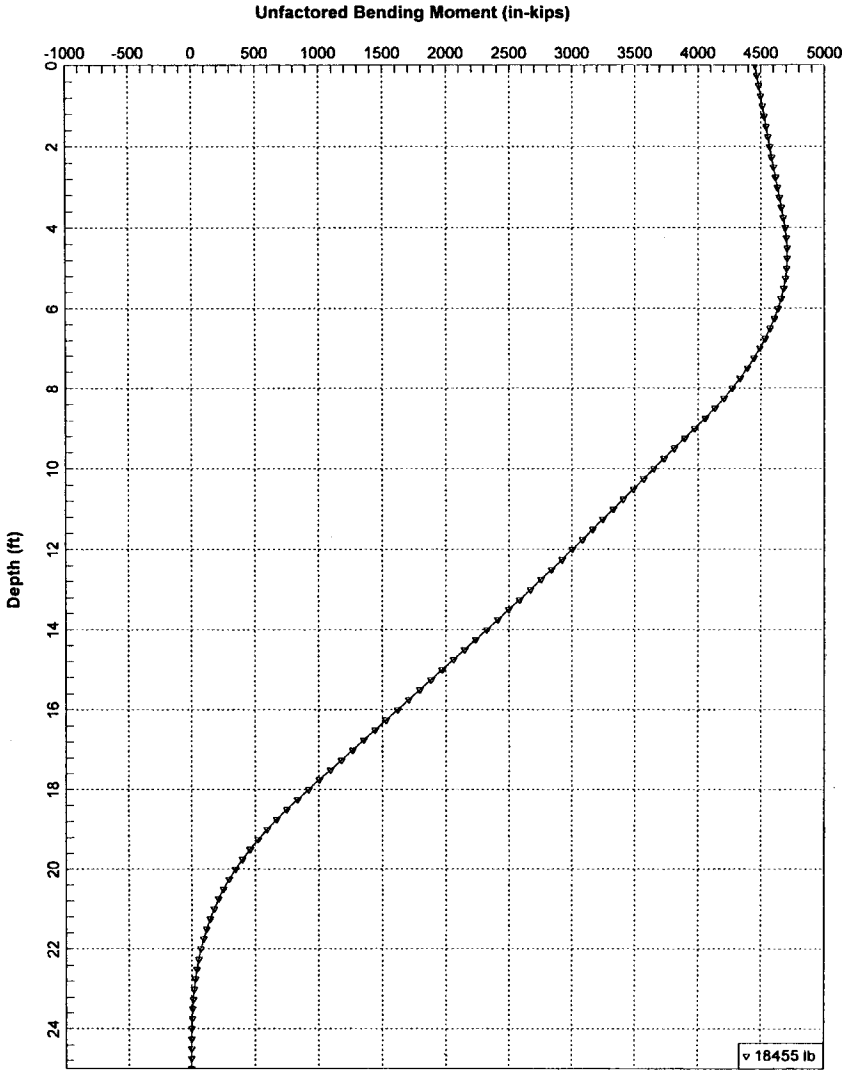
Sign Post "D" at 306+33 (F-9780 lb & M-164618 lb-ft)

Sign Post E at 344+25 (F-4939 lb & M-371147 lb-ft).lpd

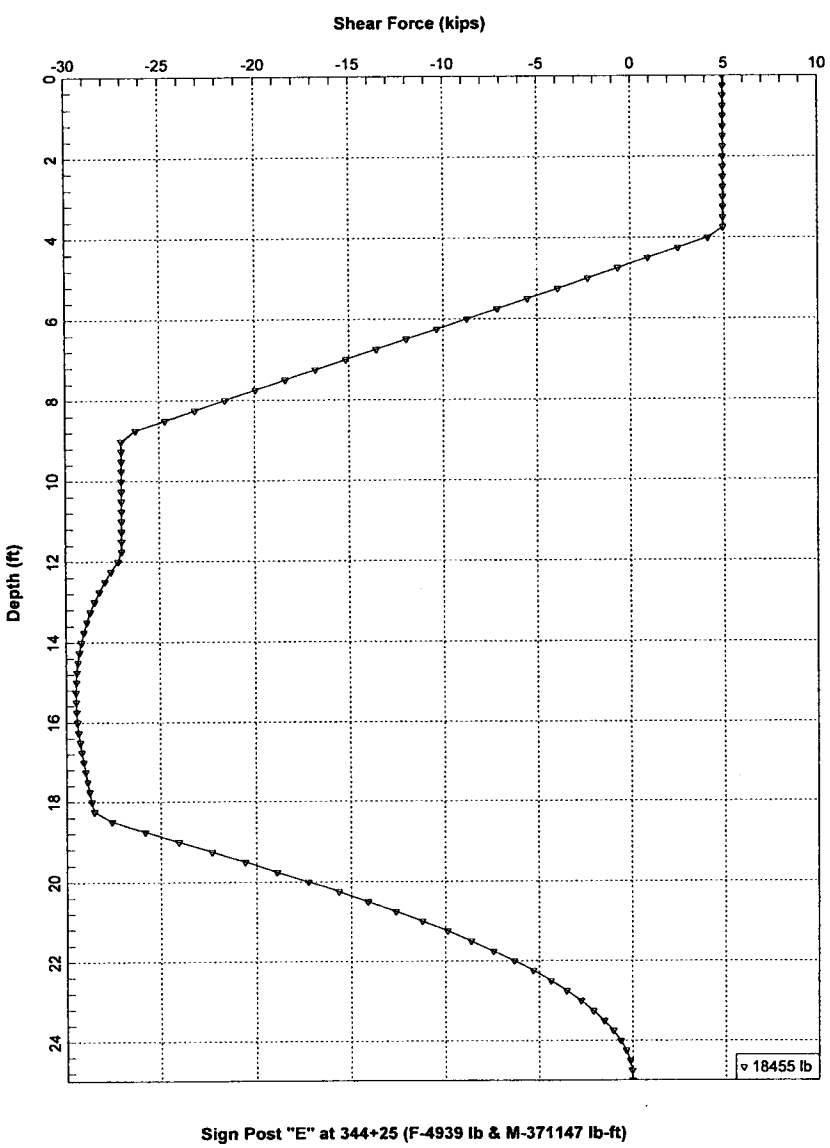
```
LPILEP5
Sign Post "E" at 344+25 (F-4939 lb & M-371147 lb-ft)
1       1       0       0       0       0
100     2       48      300     0
0       60      318086.3        2827.4  3000000
300     60      318086.3        2827.4  3000000
4       8       8       0       0
3       48      108     0       0
10      108     144     0       0
4       144     222     197.6   197.6
3       222     312     0       0
48      0.072
108     0.072
108     0.036
144     0.036
144     0.036
222     0.036
222     0.036
312     0.036
48      12.15   0       0.0044  0
108     12.15   0       0.0044  0
108     0       0       0       0
144     0       0       0       0
144     0       38      0       0
222     0       38      0       0
222     17.36   0       0.0032  0
312     17.36   0       0.0032  0
0       1       0
1
1       4939    4453764 18455
0
1       1       0
100     1E-5    100
```



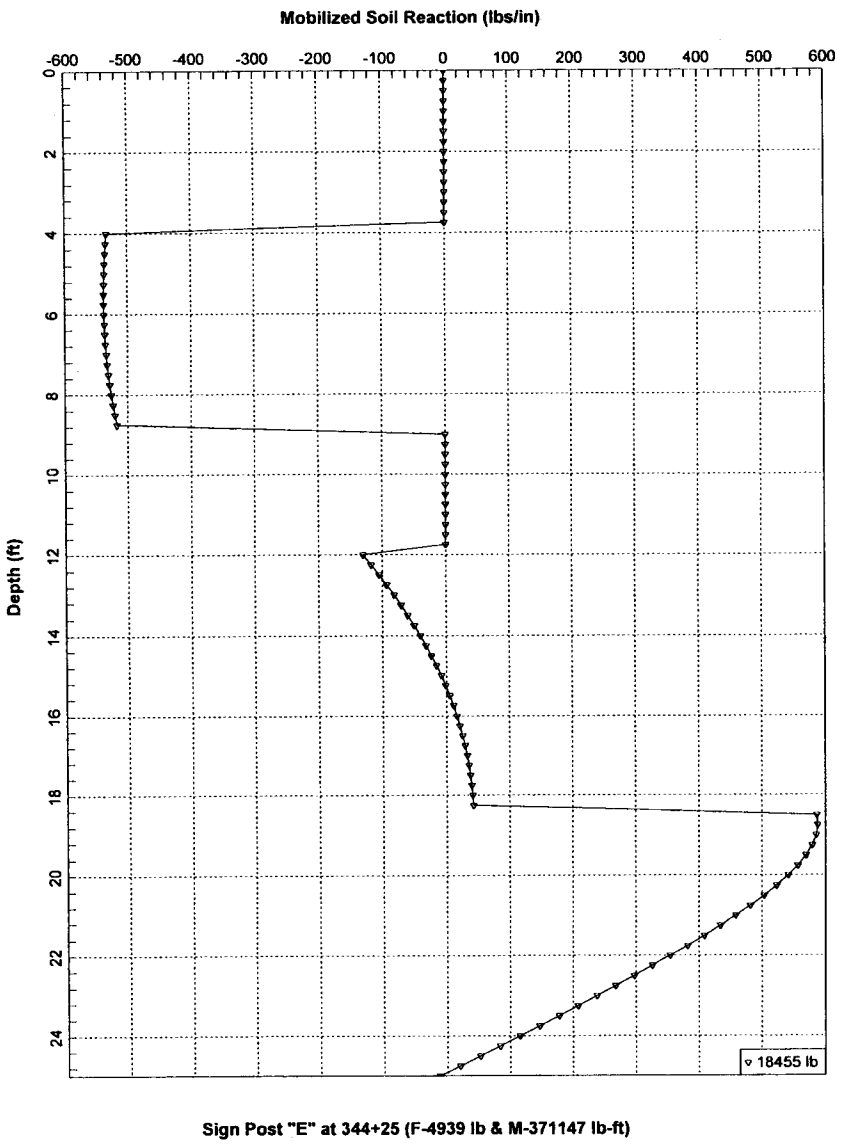
Sign Post "E" at 344+25 (F-4939 lb & M-371147 lb-ft)



Sign Post "E" at 344+25 (F-4939 lb & M-371147 lb-ft)



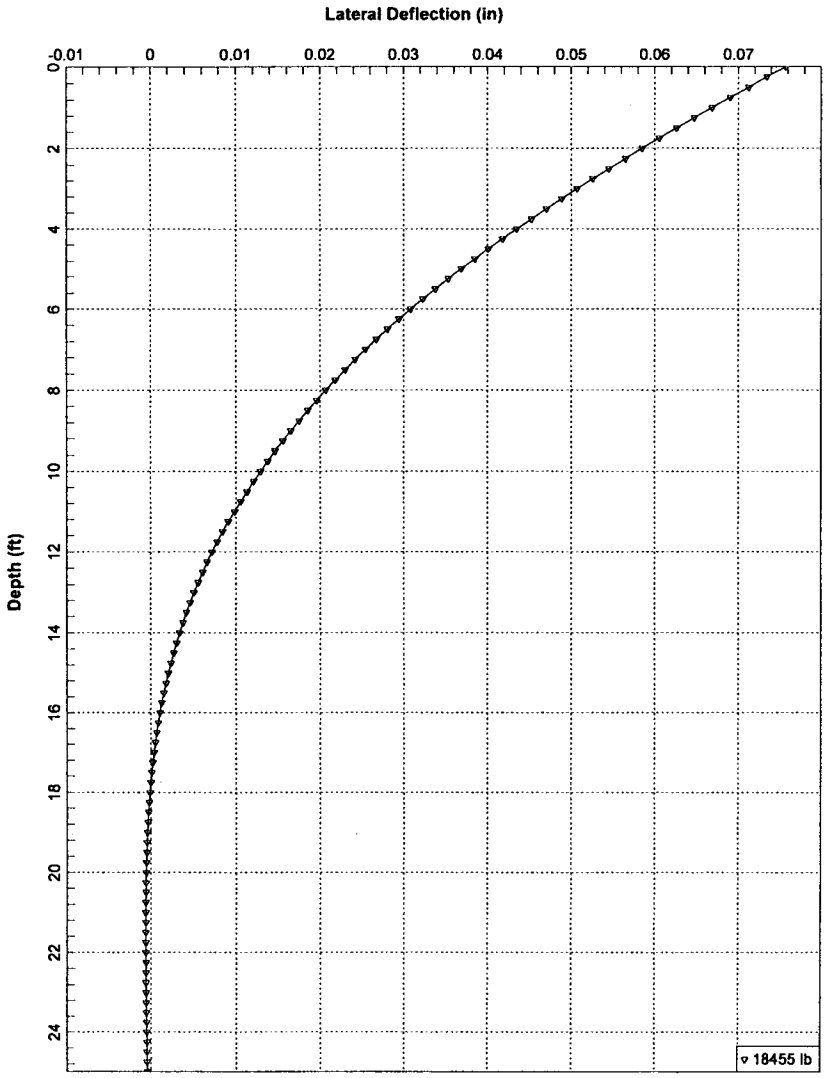
Sign Post "E" at 344+25 (F-4939 lb & M-371147 lb-ft)



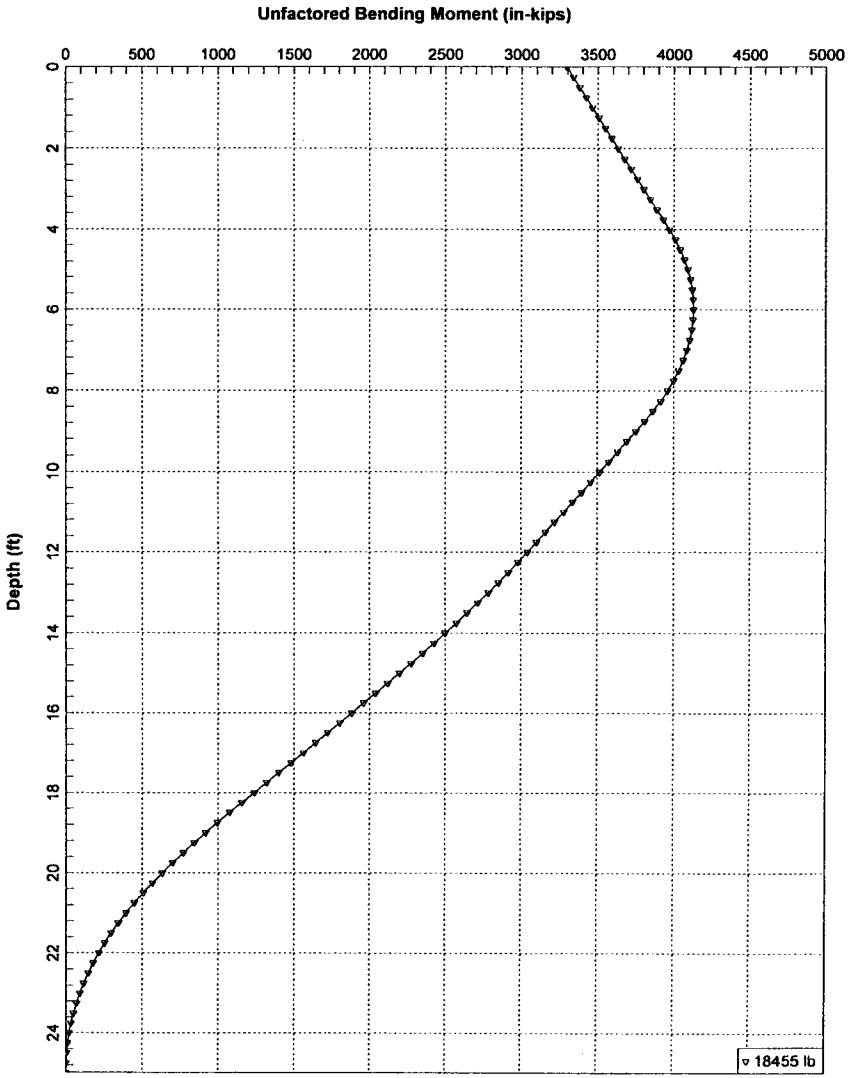
Sign Post "E" at 344+25 (F-4939 lb & M-371147 lb-ft)

