FOR CONTRACT NO.: 12-0J9604

INFORMATION HANDOUT

MATERIALS INFORMATION

GEOTECHNICAL DESIGN REPORT
AERIALLY DEPOSITED LEAD INVESTIGATION REPORT

ROUTE: 12-Ora-22-R3.6/R12.7

GEOTECHNICAL DESIGN REPORT FOR PROPOSED SOUNDWALL NOS. 224, 603 AND 699 STATE ROUTE 22 BETWEEN BEACH BOULEVARD AND TUSTIN AVENUE, CITIES OF GARDEN GROVE AND ORANGE, CALIFORNIA

CALTRANS DISTRICT 12, ORANGE COUNTY, STATE ROUTE 22,
MILE POSTS: 3.6 TO 12.9, EA 0J9601

Prepared for:

PBS&J
625 The City Drive South, Suite 200
Orange, California 92806

Project No. 602198-001

December 12, 2008

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

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A LEIGHTON GROUP COMPANY

December 12, 2008

Project No. 602198-001

To: PBS&J
625 The City Drive South, Suite 200
Orange, California 92806

Attention: Mr. Alaedin Moubayed

Subject: Geotechnical Design Report for Proposed Soundwall Nos. 224, 603 and 699, State Route 22 between Beach Boulevard and Tustin Avenue, Cities of Garden Grove and Orange, California

In response to your request, Leighton Consulting, Inc. (Leighton) has performed a geotechnical exploration for the proposed Soundwall Nos. 224, 603 and 699 along westbound State Route 22 (SR-22). Our exploration and analysis indicate that the three proposed soundwalls may consist of Caltrans standard soundwalls supported on Cast-In-Drilled-Hole (CIDH) piles.

This report defines the geotechnical conditions as evaluated from field and laboratory test data and used in the development of the geotechnical design. It provides recommendations and specifications for project design and construction. Per the review comment from Caltrans in the email dated August 20, 2008, additional field exploration using Cone Penetration Tests (CPTs) was performed for each of the soundwalls and a draft version of this report was issued on September 11, 2008. An additional review comment was verbally received from Caltrans on December 2, 2008, regarding the survey benchmark for locations and elevations of our borings and CPTs. The survey benchmark has been added on the Log of Test Borings.

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

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Tae Kuk Kim, PE 69316
Project Engineer

Djan Chandra, PE, GE 2376
Senior Principal Engineer

TK/DJC/lr

Distribution: (1) Addressee
(4) RMC, Inc.
Attention: Mr. Michael Han

Leighton

Caltrans Oversight Review Form

In general accordance with Deputy Director Richard P. Weaver's January 28, 1993 memorandum the project is approved regarding impact on State facilities and conformance with applicable State standards and practices, and technical oversight was performed as described in the California Department of Transportation A&E Consultant Services Manual.

Caltrans personnel who had responsibility of geotechnical oversight:

Name	Title	Registration No.
Civil Engineer		

Name	Title	Registration No.
Engineering Geologist		

Leighton

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Leighton

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1.0 INTRODUCTION

1.1 Project Description

The three proposed soundwalls will be located along westbound SR-22 between Beach Boulevard and Tustin Avenue in the cities of Garden Grove and Orange, California. The approximate location of the soundwalls is shown on Figure 1.

Soundwall No. 224 will be approximately 777 feet long, to be located on the eastbound onramp from northbound Beach Boulevard in the city of Garden Grove, California. An existing block wall of the same length will be removed to accommodate the new wall. The new soundwall will consist of an approximately 14-foot high masonry block wall supported on Cast-In-Drilled-Hole (CIDH) piles.

Soundwall No. 603 will be approximately 47 feet long, to be located east of SR-22 and Interstate 5 (I-5) Connector in the city of Orange, California. It will consist of an approximately 14-foot high masonry block soundwall supported on CIDH piles. The individual piles will be connected with a pile cap or concrete barrier.