Sign Post E at 344+25 (F-14073 lb & M-274689 lb-ft).lpd

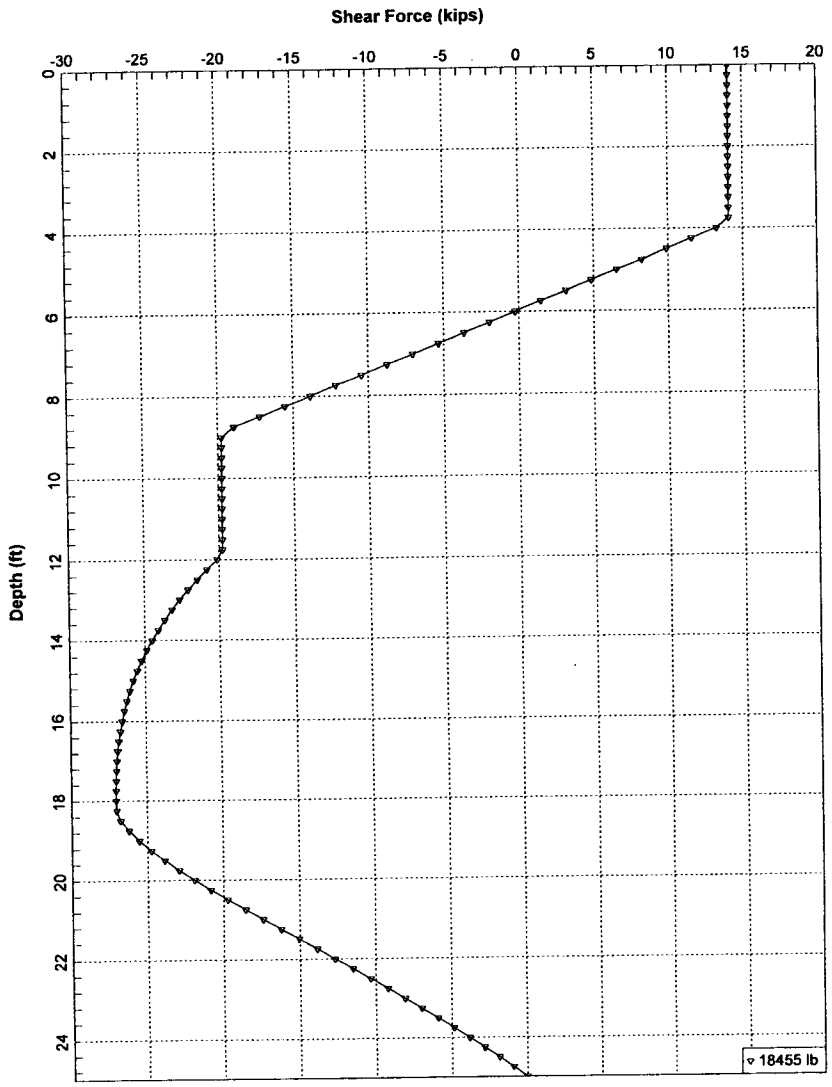
```
LPILEP5
Sign Post "E" at 344+25 (F-14073 lb & M-274689 lb-ft)
1       1       0       0       0       0
100     2       48      300     0
0       60      318086.3        2827.4  3000000
300     60      318086.3        2827.4  3000000
4       8       8       0       0
3       48      108     0       0
10      108     144     0       0
4       144     222     197.6   197.6
3       222     312     0       0
48      0.072
108     0.072
108     0.036
144     0.036
144     0.036
222     0.036
222     0.036
312     0.036
48      12.15   0       0.0044  0
108     12.15   0       0.0044  0
108     0       0       0       0
144     0       0       0       0
144     0       38      0       0
222     0       38      0       0
222     17.36   0       0.0032  0
312     17.36   0       0.0032  0
0       1       0
1
1       14073   3296268 18455
0
1       1       0
100     1E-5    100
```



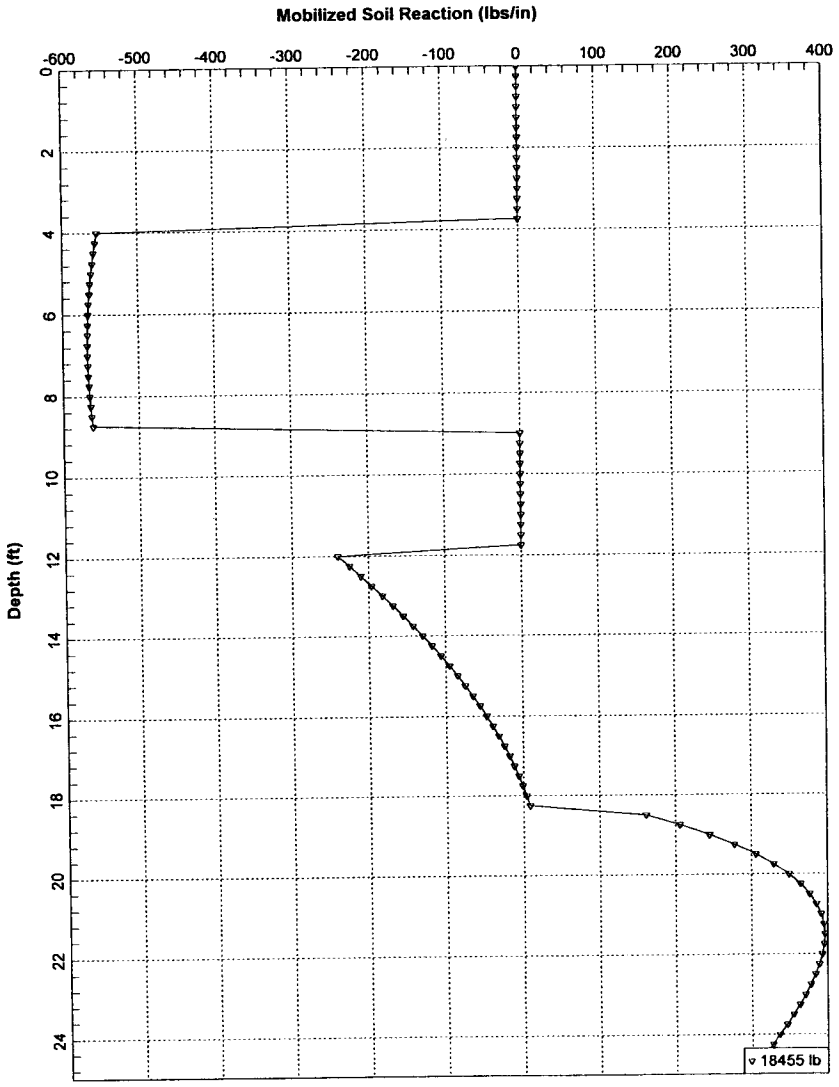
Sign Post "E" at 344+25 (F-14073 lb & M-274689 lb-ft)



Sign Post "E" at 344+25 (F-14073 lb & M-274689 lb-ft)



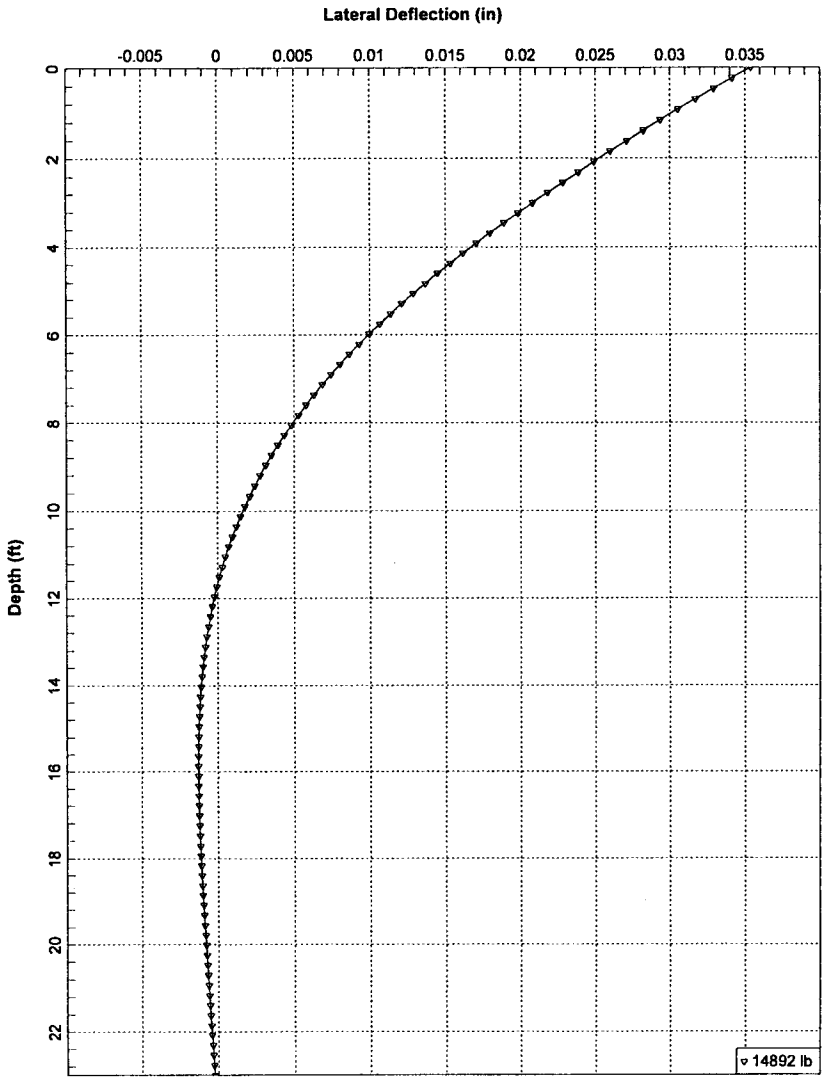
Sign Post "E" at 344+25 (F-14073 lb & M-274689 lb-ft)



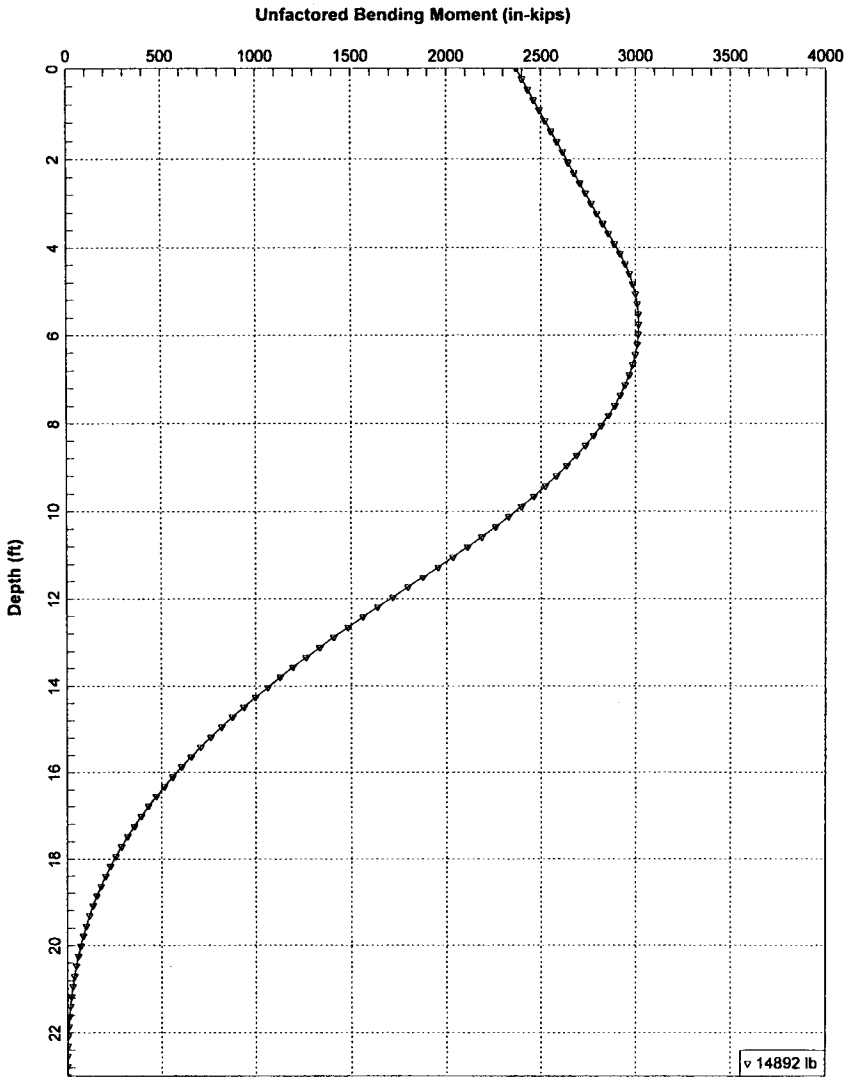
Sign Post "E" at 344+25 (F-14073 lb & M-274689 lb-ft)

Sign Post F at 347+96 (F-11051 lb & M-197481 lb-ft).lpd

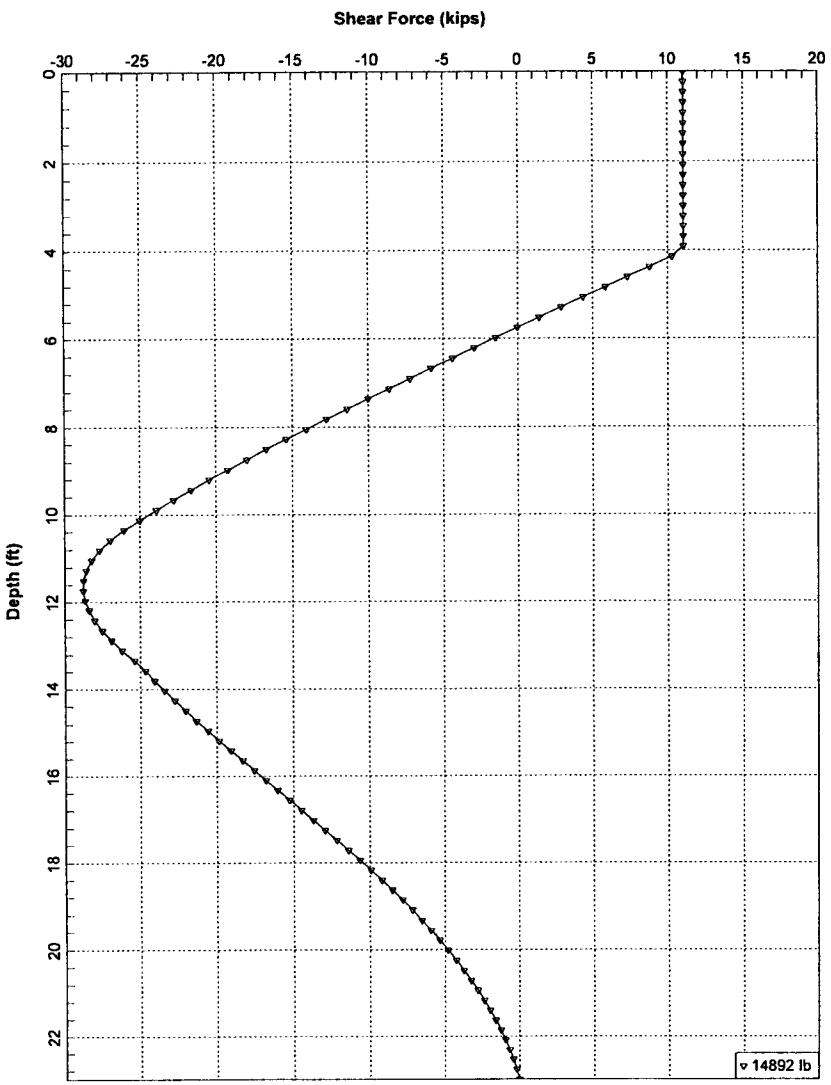
```
LPILEP5
Sign Post "F" at 347+96 (F-11051 lb & M-197481 lb-ft)
1       1       0       0       0       0
100     2       48      276     0
0       60      318086.3        2827.4  3000000
276     60      318086.3        2827.4  3000000
3       6       6       0       0
3       48      102     0       0
3       102     162     0       0
3       162     288     0       0
48      0.072
102     0.072
102     0.036
162     0.036
162     0.036
288     0.036
48      13.89   0       0.0032  0
102     13.89   0       0.0032  0
102     13.89   0       0.0032  0
162     13.89   0       0.0032  0
162     6.94    0       0.0044  0
288     6.94    0       0.0044  0
0       1       0
1
1       11051   2369772 14892
0
1       1       0
100     1E-5    100
```



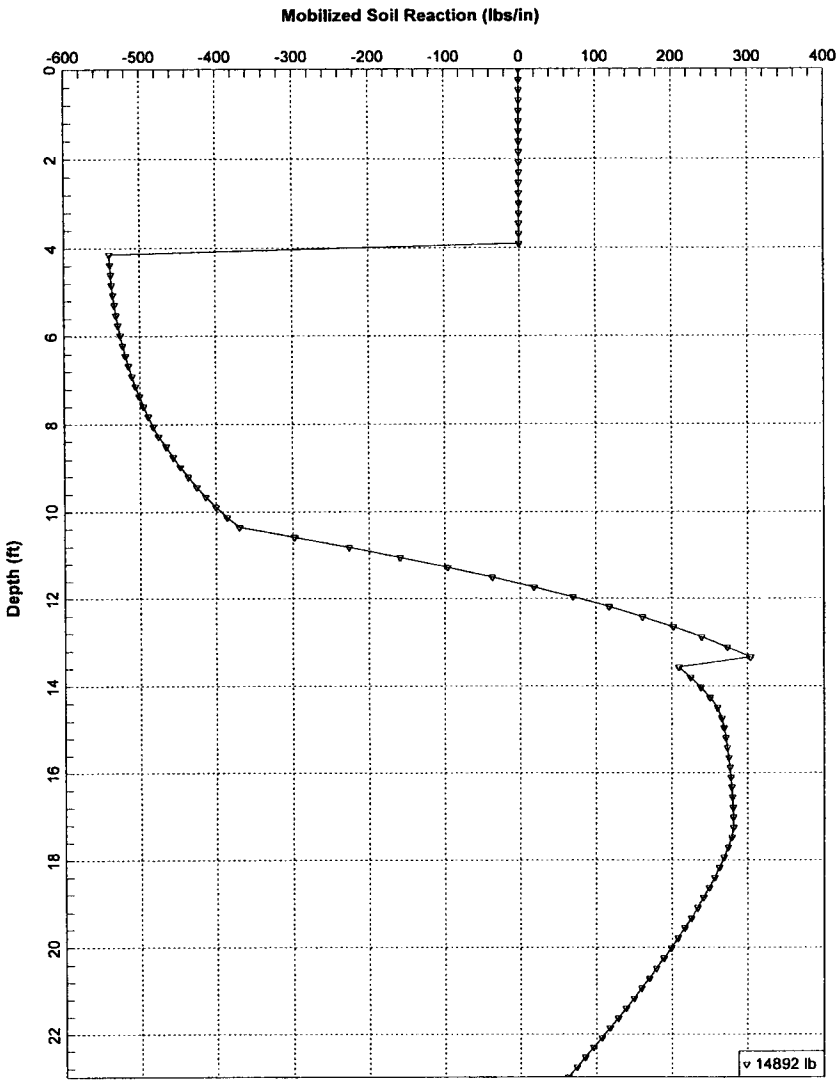
Sign Post "F" at 347+96 (F-11051 lb & M-197481 lb-ft)



Sign Post "F" at 347+96 (F-11051 lb & M-197481 lb-ft)

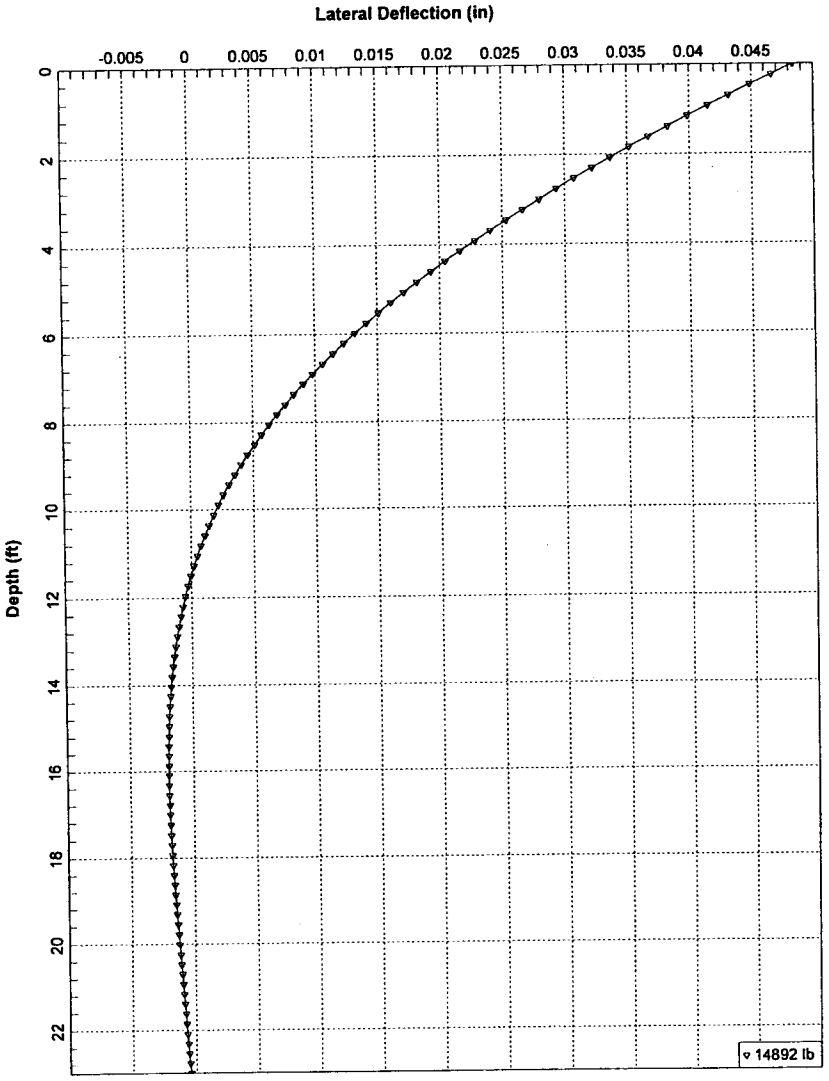


Sign Post "F" at 347+96 (F-11051 lb & M-197481 lb-ft)

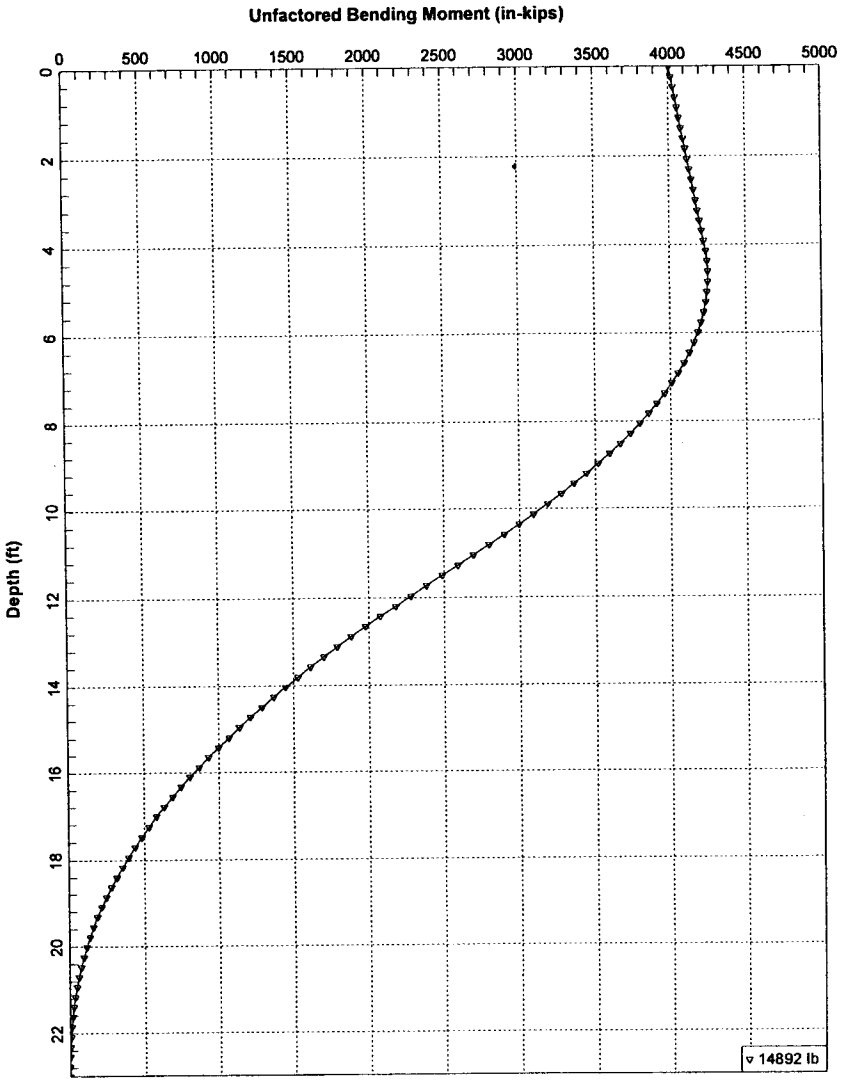


Sign Post "F" at 347+96 (F-11051 lb & M-197481 lb-ft)

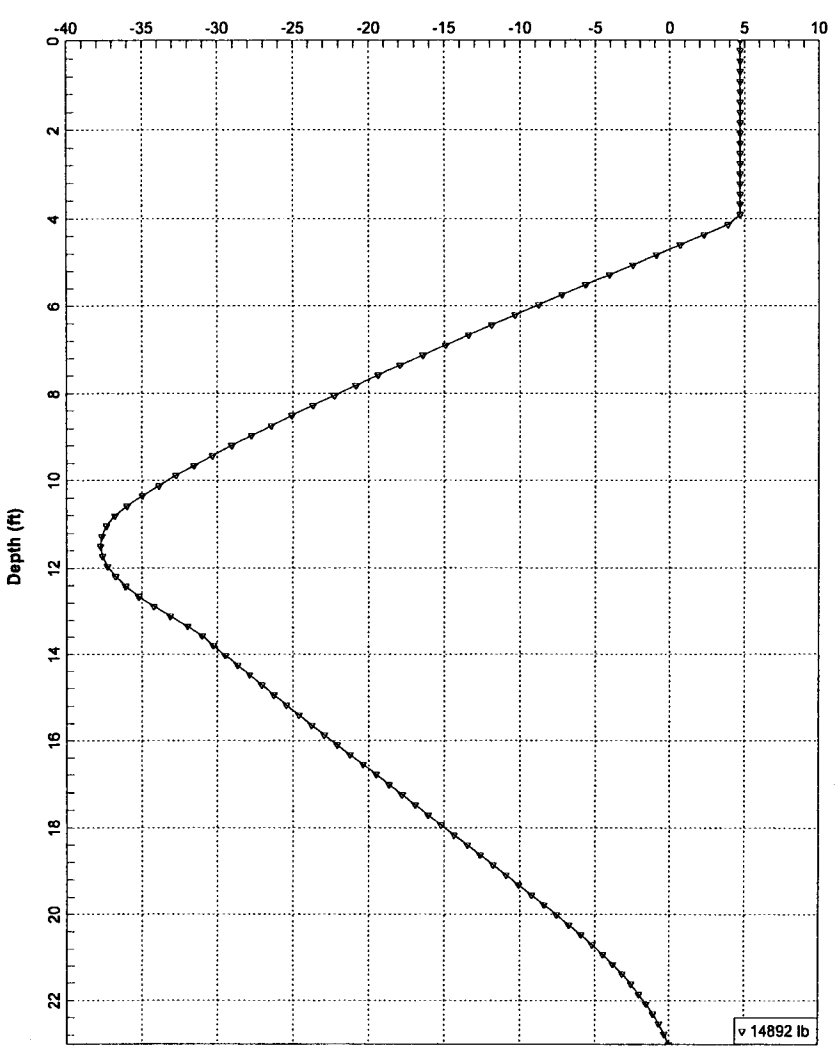
```
LPILEP5
Sign Post "F" at 347+74 (F-4702 lb & M-333704 lb-ft)
1       1       0       0       0       0
100     2       48      276     0
0       60      318086.3        2827.4  3000000
276     60      318086.3        2827.4  3000000
3       6       6       0       0
3       48      102     0       0
3       102     162     0       0
3       162     288     0       0
48      0.072
102     0.072
102     0.036
162     0.036
162     0.036
288     0.036
48      13.89   0       0.0032  0
102     13.89   0       0.0032  0
102     13.89   0       0.0032  0
162     13.89   0       0.0032  0
162     6.94    0       0.0044  0
288     6.94    0       0.0044  0
0       1       0
1
1       4702    4004448 14892
0
1       1       0
100     1E-5    100
```



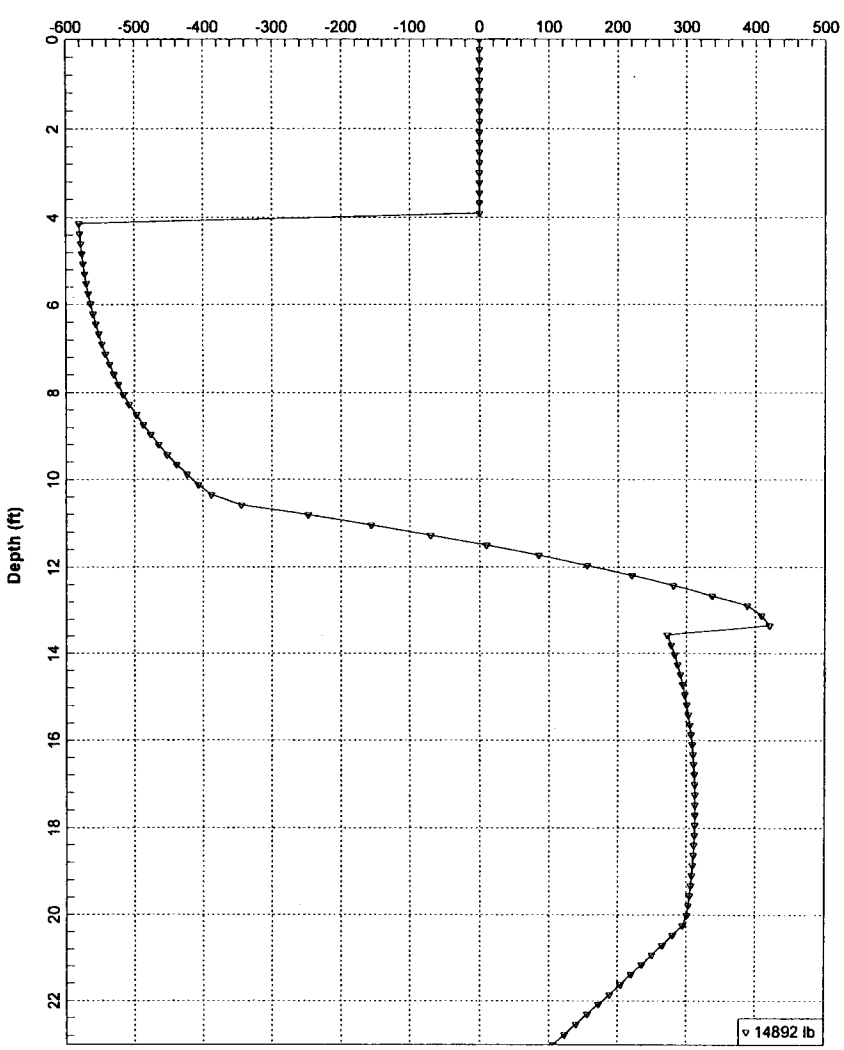
Sign Post "F" at 347+74 (F-4702 lb & M-333704 lb-ft)



Sign Post "F" at 347+74 (F-4702 lb & M-333704 lb-ft)



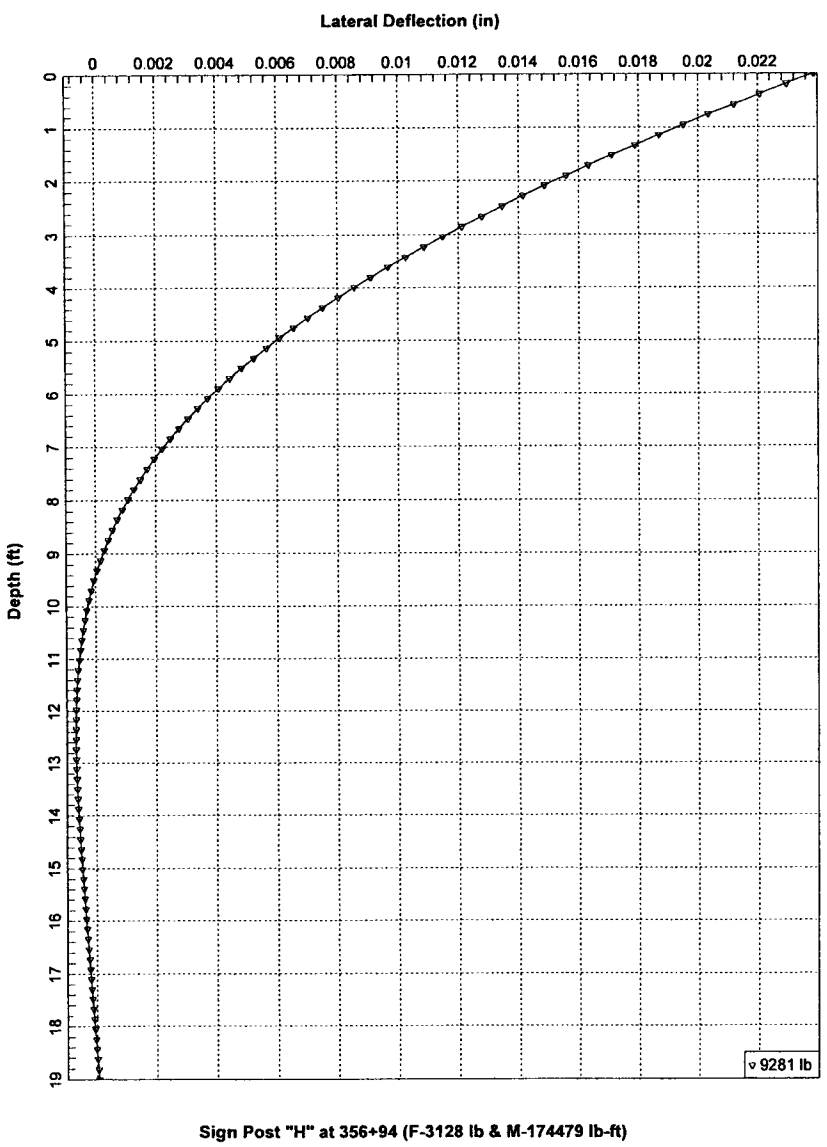
Sign Post "F" at 347+74 (F-4702 lb & M-333704 lb-ft)