Soundwall No. 699 will be approximately 2,000 feet long, to be located east of Cambridge along westbound SR-22 in the city of Orange, California. The new soundwall will replace the existing Soundwall No. 2 currently located at the same location. The existing soundwall is 8 to 10 feet high, supported on 12- to 14-inch diameter, 7.7 to 12.5 feet long CIDH piles. The new soundwall will consist of an approximately 16-foot high masonry block wall supported on CIDH piles.

1.2 Purpose and Scope

The purpose of our geotechnical exploration was to evaluate the subsurface conditions with respect to the proposed project and to provide geotechnical recommendations for design and construction. Our scope of services included the following tasks:

- *Literature Review*: We reviewed various documents pertinent to the project site including boring logs for SR-22 HOV lane widening and as-built Log of Test Borings (LOTBs) prepared by Caltrans for the existing Soundwall Nos. 2 and 210 located east of Cambridge and east of Beach Boulevard, respectively. The boring logs for SR-22 HOV lane widening are included in Appendix B. The as-built

LOTBs are presented on Figure 2 (Sheets 9 through 11). A list of references used in preparation of this report is presented in Section 6.0.

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

- *Subsurface Exploration:* We performed a subsurface exploration that consisted of drilling, logging and sampling of seven 4-inch diameter hand-auger borings to a maximum depth of 10½ feet below the ground surface. Per Caltrans' review comment, we also advanced four Cone Penetration Tests (CPTs) to a maximum depth of 25 feet below the ground surface. The boring and CPT logs are included on Figure 2 (Sheets 3 through 8) - Log of Test Borings (LOTBs) and the CPT logs are also included in Appendix C.

- *Geotechnical Design and Analysis:* Geotechnical analysis was performed on the collected data to develop recommendations for design and construction.

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

2.0 GEOTECHNICAL FIELD AND LABORATORY INVESTIGATIONS

2.1 Subsurface Exploration

Our field exploration consisted of advancing seven 4-inch diameter hand-auger borings to a maximum depth of 10½ feet below the current grade. Borings HA-1 and HA-2 are located by the proposed Soundwall No. 224 location, boring HA-3 is located by the proposed Soundwall No. 603 location, and borings HA-4 through HA-7 are located by the proposed Soundwall No. 699 location. Additionally, four CPTs were advanced at the proposed soundwall locations to a maximum depth of 25 feet below the existing grade. The approximate location of these borings is shown on Figure 2 and summarized in Table 1.

Table 1 – Approximate Location of Boring

Boring No.	Closest Street	Station No.	Offset from SR-22 Center Line	Elevations (feet, MSL)
HA-1	Beach Boulevard	223+00	550 feet Right	53.0
CPT-1		223+00	490 feet Right	54.0
HA-2		225+00	220 feet Right	54.0
CPT-2		225+50	200 feet Right	55.0
HA-3	SR-22 and I-5 Connector	602+00	220 feet Left	147.0
CPT-3		602+50	113 feet Left	146.0
HA-4	East of Cambridge Street	689+20	140 feet Left	206.0
HA-5		693+20	130 feet Left	208.0
CPT-4		695+80	140 feet Left	209.0
HA-6		696+80	120 feet Left	209.0
HA-7		699+40	120 feet Left	210.0

The survey benchmark of the civil plan that was used to identify the locations and elevations of our borings and CPTs is shown on the LOTBs (Sheets 3 through 8 of Figure 2).

Relatively undisturbed samples were collected from the borings using the Modified California Ring sampler. In addition to driven samples, representative bulk soil samples were also collected from the borings.

The test borings were logged in the field by a member of our technical staff. Each soil sample collected was reviewed and described in accordance with the Unified Soil Classification System. The samples were sealed and packaged for transportation to our laboratory. After completion of drilling, the borings were backfilled with soil cutting. Geotechnical logs of the borings are included on Figure 2.