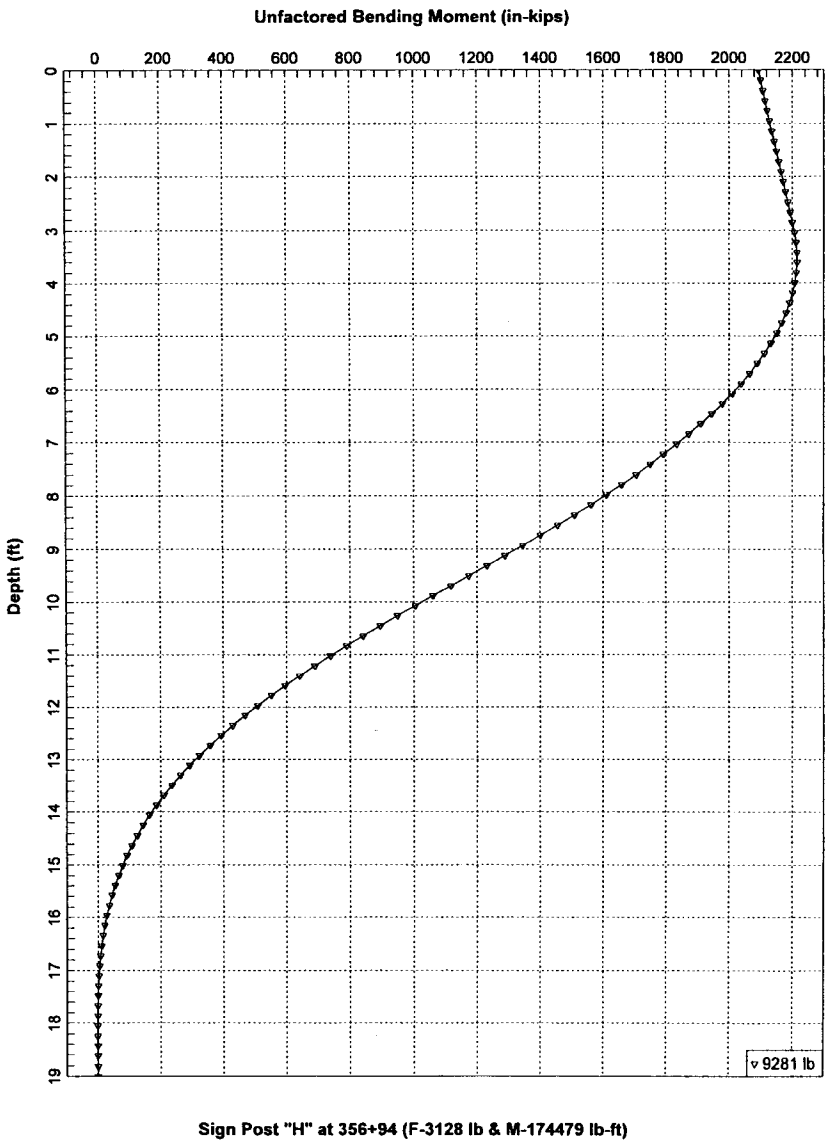
Sign Post "F" at 347+74 (F-4702 lb & M-333704 lb-ft)

Sign Post H at 356+94 (F-3128 lb & M-174479 lb-ft).lpd

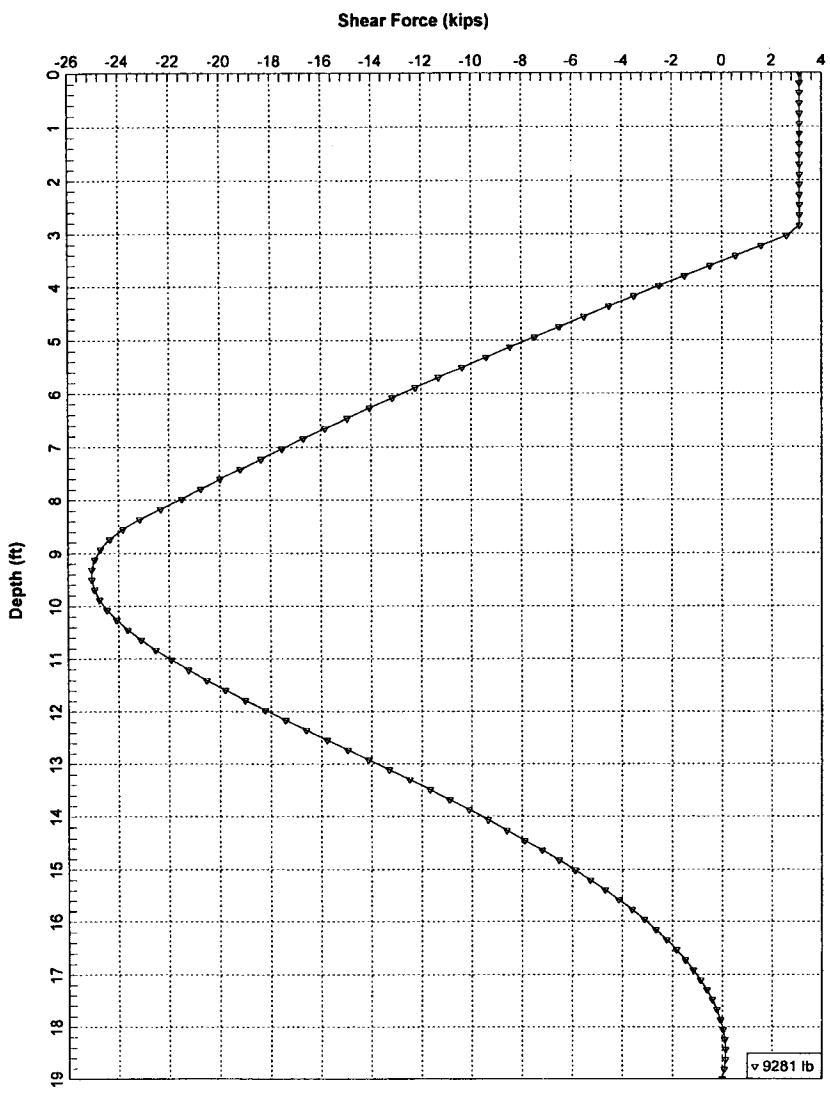
```
LPILEP5
Sign Post "H" at 356+94 (F-3128 lb & M-174479 lb-ft)
1       1       0       0       0       0
100     2       36      228     0
0       54      208696.4        2290    3000000
228     54      208696.4        2290    3000000
3       6       6       0       0
3       36      96      0       0
3       96      150     0       0
3       150     228     0       0
36      0.072
96      0.072
96      0.072
150     0.072
150     0.036
228     0.036
36      13.89   0       0.0033  0
96      13.89   0       0.0033  0
96      20.83   0       0.0024  0
150     20.83   0       0.0024  0
150     20.83   0       0.0024  0
228     20.83   0       0.0024  0
0       1       0
1
1       3128    2093748 9281
0
1       1       0
100     1E-5    100
```



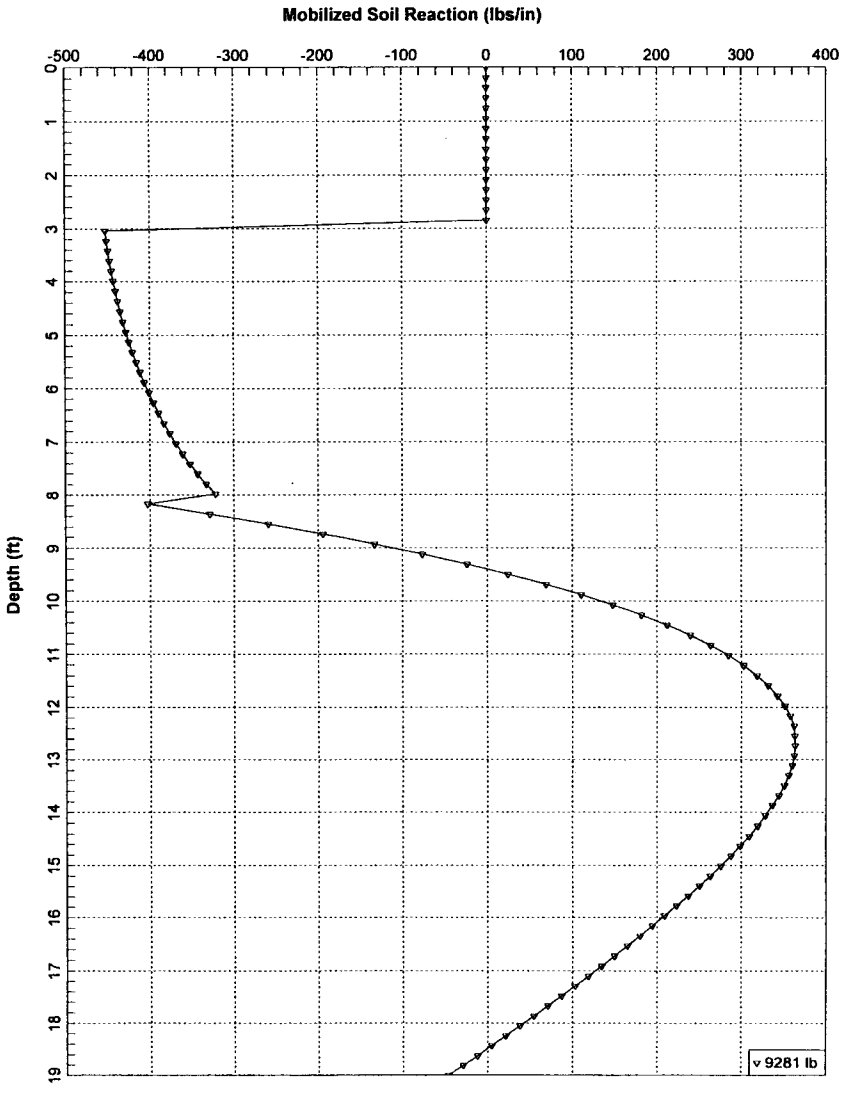
Sign Post "H" at 356+94 (F-3128 lb & M-174479 lb-ft)



Sign Post "H" at 356+94 (F-3128 lb & M-174479 lb-ft)



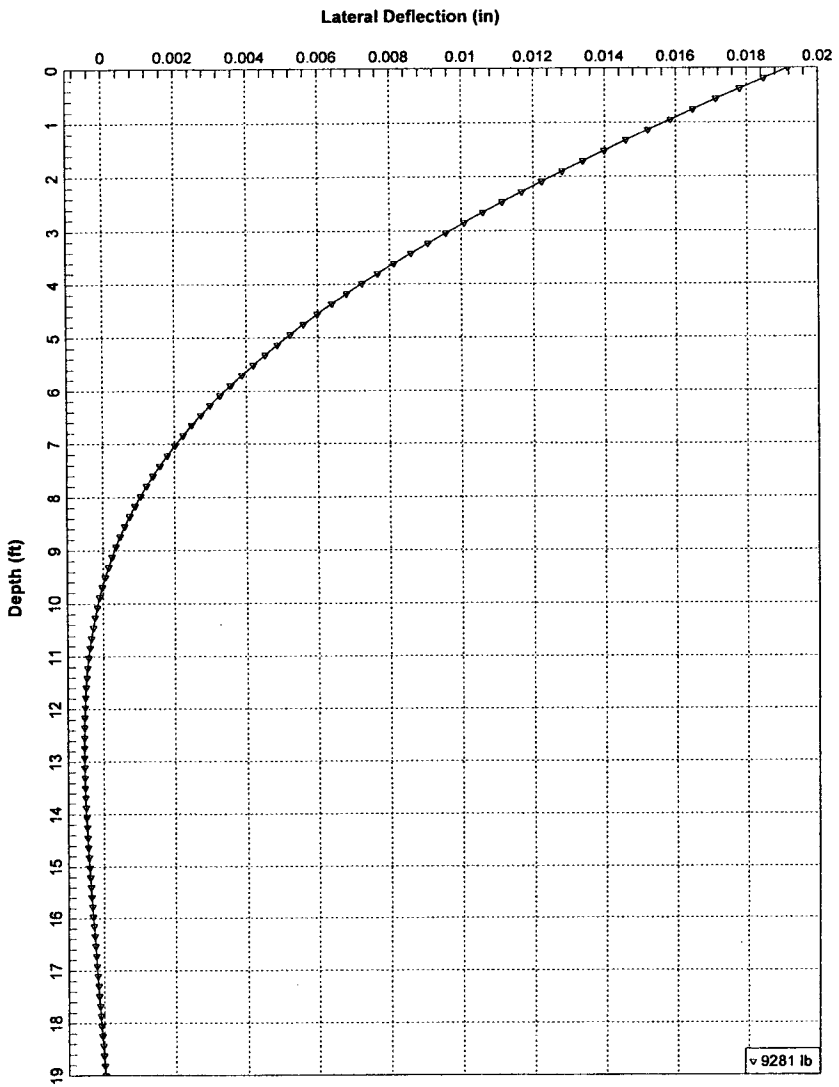
Sign Post "H" at 356+94 (F-3128 lb & M-174479 lb-ft)



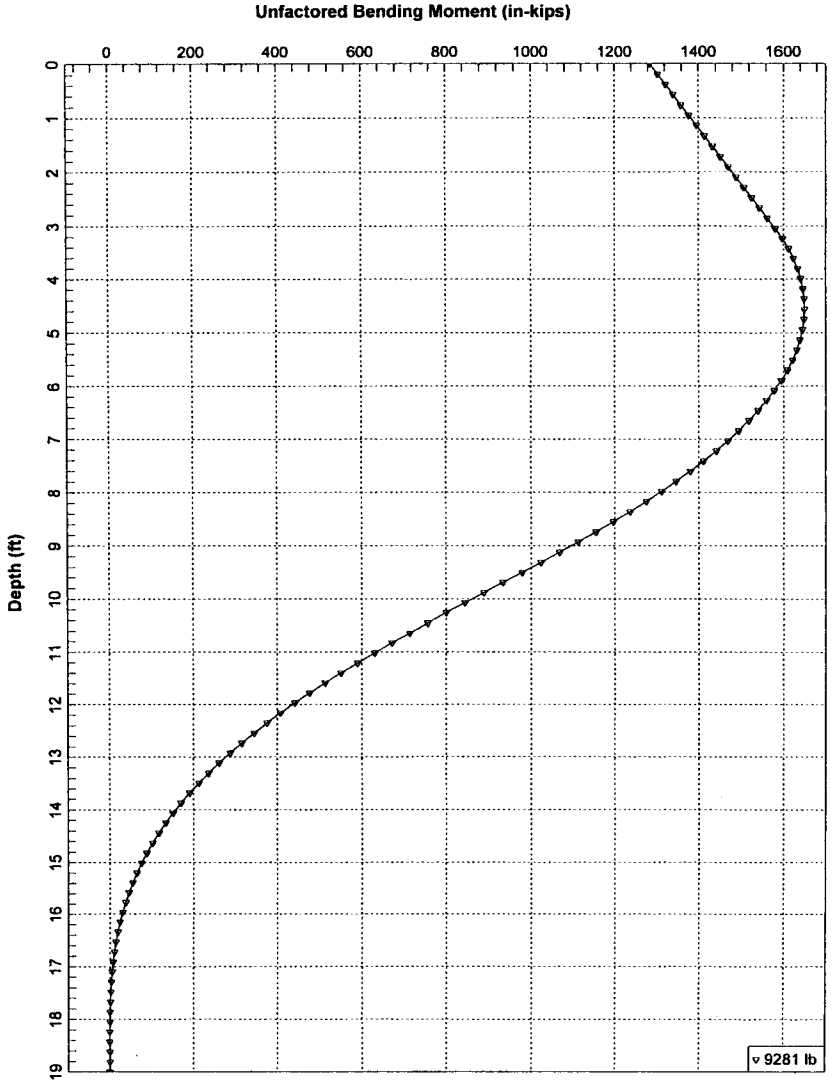
Sign Post "H" at 356+94 (F-3128 lb & M-174479 lb-ft)

Sign Post H at 356+94 (F-8130 lb & M-107073 lb-ft).lpd

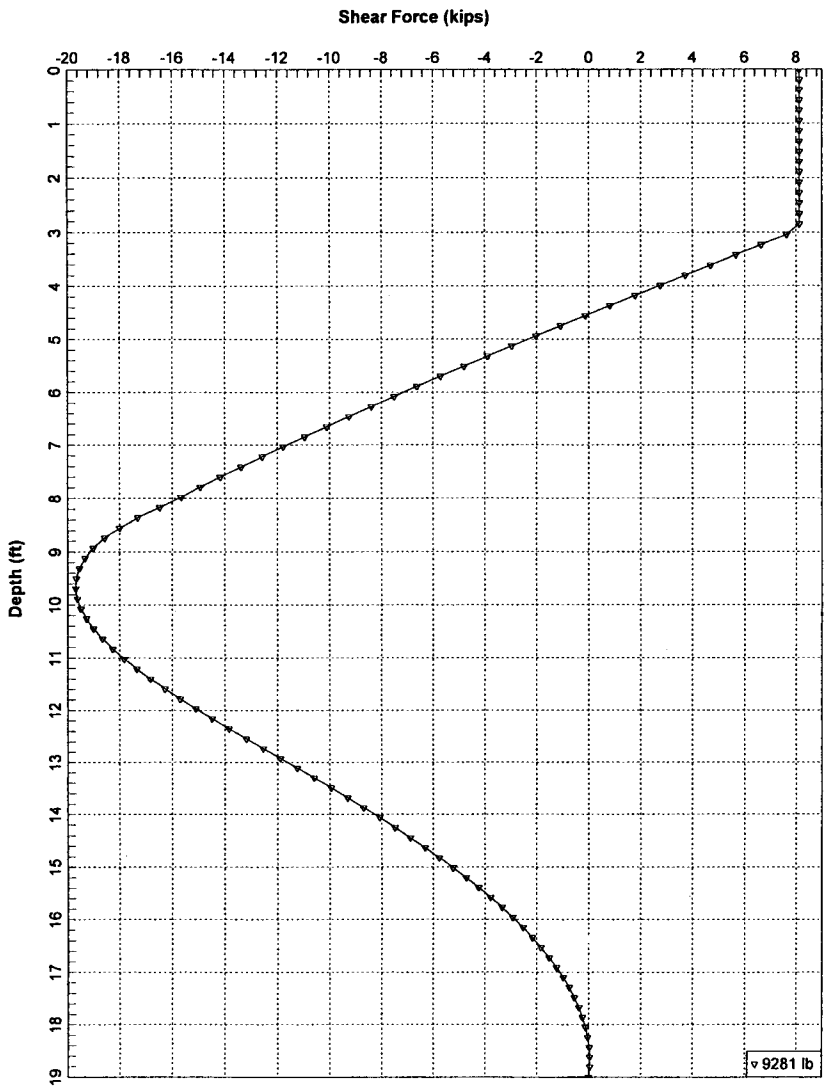
```
LPILEP5
Sign Post "H" at 356+94 (F-8130 lb & M-107073 lb-ft)
1       1       0       0       0       0
100     2       36      228     0
0       54      208696.4        2290    3000000
228     54      208696.4        2290    3000000
3       6       6       0       0
3       36      96      0       0
3       96      150     0       0
3       150     228     0       0
36      0.072
96      0.072
96      0.072
150     0.072
150     0.036
228     0.036
36      13.89   0       0.0033  0
96      13.89   0       0.0033  0
96      20.83   0       0.0024  0
150     20.83   0       0.0024  0
150     20.83   0       0.0024  0
228     20.83   0       0.0024  0
0       1       1
1
1       8130    1284876 9281
0
1       1       0
100     1E-5    100
```



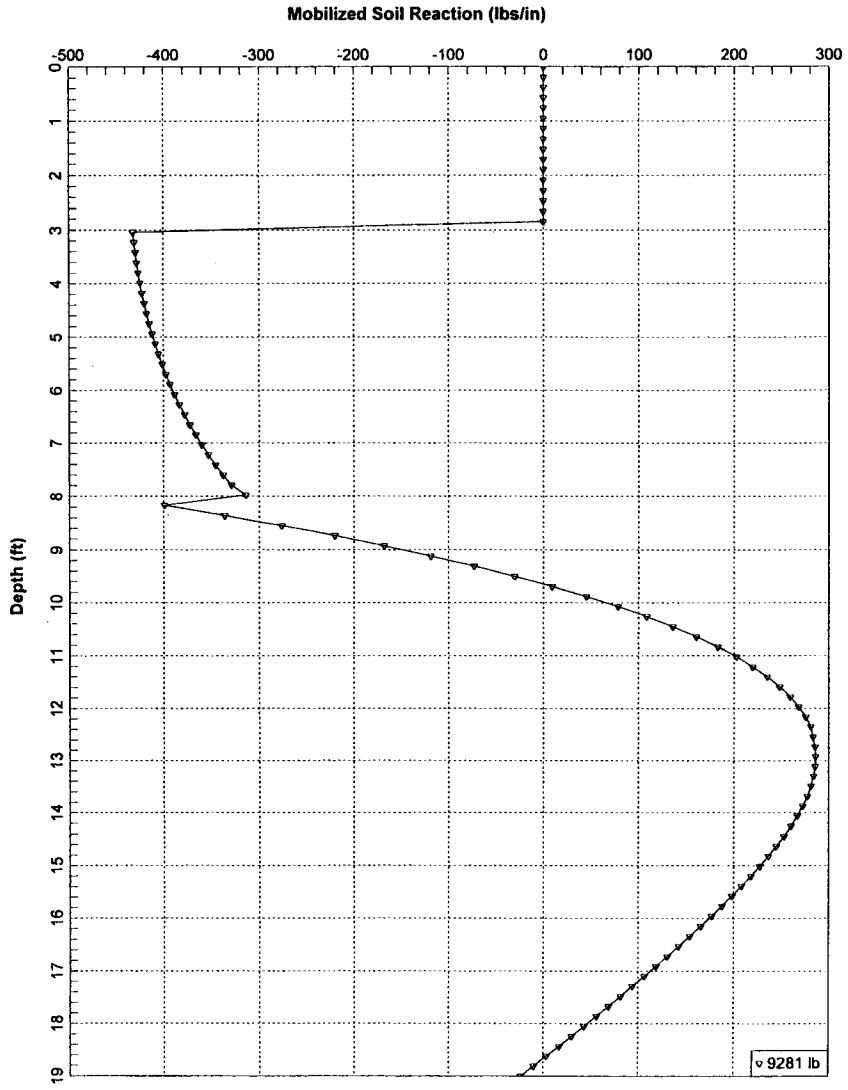
Sign Post "H" at 356+94 (F-8130 lb & M-107073 lb-ft)



Sign Post "H" at 356+94 (F-8130 lb & M-107073 lb-ft)



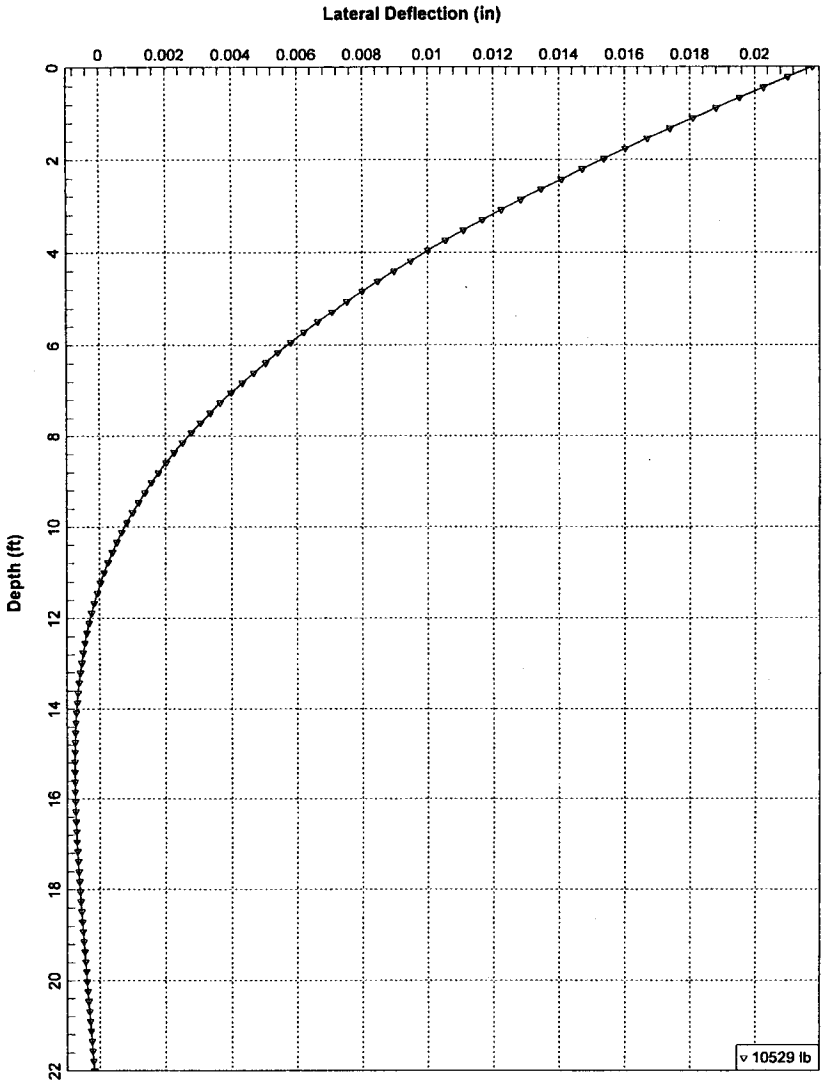
Sign Post "H" at 356+94 (F-8130 lb & M-107073 lb-ft)



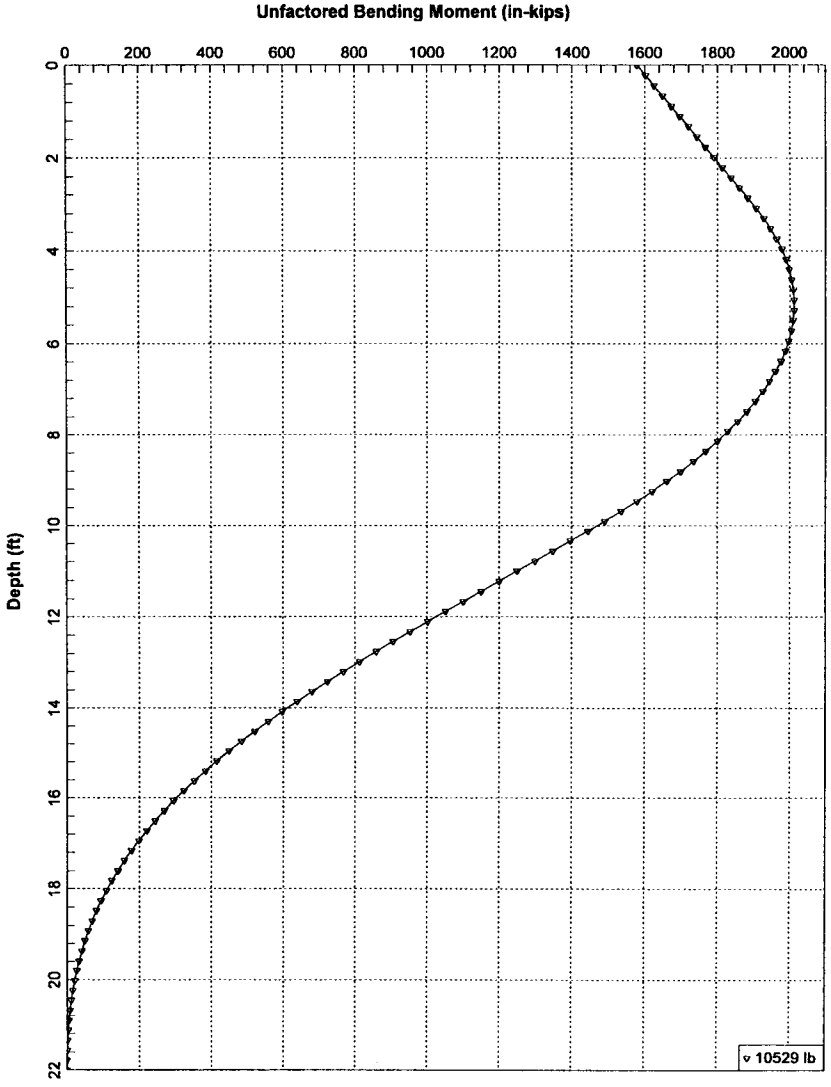
Sign Post "H" at 356+94 (F-8130 lb & M-107073 lb-ft)

Sign Post I at 384+22 (F-8924 lb & M-131555 lb-ft).lpd

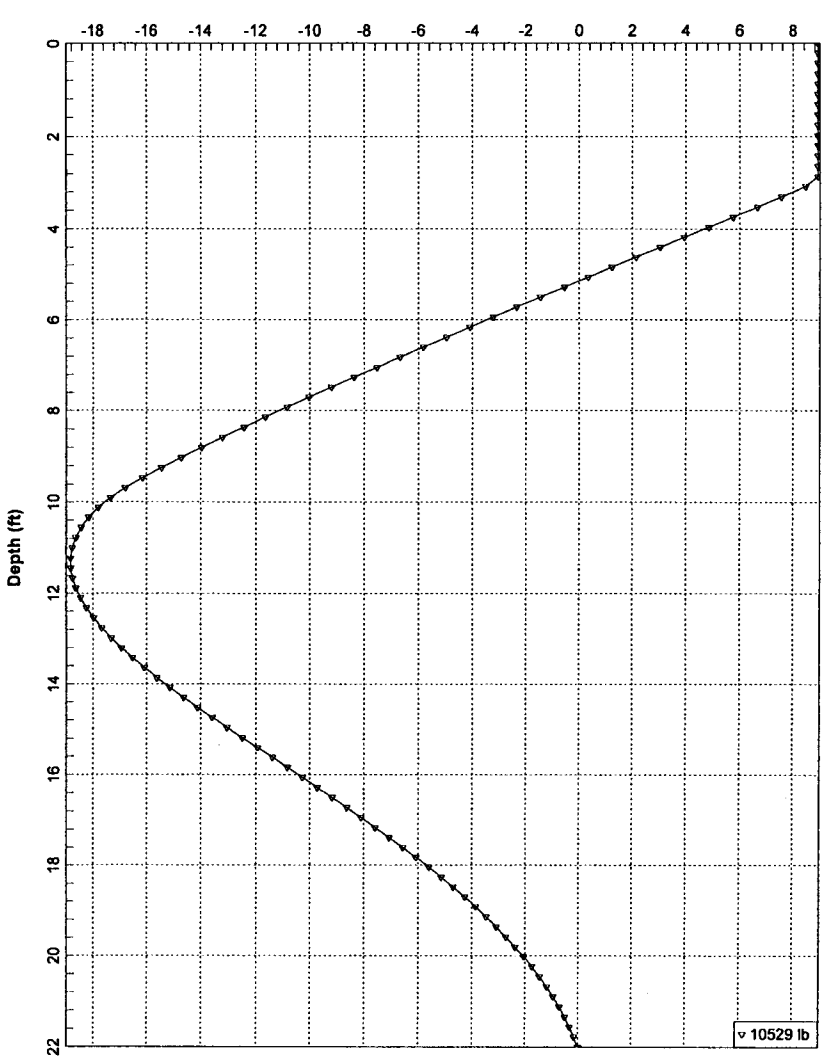
```
LPILEP5
Sign Post "I" at 384+22 (F-8924 lb & M-131555 lb-ft)
1       1       0       0       0       0
100     2       36      264     0
0       60      318086.3        2827    3000000
264     60      318086.3        2827    3000000
2       4       4       0       0
3       36      180     0       0
3       180     264     0       0
36      0.072
180     0.072
180     0.036
264     0.036
36      10.42   0       0.0047  0
180     10.42   0       0.0047  0
180     10.42   0       0.0047  0
264     10.42   0       0.0047  0
0       1       1
1
1       8924    1578660 10529
0
1       1       0
100     1E-5    100
```



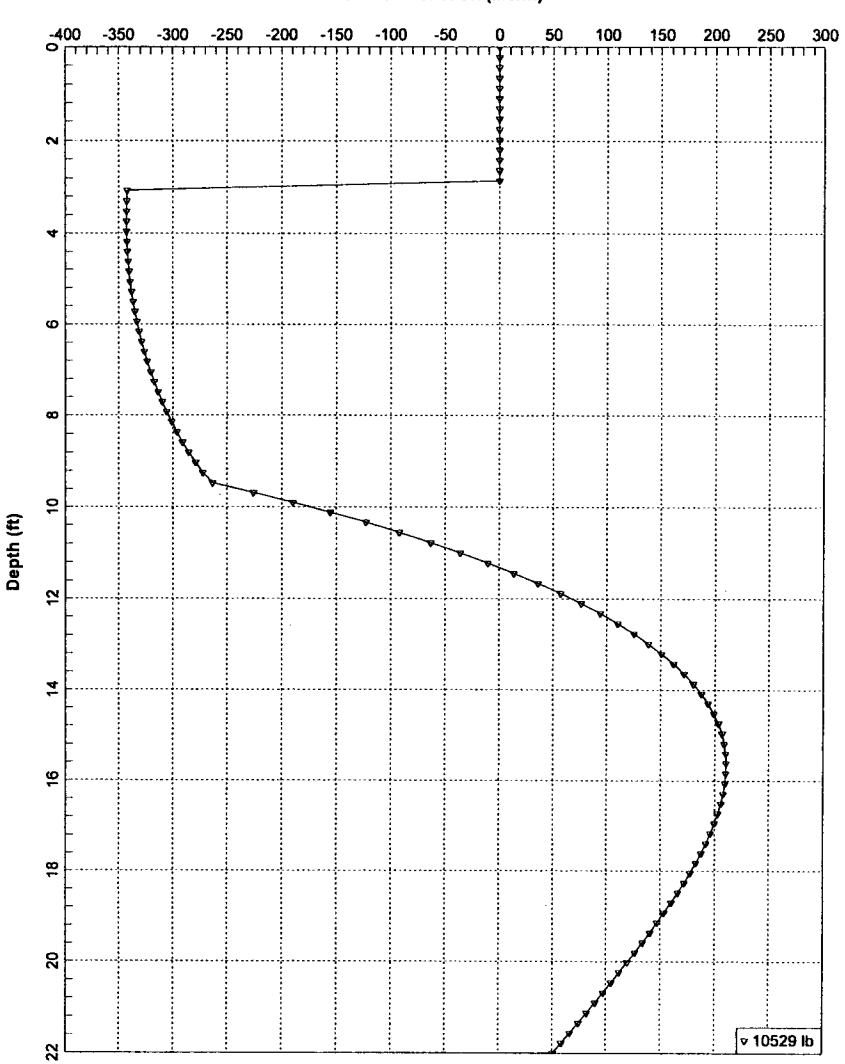
Sign Post "I" at 384+22 (F-8924 lb & M-131555 lb-ft)