The CPT soundings were performed in general accordance with ASTM Test Method D3441. The tests consisted of pushing an instrumented cone-tipped probe into the ground while simultaneously recording the tip resistance and side friction resistance of the soils during penetration. CPT logs are included on Figure 2 and plots of friction and tip resistance along with interpretation of the CPT soundings describing subsurface stratigraphy are also included in Appendix C.

2.2 Geotechnical Laboratory Testing

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

- In-situ moisture content and density;
- Grain-size distribution;
- Direct shear;
- Consolidation; and
- Corrosivity (soluble sulfate contents, chloride, pH, and resistivity).

All laboratory tests, except corrosivity tests, were performed in general accordance with ASTM procedures. The corrosivity tests were performed in accordance with Caltrans procedures. Results of the laboratory tests are presented in Appendix A. The results of in-situ moisture and density tests are also shown on Figure 2 - Log of Test Borings (LOTBs).

3.0 GEOTECHNICAL FINDINGS

3.1 Geologic Setting

The project sites are located in the northwestern part of the Tustin Plain within the Peninsular Ranges geomorphic province. The Peninsular Ranges geomorphic province extends 900 miles southward from the Los Angeles Basin to the tip of Baja California (Yerkes et al., 1965) and is characterized by elongate northwest-trending mountain ranges separated by sediment-floored valleys. The most dominant structural features of the province are the northwest trending fault zones, most of which die out, merge with, or are terminated by the steep reverse faults at the southern margin of the Transverse Ranges geomorphic province.

East of the sites are the northwest-trending Santa Ana Mountains, a large range which has been uplifted on its eastern side along the Whittier-Elsinore Fault Zone, producing a tilted, irregular highland that slopes westward toward the sea. Sediments eroded from the Santa Ana Mountains have been transported by Santiago Creek and the lower reach of the Santa Ana River to build a large, broad alluvial fan known as the Tustin Plain. The Tustin Plain is comprised of relatively flat-lying, unconsolidated to semi-consolidated clastic sediments that are approximately 1,000 to 1,100 feet thick (Singer, 1973; Sprotte et al., 1980a and 1980b). Beneath the site, the near surface, unconsolidated, relatively fine grained sediments are Holocene age (less than 11,000 years old) and consist of predominately youthful alluvial fan deposits (Sprotte et al., 1980a and 1980b). These sediments in turn are underlain at depth by sedimentary bedrock of Tertiary age.

3.2 Soundwall No. 224

Subsurface exploration relevant to this soundwall includes borings HA-1, HA-2, CPT-1 and CPT-2 by Leighton, borings B-1 through B-3 (Caltrans, 1997), and borings BH-74 and BH-75 (URS, 2006). Based on these borings and CPTs, the subsurface profile for Soundwall No. 224 generally consists of loose to medium dense silty sand and sand with isolated layer of firm sandy clay within the upper approximately 20 feet. The soils below 20 feet to 50 feet consist of firm to stiff sandy clay and loose to medium dense silty sand and clayey sand.

Groundwater was not encountered in our borings to depth of 10½ feet below the existing grade during our field exploration. However, groundwater was encountered in Borings B-1 through B-3 in 1994 and BH-74 in 2001 by others, at a depth of 10 to 13 feet below the existing grade. The historically high groundwater table at the site is 10 feet or shallower below the ground surface (CDMG, 1997a).

We have performed direct shear test on a representative sample collected from our boring. The cohesion intercept (c) and friction angle (ϕ) representing the effective shear strength of the soils were found to be 40 psf and 30 degrees, respectively. The test result is presented in Appendix A. Based on these test result, SPT blowcounts and soil types, the shear strength parameters and unit weights selected for design are presented in Table 2.