Sign Post "I" at 384+22 (F-8924 lb & M-131555 lb-ft)



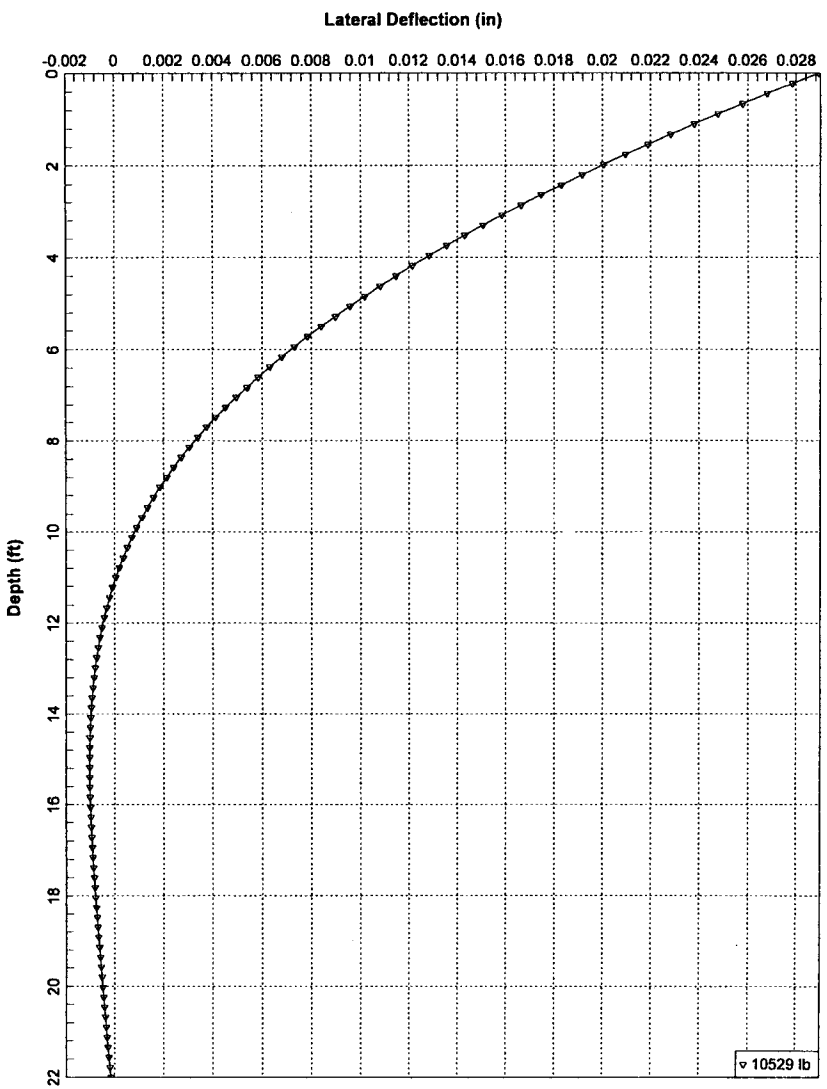
Sign Post "I" at 384+22 (F-8924 lb & M-131555 lb-ft)



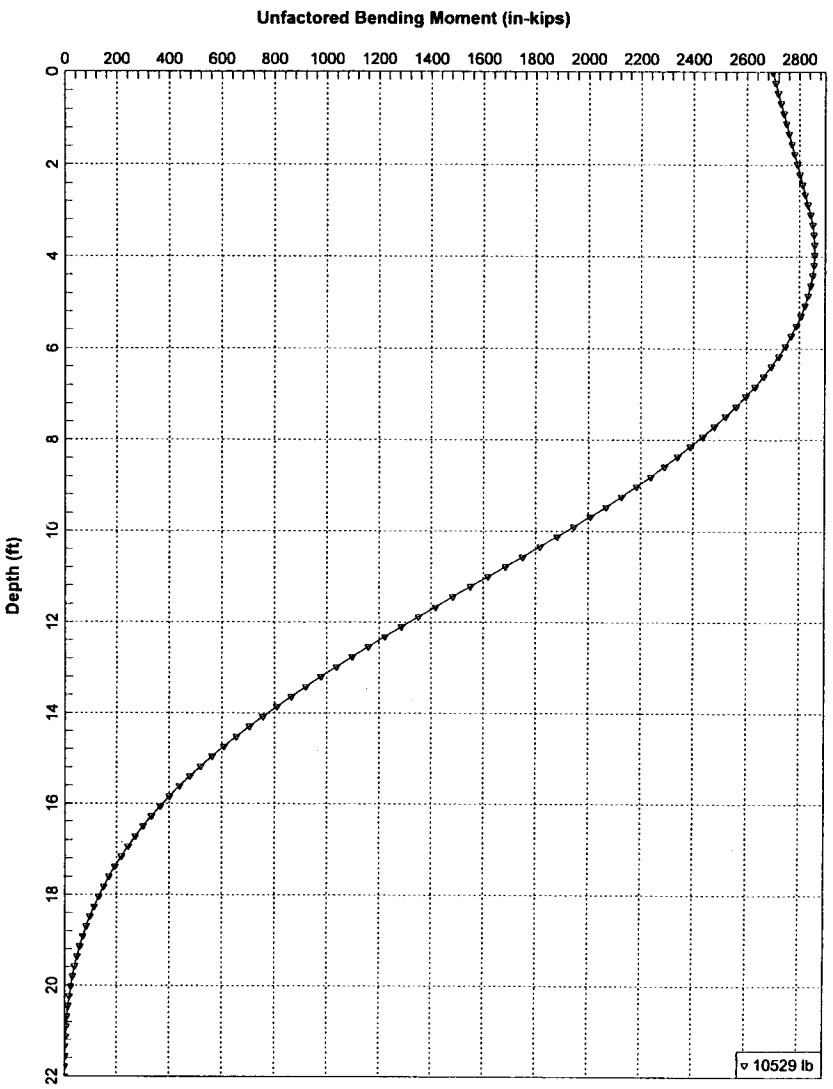
Sign Post "I" at 384+22 (F-8924 lb & M-131555 lb-ft)

Sign Post I at 384+22 (F-3922 lb & M-224867 lb-ft).lpd

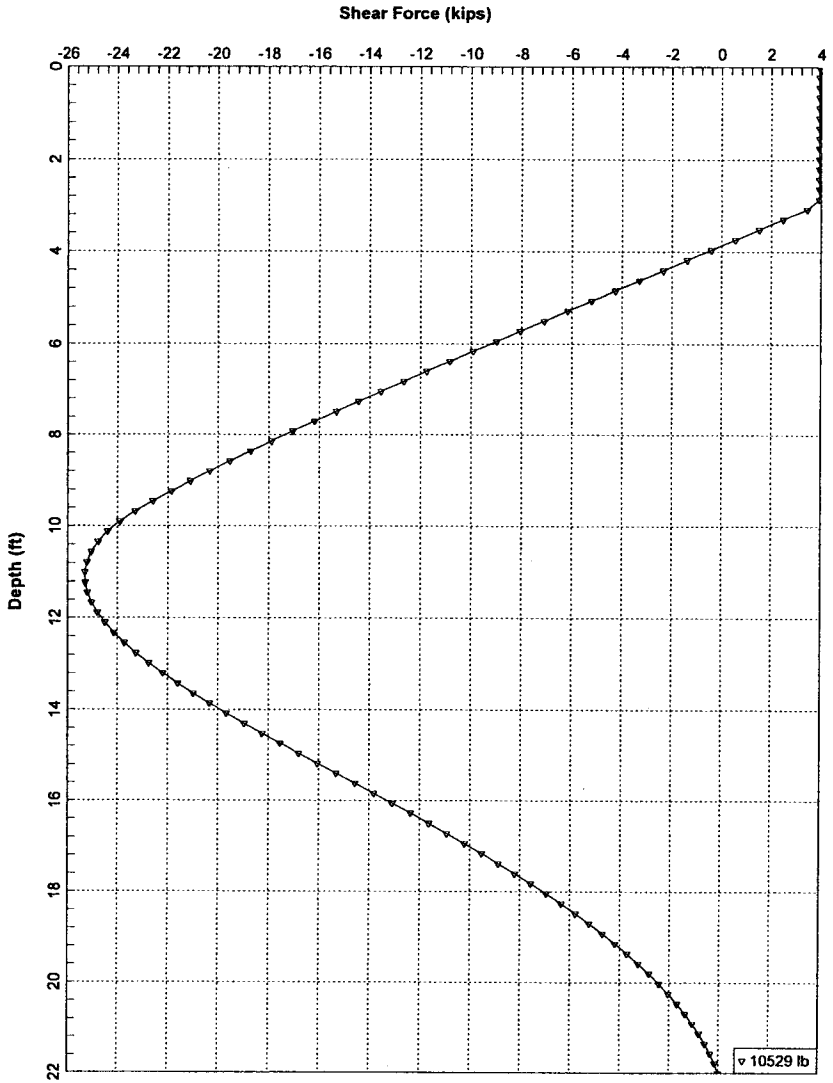
```
LPILEP5
Sign Post "I" at 384+22 (F-3922 lb & M-224867 lb-ft)
1       1       0       0       0       0
100     2       36      264     0
0       60      318086.3        2827    3000000
264     60      318086.3        2827    3000000
2       4       4       0       0
3       36      180     0       0
3       180     264     0       0
36      0.072
180     0.072
180     0.036
264     0.036
36      10.42   0       0.0047  0
180     10.42   0       0.0047  0
180     10.42   0       0.0047  0
264     10.42   0       0.0047  0
0       1       1
1
1       3922    2698404 10529
0
1       1       0
100     1E-5    100
```



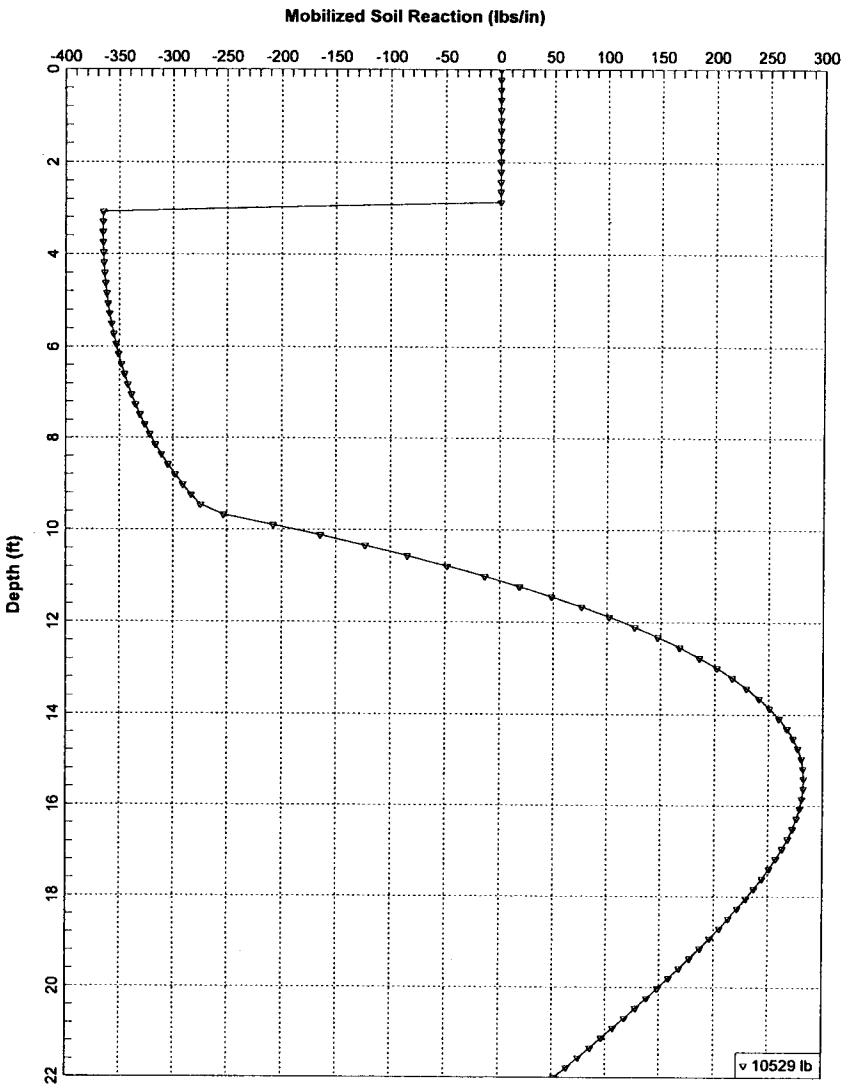
Sign Post "I" at 384+22 (F-3922 lb & M-224867 lb-ft)



Sign Post "I" at 384+22 (F-3922 lb & M-224867 lb-ft)



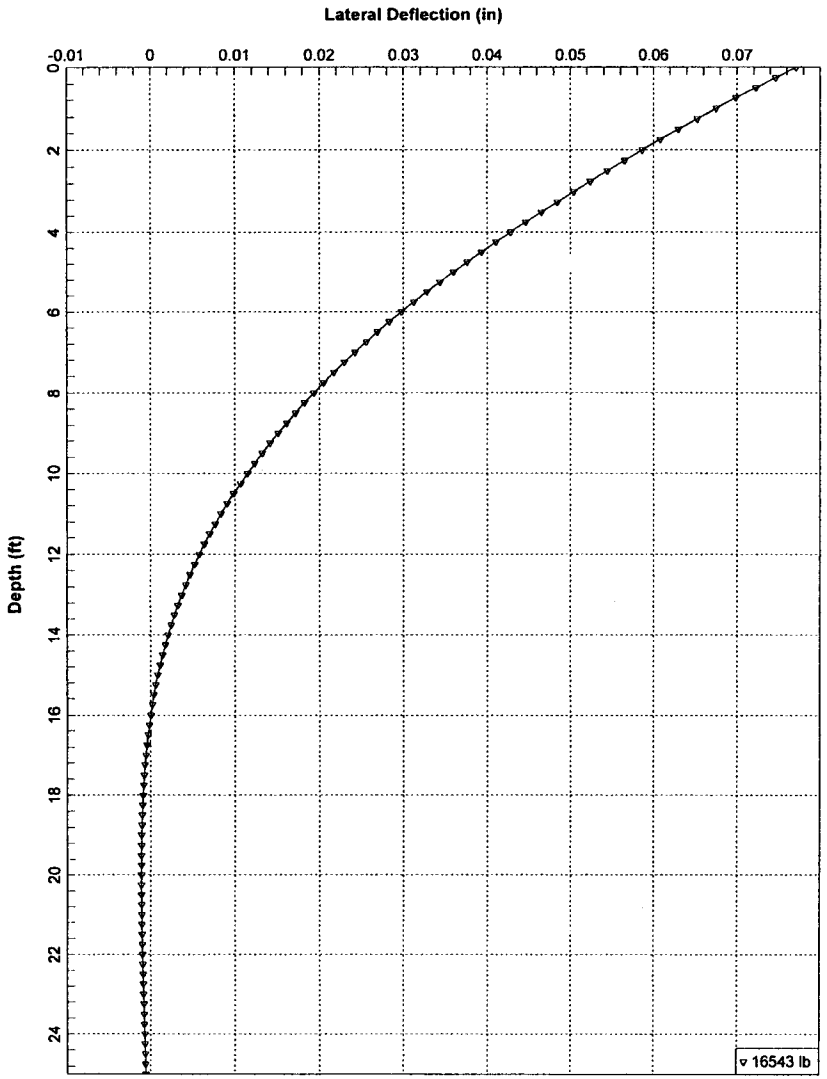
Sign Post "I" at 384+22 (F-3922 lb & M-224867 lb-ft)