Table 2 – Generalized Soil Profile for Soundwall No. 224

Depth below Existing Grade (feet)	Generalized Soil Type	Total Unit Weight (pcf)	Friction angle[1] (degrees)	Cohesion[1] (psf)
0 to 20	Silty Sand / Clayey Sand	120	30	-
20 to 50	Sandy Clay/ Silty Sand/ Clayey Sand	110	-	650

[1] Based on SPT blow counts of subsurface soil (NAFVAC, 1988) and laboratory test results

3.3 Soundwall No. 603

Subsurface exploration relevant to this soundwall includes boring HA-3 and CPT-3 by Leighton and borings GMR B-41, GMR B-42 and BH-53 (URS, 2006). Based on these borings and CPT, the subsurface profile for Soundwall No. 603 generally consists of loose to medium dense silty sand and clayey sand within the upper approximately 20 feet. The soils below 20 feet to 30 feet consist of loose to medium dense clayey sand and sand with isolated layer of sandy clay.

Groundwater was not encountered in our boring and previous borings by others within the site vicinity to the maximum depth of 100 feet below the existing grade. The historically high groundwater table at the site is deeper than 40 feet below the ground surface (CDMG, 1997b).

We have performed direct shear test on a representative sample collected from our boring. The cohesion intercept (c) and friction angle (ϕ) representing the effective shear strength of the soils were found to be 100 psf and 26 degrees, respectively. The test result is presented in Appendix A. Based on these test result, SPT blowcounts and soil types, the shear strength parameters and unit weights selected for design are presented in Table 3.

Table 3 – Generalized Soil Profile for Soundwall No. 603

Depth below Existing Grade (feet)	Generalized Soil Type	Total Unit Weight (pcf)	Friction angle[(1)] (degrees)	Cohesion[(1)] (psf)
0 to 20	Silty Sand/ Clayey Sand	120	26	-
20 to 30	Clayey Sand/ Sand/ Sandy Clay	110	30	-

[(1)] Based on SPT blow counts of subsurface soil (NAFVAC, 1988) and laboratory test results

3.4 Soundwall No. 699

Subsurface exploration relevant to this soundwall includes borings HA-4 through HA-7, and CPT-4 by Leighton, borings SW-8 through SW-11 and RB-12 (Caltrans, 2002), and borings GMR B-133 GMR B-135, GMR B-136 and GMR B-153 (URS, 2006). Based on these borings and CPT, the subsurface profile for Soundwall No. 699 generally consists of loose to dense sand with varying contents of gravel and silt within the upper approximately 13 feet. The soils below 13 feet to 20 feet consist of medium dense to dense silty sand and gravelly sand.

Groundwater was not encountered in our borings and previous borings by others within the site vicinity to the maximum depth of 100 feet below the existing grade. The historically high groundwater table at the site is on the order of 30 feet below the ground surface (CDMG, 1997b).

We have performed direct shear test on a representative sample collected from our boring. The cohesion intercept (c) and friction angle (ϕ) representing the effective shear strength of the soils were found to be 0 psf and 37 degrees, respectively. The test result is presented in Appendix A. Based on these test result, SPT blowcounts and soil types, the shear strength parameters and unit weights selected for design are presented in Table 3.

Table 4 – Generalized Soil Profile for Soundwall No. 699

Depth below Existing Grade (feet)	Generalized Soil Type	Total Unit Weight (pcf)	Friction angle[1] (degrees)	Cohesion[1] (psf)
0 to 13	Silty Sand/ Gravelly Sand/ Silt	110	35	-
13 to 20	Silty Sand/ Gravelly Sand	110	35	-

[1] Based on SPT blow counts of subsurface soil (NAFVAC, 1988) and laboratory test results

3.5 Corrosion Potential

Representative samples of the subsurface soils for each soundwall were subjected to analytical testing to evaluate the potential for corrosion to concrete and ferrous metals. The test results are included in Appendix A and indicate the tested soils exhibited sulfate concentration of 111 to 165 parts per million (ppm), minimum resistivity of 2,966 to 6,200 ohm-cm, chloride concentration of 52 to 56 ppm, and pH level of 7.4 to 7.8.

Caltrans specifications define a corrosive soil as a material in which any of the conditions exist: chloride content greater than 500 ppm, soluble sulfate content greater than 2,000 ppm, a minimum resistivity less than 1,000 ohm-cm, or a pH of 5.5 or less. Based on the guidelines established by Caltrans, the subsurface soils are considered not corrosive to structural concrete.

4.0 FOUNDATION DESIGN RECOMMENDATIONS

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

4.1 Soundwall No. 224

We understand that this soundwall will consist of an approximately 14-foot high masonry block wall, supported on CIDH piles with a pile cap connecting the individual piles. Based on the as-built plan (Caltrans, 1997), the existing Soundwall No. 210 is located immediately to the east of this proposed soundwall. The western portion of this existing soundwall consists of an approximately 16 feet high masonry soundwall, supported on a shallow foundation with a width of 5 feet 6 inches and a minimum embedment of 1 foot 9 inches.

The pile spacing and diameter for Soundwall No. 224 should be designed per Caltrans Standard Plans B15-5 with a soil friction angle value (ϕ) of 30 degrees. Case 1 for level ground on both sides of soundwall may be used for design if the closest horizontal distance from the top of slope and the soundwall is 15 feet or more. If the distance is less than 15 feet, Case 2 for level ground on one side and sloping ground on the opposite side may be used for design.

4.2 Soundwall No. 603

We understand that this soundwall will consist of an approximately 14-foot high masonry block wall, supported on CIDH piles. The individual piles will be connected with a pile cap or concrete barrier. Based on the as-built-plan (Caltrans, 1998), the western portion of the existing Soundwall No. 384, located to the east of the proposed soundwall, consist of an approximately 12½ feet to 14½ feet high masonry soundwall supported on 16-foot long CIDH piles. Based on the information collected from our borings, the subsurface soils at the foundation level for the proposed soundwall is expected to generally consist of loose to medium dense silty sand and clayey sand.

The pile spacing and diameter for the Soundwall No. 603 should be designed per Caltrans Standard Plans B15-5 and B-15-8 with a soil friction angle value (ϕ) of 25 degrees. If the closest horizontal distance from the top of slope and the soundwall is 15 feet or more, Case 1 for level ground on both sides of soundwall may be used for design. Otherwise, Case 2 for level ground on one side soundwall and sloping ground on the opposite side should be used.

4.3 Soundwall No. 699

We understand that this soundwall will consist of a 16-foot high masonry block wall, supported on CIDH piles with a pile cap connecting the individual piles. The proposed soundwall will replace an approximately 2,000 feet of the existing Soundwall No. 2. Based on the as-built-plan (Caltrans, 2002), the existing Soundwall No. 2 consists of 8-foot high wall supported on 12- to 14-inch diameter, 7.7 to 12.5 feet long CIDH piles. Based on the information collected from our borings, the subsurface soils at the foundation level for the proposed soundwall is expected to generally consist of loose to medium dense silty sand, gravelly sand and silt.

The pile spacing and diameter for the Soundwall No. 699 should be designed per Caltrans Standard Plans B15-5 with a soil friction angle value (ϕ) of 35 degrees. If the closest horizontal distance from the top of slope and the soundwall is 15 feet or more, Case 1 for level ground on both sides of soundwall may be used for design. Otherwise, Case 2 for level ground on one side soundwall and sloping ground on the opposite side should be used.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Removal of Existing Foundations

The western portion of the existing Soundwall No. 2 will be removed and replaced with Soundwall No. 699. Based on the as-built plan (Caltrans, 1979b), the existing soundwall is supported on 12- to 14-inch diameter, 7.7 to 12.5 feet long CIDH piles. We recommend that the existing CIDH piles should be removed to at least 2 foot below the foundation level and replaced with sand/cement slurry or properly compacted fill. The remnants of the existing piles may create significant construction difficulties with the installation of new piles. Based upon the actual as-built conditions exposed in the field after demolition, some adjustment in planned pile locations may be necessary to ensure adequate clearance from existing piles. The minimum clearance between proposed and existing piles is recommended to be at least 1 foot, but field conditions should be considered in the final determination of pile locations. In addition to the potential for pile offset, drilling difficulties may be encountered where new piles are planned to be located in close proximity to existing piles where the as-built orientation of the existing piles are not plumb.