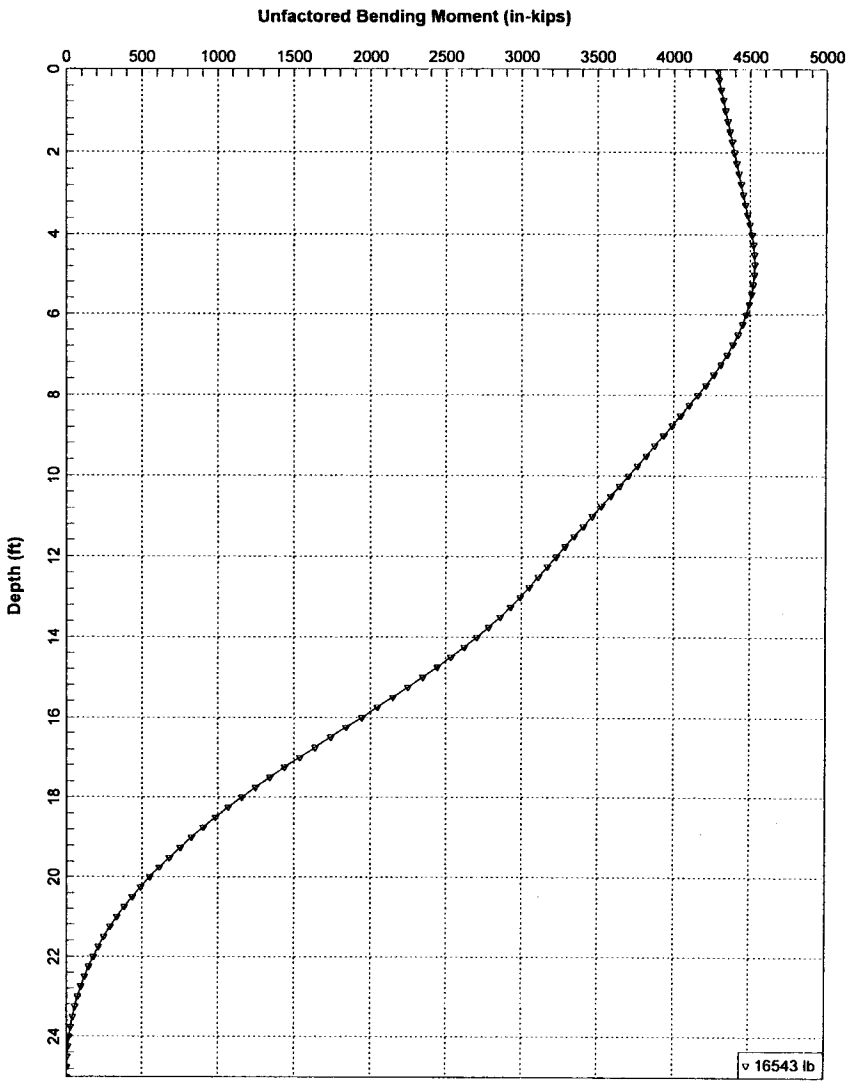
Sign Post "I" at 384+22 (F-3922 lb & M-224867 lb-ft)

Sign Post K at 393+50 (F-4854 lb & M-356637 lb-ft).lpd

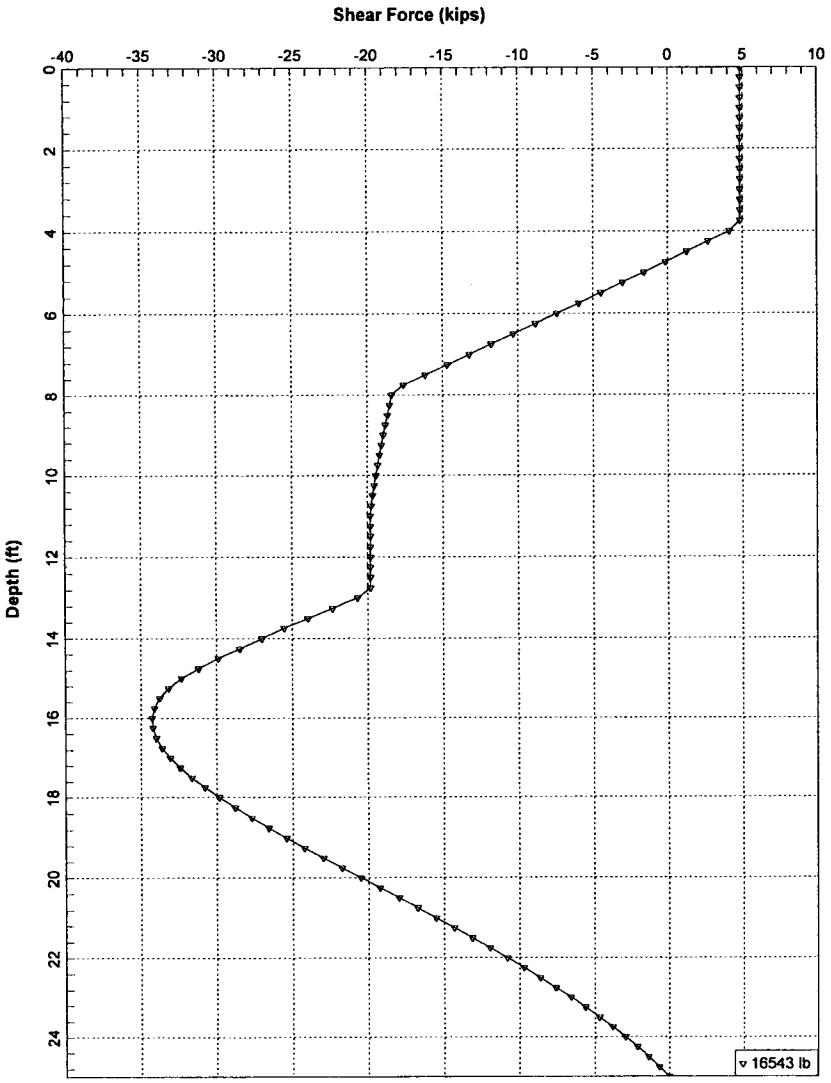
```
LPILEP5
Sign Post "K" at 393+50 (F-4854 lb & M-356637 lb-ft)
1       1       0       0       0       0
100     2       48      300     0
0       60      318086.3        2827.4  3000000
300     60      318086.3        2827.4  3000000
4       8       8       0       0
3       48      96      0       0
4       96      132     39.5    39.5
10      132     156     0       0
3       156     336     0       0
48      0.072
96      0.072
96      0.072
132     0.072
132     0.036
156     0.036
156     0.036
336     0.036
48      10.42   0       0.0044  0
96      10.42   0       0.0044  0
96      0       34      0       0
132     0       34      0       0
132     0       0       0       0
156     0       0       0       0
156     8.68    0       0.0044  0
336     8.68    0       0.0044  0
0       1       0
1
1       4854    4279644 16543
0
1       1       0
100     1E-5    100
```



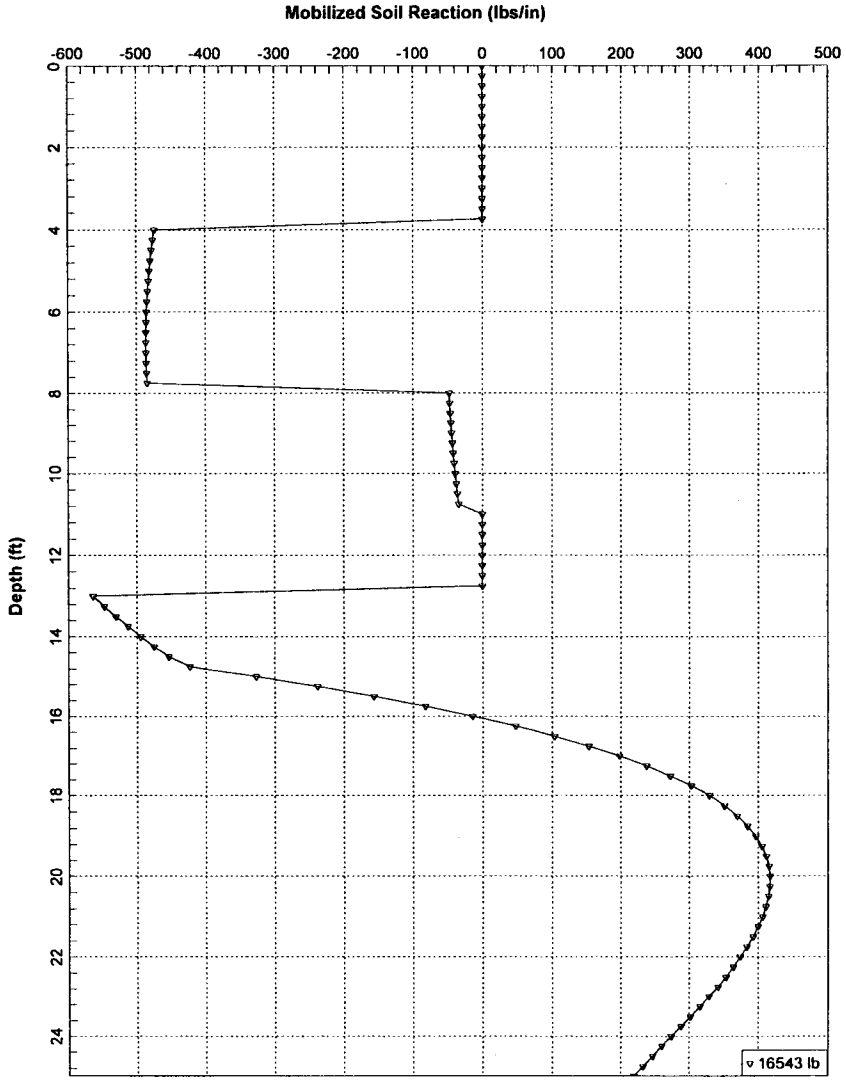
Sign Post "K" at 393+50 (F-4854 lb & M-356637 lb-ft)



Sign Post "K" at 393+50 (F-4854 lb & M-356637 lb-ft)



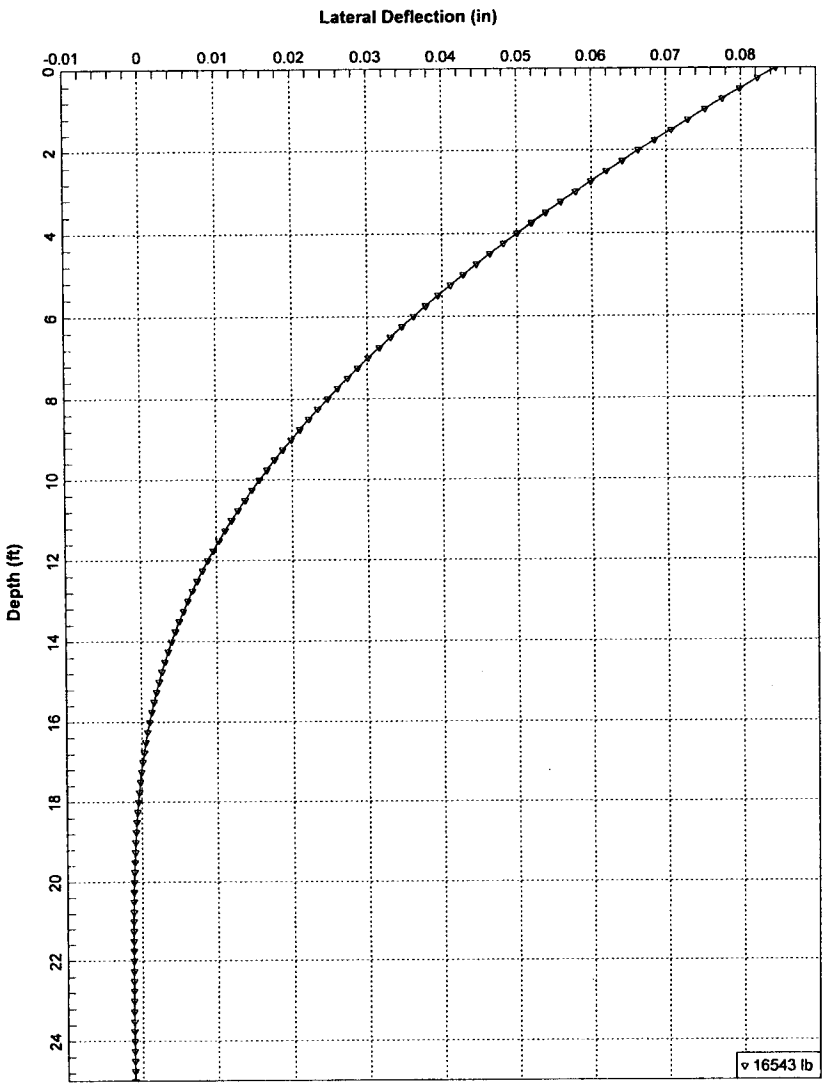
Sign Post "K" at 393+50 (F-4854 lb & M-356637 lb-ft)



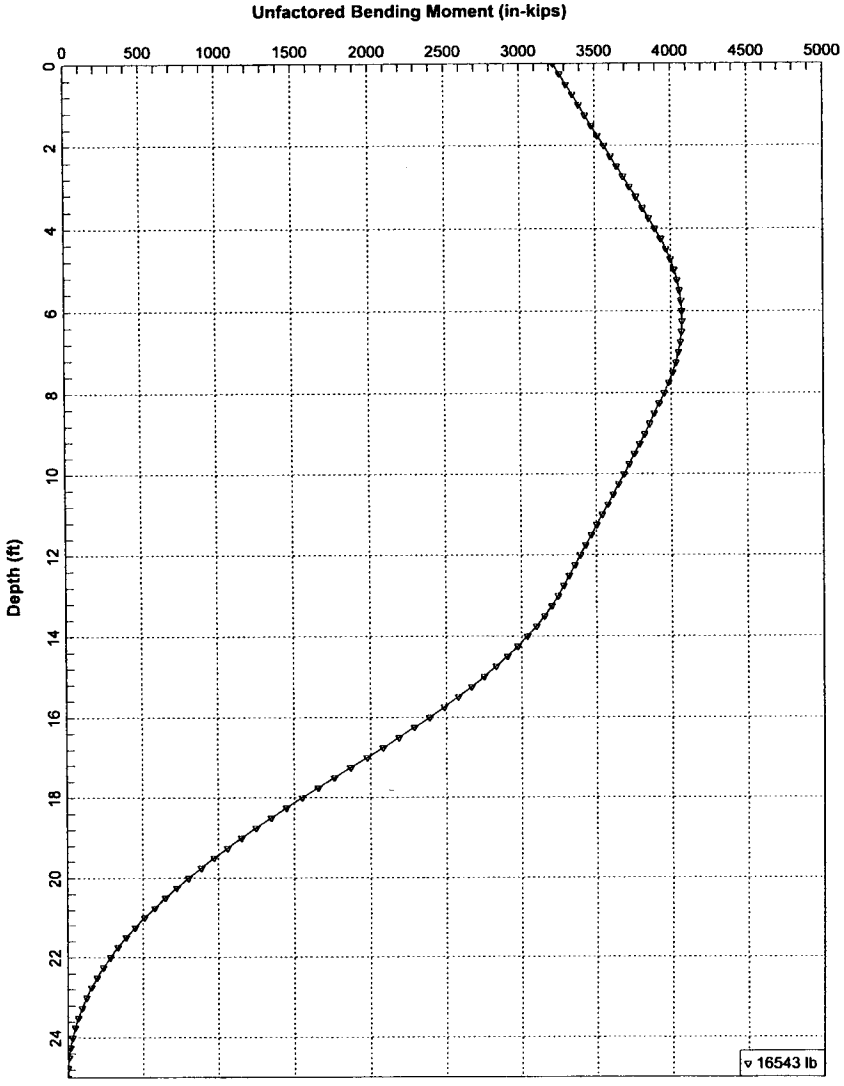
Sign Post "K" at 393+50 (F-4854 lb & M-356637 lb-ft)