5.2 CIDH Pile Construction

CIDH piles will be constructed using the conventional soil augering equipment and technique to advance the drilled hole and remove soil cuttings. The drilling operations are recommended to be observed and evaluated by a representative of the geotechnical engineer to allow further evaluation of the actual subsurface conditions. It is anticipated that the construction of CIDH piles for the proposed developments would be feasible using the dry construction method in accordance with the Caltrans Standard Specifications. Shallow groundwater, however, may be encountered during installation of the CIDH piles for the proposed Soundwall No. 224. In the event that the boreholes cannot be maintained open due to the presence of caving sand and/or perched groundwater conditions, temporary casing or drilling slurry may be employed to facilitate the construction of the CIDH piles. The installation/removal of temporary casing or the use of slurry for borehole stability should be in accordance with the Caltrans Standard Specifications to reduce the potential for adversely affecting the frictional resistance of the soils and, thereby, reducing the load capacity of the piles.

To maintain a relatively clean hole and to achieve high quality CIDH pile construction, it is recommended that the entire construction operation including drilling of the CIDH pile, lowering of the reinforcing cage, and the concrete placement, be carried out consecutively in the same day. We further recommend that the use of a drop chute or a tremie pipe with pump concrete are to be considered to avoid concrete segregation during CIDH pile construction.

5.3 Groundwater Control

Based on the current and previous field explorations, groundwater levels at the sites for Soundwall Nos. 609 and 699 are expected to be below the depths of construction. Localized perched groundwater may exist at shallower depths on a seasonal basis.

Groundwater was encountered at a depth of 10 to 13 feet below the existing grade for Soundwall No. 224. Placement of concrete with a drop chute or tremie pipe is expected to displace the groundwater that may accumulate at the bottom of the CIDH pile boreholes.

5.4 Earthwork

Onsite soils to be used as compacted structural fill should be free of organic material and/or construction debris. Any imported fill soil should be approved by the geotechnical engineer prior to placement as fill. Fill soils should be placed in loose lifts not exceeding 8 inches, moisture-conditioned as necessary to within three percent above optimum, and compacted to a minimum of 90 percent of the maximum density as determined by Caltrans Test 216. Crushed aggregate base should be compacted to a minimum of 95 percent relative compaction. Subgrade within a depth of 30 inches below the finished grade should also be compacted to at least 95 percent relative compaction.

5.5 Additional Geotechnical Services

The proposed construction involves various activities that would require geotechnical observation and testing, including placement of compacted fill and CIDH pile installation for the soundwalls. These and other soils related activities should be observed and tested by a qualified representative of the geotechnical engineer.

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

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SR-22 Soundwall Locations	**SITE LOCATION MAP**	Project No. **602198-001** Date **July 2008** Figure 1

\\GIS\Drafting\602198\002\Fig1_SiteLocationMap.mxd

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DIAN CHANDRA No. 2376 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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

LEIGHTON CONSULTING INC.
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PHONE: 949-250-1421
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REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

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

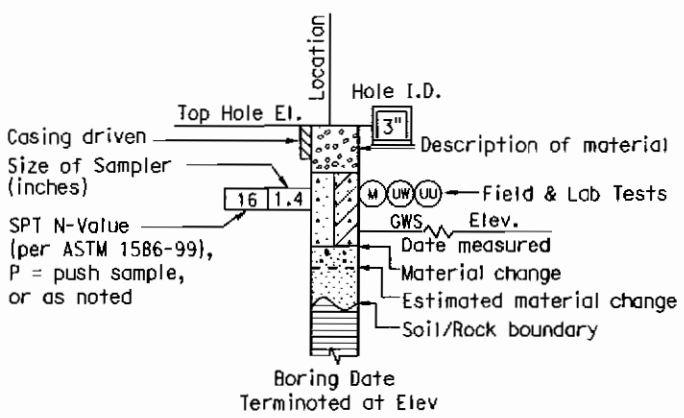
BOREHOLE IDENTIFICATION

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

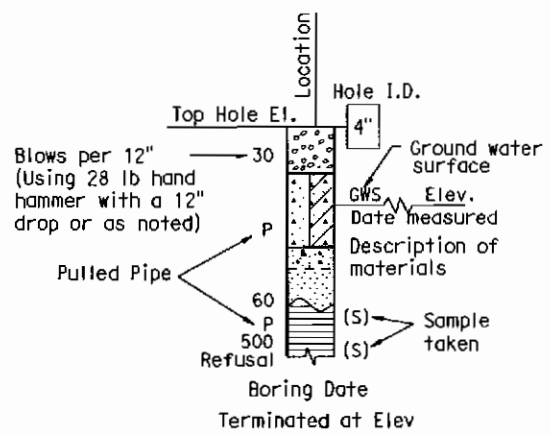
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

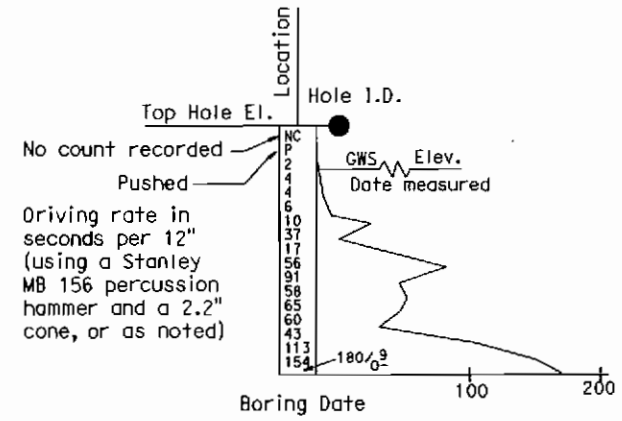
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be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



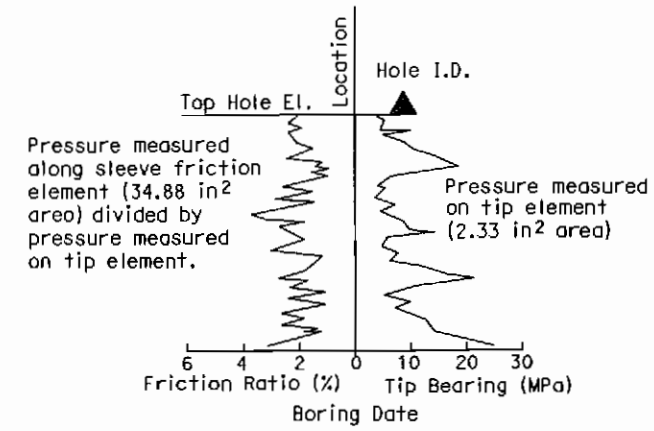
DRY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

FIGURE 2 (SHEET 1 OF 11)

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILE R3.6/R12.9	SOIL LEGEND LOG OF TEST BORINGS 1 OF 11
PREPARED BY	BUU TRAN				
CHECKED BY	T. KIM				

GS LDTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12
EA 0J9601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DIAN CHANDRA No. 2376 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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