Sign Post K at 393+50 (F-13966 lb & M-268990 lb-ft).lpd

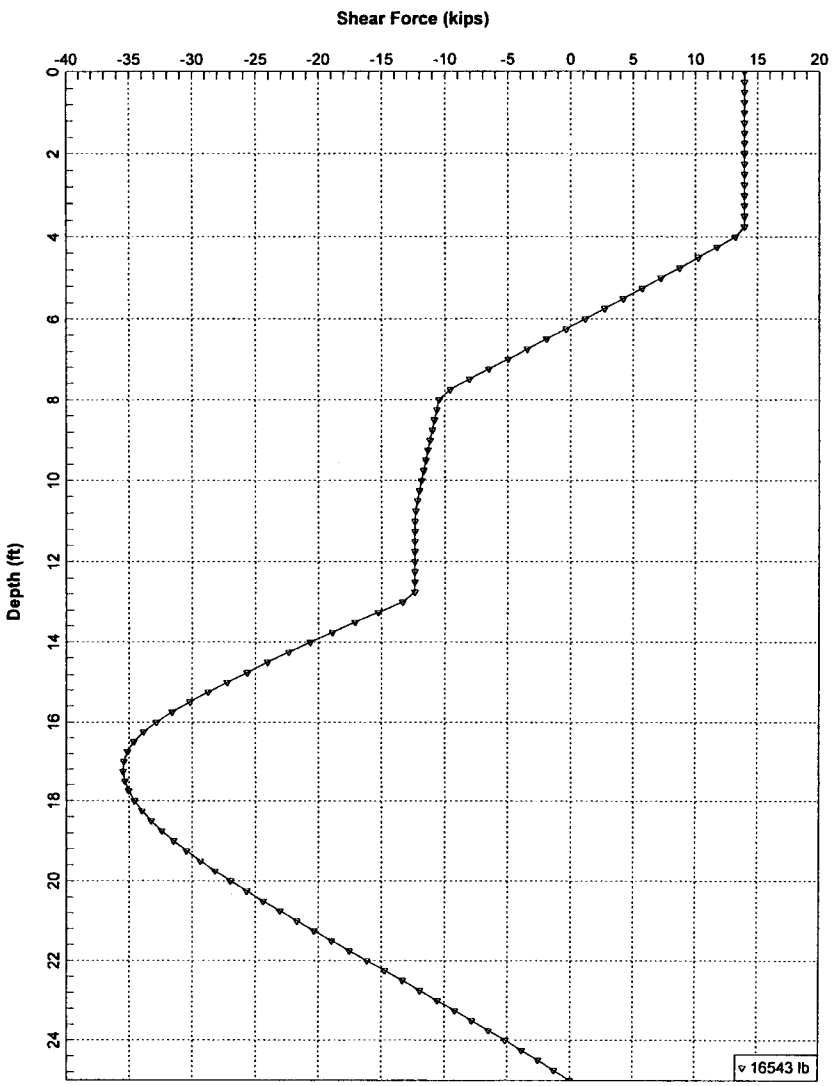
```
LPILEP5
Sign Post "K" at 393+50 (F-13966 lb & M-268990 lb-ft)
1       1       0       0       0       0
100     2       48      300     0
0       60      318086.3        2827.4  3000000
300     60      318086.3        2827.4  3000000
4       8       8       0       0
3       48      96      0       0
4       96      132     39.5    39.5
10      132     156     0       0
3       156     336     0       0
48      0.072
96      0.072
96      0.072
132     0.072
132     0.036
156     0.036
156     0.036
336     0.036
48      10.42   0       0.0044  0
96      10.42   0       0.0044  0
96      0       34      0       0
132     0       34      0       0
132     0       0       0       0
156     0       0       0       0
156     8.68    0       0.0044  0
336     8.68    0       0.0044  0
0       1       0
1
1       13966   3227880 16543
0
1       1       0
100     1E-5    100
```



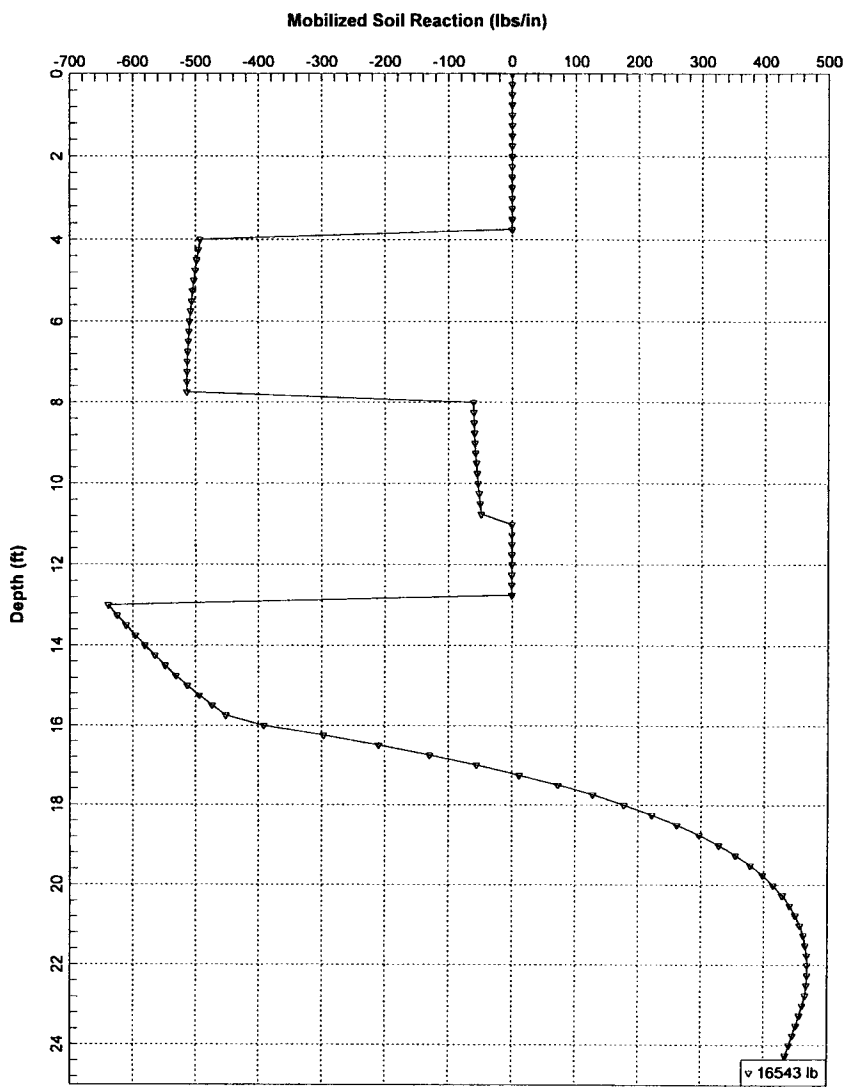
Sign Post "K" at 393+50 (F-13966 lb & M-268990 lb-ft)



Sign Post "K" at 393+50 (F-13966 lb & M-268990 lb-ft)



Sign Post "K" at 393+50 (F-13966 lb & M-268990 lb-ft)



Sign Post "K" at 393+50 (F-13966 lb & M-268990 lb-ft)

APPENDIX D

PARIKH
Practicing in the Geosciences

Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

RAJAPPAN & MEYER
1038 Leigh Avenue, Suite 100
San Jose, CA 95128

August 25, 2009
Job No.: 206144.GDR

Attn.: Mr. Jiri Vitek

Subject: Response to Caltrans Review Comments (dated July 15, 2009)
Geotechnical Design & Materials Report
I-205 Auxiliary Lane Project, San Joaquin County, California

Ref: 10-SJ-205-PM 1.9/R7.9 CU 06241 EA 10-0Q2701

Based on the review comments from Caltrans dated July 15, 2009, we have the following responses:

Comment 1: Information for the elevations of the proposed footing/pile footing bottoms and retention basin bottoms are not available. This information could be vital to evaluate the subsurface conditions for the proposed constructions.

Response 1: The footing/basin bottom elevations will be provided.

Comment 2: Due to the L/B ratio of the proposed footing, plain strain condition may be more appropriate for the soils beneath the footings and the influence zone will extend as deep as 4B below the bottom of the footings. As such, subsurface conditions may need to be explored to greater depths.

Response 2: The boring program was developed according to the original project scope, and the project has evolved during the previous design phases after the explorations have been finished. According to the review comments, the depths of the borings should be appropriate for Retaining Walls No. 1 thru 5 and 7. For the rest of the wall, the boring data could be explored to greater depths as recommended.

However, the available boring data are generally extended greater than two times the footing widths (2B), which should provide sufficient data for estimating the allowable bearing capacity for the proposed Caltrans standard retaining walls, and the current recommendations should be valid. Additional field exploration can be planned to greater depths; however, based on the soil condition and the schedule constraints, in our opinions this effort should be waived.

Comment 3: Some of the borings indicate that GW is in close proximity to the proposed foundation bottoms. Has buoyancy been considered for the proposed foundations? Geotextile has been recommended for some of the retaining wall to stabilize

foundation subgrade. If buoyancy is a consideration, drainage should be considered when using geotextile.

Response 3: Buoyancy was not considered for the foundation design. Other than subgrade stabilization, the geotextile could also serve as a "load distribution bridge" for reducing loads and differential settlements.

Comment 4: If the interaction of the proposed sound wall and the existing CMS is of concern, consideration maybe given to limit the spacing between the existing CIDH pile and the proposed CIDH piles to a distance no less than 3 times the diameter of the piles.

Response 4: Will further discuss with the designer regarding this issue. However, based on our analysis, the impact is considered low.

Comment 5: Liquefaction and associated downdrag on CIDH piles are judged to be potential for some of the CMS sites. Based on the LOTBs and recommended pile lengths, some of the CIDH piles are to be terminated at depths above or slightly above the potential liquefiable soils. How would downdrag affect these piles?

Response 5: Based on the boring data, downdrag load may be anticipated on the order of 30 kips. However, the CMS sign is a relatively light structure, and the vertical design load is approx. 4 kips. According to our calculation, the pile length of 22 feet is considered sufficient to provide vertical resistance, including the downdrag force.

Very truly yours,
PARIKH CONSULTANTS, INC.

Frank Y. Wang, P.E., 67751
Project Engineer

Gary Parikh, P.E., G.E., 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-09
GEOTECHNICAL
STATE OF CALIFORNIA

Attachments: Caltrans Review Comments (dated July 15, 2009)

Office of Special Funded Projects
Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 10 **EA:** 10-0Q2701 **Project Name:** I-205 Auxiliary Lane	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection	☐ 65% PS&E Unchecked Details ☐ PS&E (Review No. _) ☐ Construction Support ☒ Other: Geotechnical Design & Material Report	**Reviewer Name:** Thomas Song **Functional Unit:** Geotechnical Design North (59-323) **Phone Number:** (916) 227-1054 **e-mail:** Thomas_song@dot.ca.gov **Date:** 7/15/09
Design Manager: Caroline Reyes **Project Engineer:** Jes Padda **Phone Number:** (209) 942-6028	**Structure Information** **Structure Name:**		

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

No.	Document Location (Page, Section, SSP)	OGDN Review Comment	Response	✓
1	General	Information for the elevations of the proposed footing/pile footing bottoms and retention basin bottoms are not available. This information could be vital to evaluate the subsurface conditions for the proposed constructions.		
2	8.4 Retaining Walls, General	Due to the L/B ratio of the proposed footing, plain strain condition maybe more appropriate for the soils beneath the footings and the influence zone will extend as deep as 4B below the bottom of the footings. As such, subsurface conditions may need to be explored to greater depths.		

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

3	8.4 Retaining Walls, General	Some of the borings indicate that GW is in close proximity to the proposed foundation bottoms. Has buoyancy been considered for the proposed foundations? Geotextile has been recommended for some of the retaining wall to stabilize foundation subgrade. If buoyancy is a consideration, drainage should be considered when using geotextile.		
4	8.5.1 Sound Wall Extension at Sta. 126+00	If the interaction of the proposed sound wall and the existing CMS is of concern, consideration maybe given to limit the spacing between the existing CIDH pile and the proposed CIDH piles to a distance no less than 3 times the diameter of the piles.		
5	8.5.3 Changeable Message Signs (CMS)	Liquefaction and associated downdrag on CIDH piles are judged to be potential for some of the CMS sites. Based on the LOTBs and recommended pile lengths, some of the CIDH piles are to be terminated at depths above or slightly above the potential liquefiable soils. How would downdrag affect these piles?		

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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✓= Comment Resolved
(for Reviewer's use)

DESIGN COMMENT REVIEW AND RESPONSE

Project Title: I-205 Auxiliary Lanes	Submittal: 95%	Location: City of Stockton		
By: Frank Wang (Parikh Consultants, Inc.)	Date of Response:	CODE:	A-Will Comply C-Will Not Incorporate	B-Consultant to Evaluate D-City/Caltrans to Evaluate

Comment By	Item No.	Drawing/ Page No.	Review Comment	Design Response
Tom Song	49	Geotechnical Report	Numbering of boreholes is not consistent throughout the Geotech Report	Will rectify.
	50	Page 16	Ground water level is close to the bottom of footing as such based on the groundwater levels shown on the LOTBs, excavation depth would exceed 10' safety/stability would not need to be considered more closely.	Based on the subsurface condition, the subsoils generally consist of fine-grained materials. It is recommended that the temporary cut slope be 1:1 or flatter. In our opinion, the cut slope should be satisfactory during the construction of the retaining walls. The proposed footing excavation should conform to Caltrans standard specification Section 19-3.04. Will provide more information regarding this comment.
	51	Page 10	Title numbering is not consistent.	Will rectify.
	52	Pages 19-22	Estimated settlements associated w/ liquefaction may need to be provided to aid structural design for retaining walls 7-11.	Will comply. The estimated post-liquefaction settlement is generally on the order of 1/2 inch to 1 inch. Detail discussion will be provided in the subsequent submittal.
	53		Clays with moderate to high plasticity and shrink/swell potential were encountered at several localized areas. They may need to be discussed distinctively.	Will comply. However, the bottom of the footing is generally embedded 34 inches or more below the lowest adjacent finish grade. In our opinion, the moisture fluctuation should be relatively minor. In order to reduce potential expansion, it is recommended that the expansive subgrade be compacted at about 2% to 3% over optimum moisture content.

DESIGN COMMENT REVIEW AND RESPONSE

Project Title: I-205 Auxiliary Lanes	Submittal: 95%	Location: City of Stockton		
By: Frank Wang (Parikh Consultants, Inc.)	Date of Response:	CODE:	A-Will Comply	B-Consultant to Evaluate
			C-Will Not Incorporate	D-City/Caltrans to Evaluate

Comment By	Item No.	Drawing/ Page No.	Review Comment	Design Response
	54	LOTB 4 of 10	Borings RW-20A and RW-23 may have been terminated too shallow to investigate the thickness of the clay/fat clay layers and groundwater.	RW-20 was originally planned to be drilled by truck-mounted rig to 45 feet deep from the top of the embankment. Due to the limited access (narrow shoulder), we have utilized portable minuteman rig to conduct the exploration. The boring was then divided into two separate borings (1) RW-20A from the top of the embankment to 20 feet depth; and (2) RW-20B from the toe of the embankment to 25 feet depth. Boring RW-23 was drilled mainly to verify the material type at the invert of the proposed detention basin. The soil strata and groundwater information can be referred to the nearby borings.
	55	Page 24	Third Paragraph – type of the foundation of the existing CMS may need to be provided to evaluate its impact.	Based on the information provided by the designer, the existing CMS is Type VI post, supported on 5'-9" square pedestal with 5-foot diameter CIDH of 22 feet long. The existing CMS information will be added in the report for the subsequent submittal.
	56	Page 24	Fourth Paragraph – Minimum dimension of the gap recommended may need to be given.	In our opinion, it is recommended that a minimum 2-inch gap be maintained between the existing post and the new sound wall.

DESIGN COMMENT REVIEW AND RESPONSE

Project Title: I-205 Auxiliary Lanes	Submittal: 95%	Location: City of Stockton		
By: Frank Wang (Parikh Consultants, Inc.)	Date of Response:	CODE:	A-Will Comply	B-Consultant to Evaluate
			C-Will Not Incorporate	D-City/Caltrans to Evaluate

Comment By	Item No.	Drawing/ Page No.	Review Comment	Design Response
	57	Page 25, 26 and 27	Based on the recommended pile length, the CIDH piles will be installed through the identified potentially liquefiable soils. How is liquefaction been considered in the CIDH pile recommendations, such as downdrag and settlement and loss of lateral capacity.	The proposed CMS and other sign structures will be constructed per Caltrans standard. The loads were provided by the structural engineer to verify the feasibility of the standard design. For lateral pile capacity analysis, the effect of liquefaction was accounted for by using the p-y relationship for liquefied sand presented by Rollins et al (2003) of LPILE Plus Ver. 5.0 (ENSOFT). The capacities within the potential liquefaction zone were neglected for estimating torsional and vertical resistances. Down drag force due to post-liquefaction settlement was only considered for vertical pile capacity. Based on loads provided and the analysis results, the resultant resistance appeared to be adequate.

DESIGN COMMENT REVIEW AND RESPONSE

Project Title: I-205 Auxiliary Lanes	Submittal: 95%	Location: City of Stockton		
By: Frank Wang (Parikh Consultants, Inc.)	Date of Response:	CODE:	A-Will Comply	B-Consultant to Evaluate
			C-Will Not Incorporate	D-City/Caltrans to Evaluate

Comment By	Item No.	Drawing/ Page No.	Team Leader	Review Comment	Design Response
Carolyn Zhen	396	SW-2, Section A-A	PAR	In GDR, please discuss how the new masonry block will impact the existing soundwall.	Per our discussion with the designer, the current sound wall is supported on 12 feet long piles. Based on the subsoils condition, the minimum required pile length for design wall height of 14 feet per Caltrans Standard Plan (Sheet B15-8) is 9 feet long for Case I level ground condition and the recommended angle of shearing resistance (ϕ) of 35°. The existing foundation is considered adequate for the proposed improvement.
Carolyn Zhen	397	GDR: Page 19, last paragraph	PAR	In GDR, its stated "loose silty sand pocket was encountered..." However, in LOTB sheet 4 of 10, a silty sand layer was noted.	The loose silty sand layer encountered in Boring RW-19 appears to be relatively thin and discontinuous. The sand layers encountered in Boring RW-18B & RW-20B are at different elevations and appear to be dense to very dense. The text will be revised to "loose silty sand lens was encountered..."
Carolyn Zhen	398	GDR: page 21, 4th para.	PAR	In GDR, its stated "loose silty sand pocket was encountered..." However, in LOTB sheet 5 of 10, a SP layer was noted.	Will revise the report text.