LEIGHTON CONSULTING INC.
17781 COMAN, IRVINE CA 92614
PHONE: 949-250-1421
FAX: 949-250-1114

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)
GM	SILTY GRAVEL SILTY GRAVEL with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL
SP	Poorly graded SAND Poorly graded SAND with GRAVEL
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)
SM	SILTY SAND SILTY SAND with GRAVEL
SC	CLAYEY SAND CLAYEY SAND with GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL
PT	PEAT
	COBBLES COBBLES and BOULDERS BOULDERS

Graphic/Symbol	Group Names
CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTING

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

APPARENT DENSITY OF COHESIONLESS SOILS

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

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

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

FIGURE 2 (SHEET 2 OF 11)

ENGINEERING SERVICES	GEOTECHNICAL SERVICES
PREPARED BY	BUU TRAN
CHECKED BY	T. KIM

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN

DESIGN BRANCH

BRIDGE NO.

POST MILE R3.6/R12.9

SOIL LEGEND

LOG OF TEST BORINGS 2 OF 11

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12
EA 0J9601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DIAN CHANDRA No. 2376 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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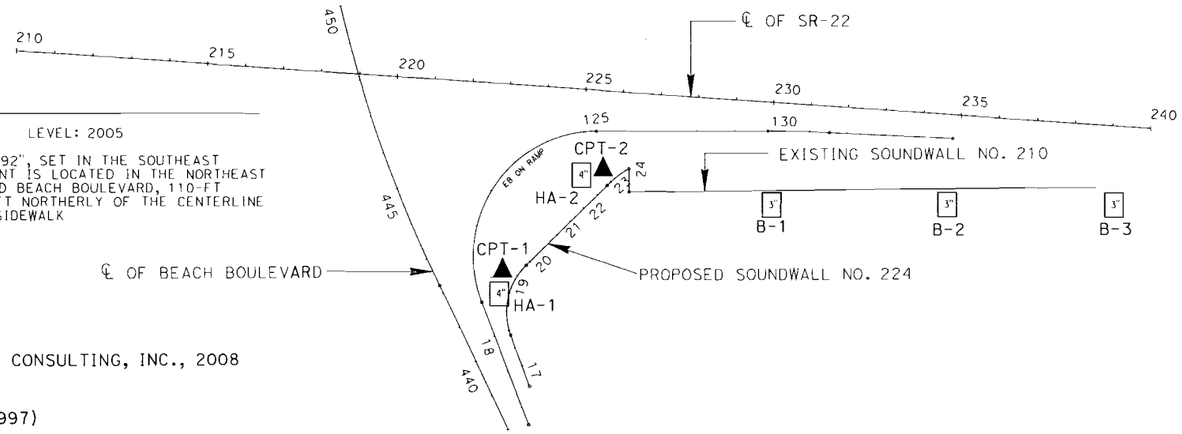
LEIGHTON CONSULTING INC.
17781 COWAN, IRVINE CA 92614
PHONE: 949-250-1421
FAX: 949-250-1114

THE BENCHMARK:

1C-135-92 ELEVATION: 44.39 FEET LEVEL: 2005

FOUND 3¾" OCS ALUMINUM BENCHMARK DISK STAMPED "1C-135-92", SET IN THE SOUTHEAST CORNER OF A 4-FT BY 18-FT CONCRETE CATCH BASIN. MONUMENT IS LOCATED IN THE NORTHEAST CORNER OF THE INTERSECTION OF WESTMINSTER BOULEVARD AND BEACH BOULEVARD, 110-FT EASTERLY OF THE CENTERLINE OF BEACH BOULEVARD AND 38-FT NORTHERLY OF THE CENTERLINE OF WESTMINSTER AVENUE. MONUMENT IS SET LEVEL WITH THE SIDEWALK



LEGEND

HA-2 [4"] HAND AUGER BORING BY LEIGHTON CONSULTING, INC., 2008

B-3 [3"] BORING BY OTHERS (CALTRANS, 1997)

CPT-2 ▲ CONE PENETRATION TEST BY LEIGHTON CONSULTING, INC., 2008

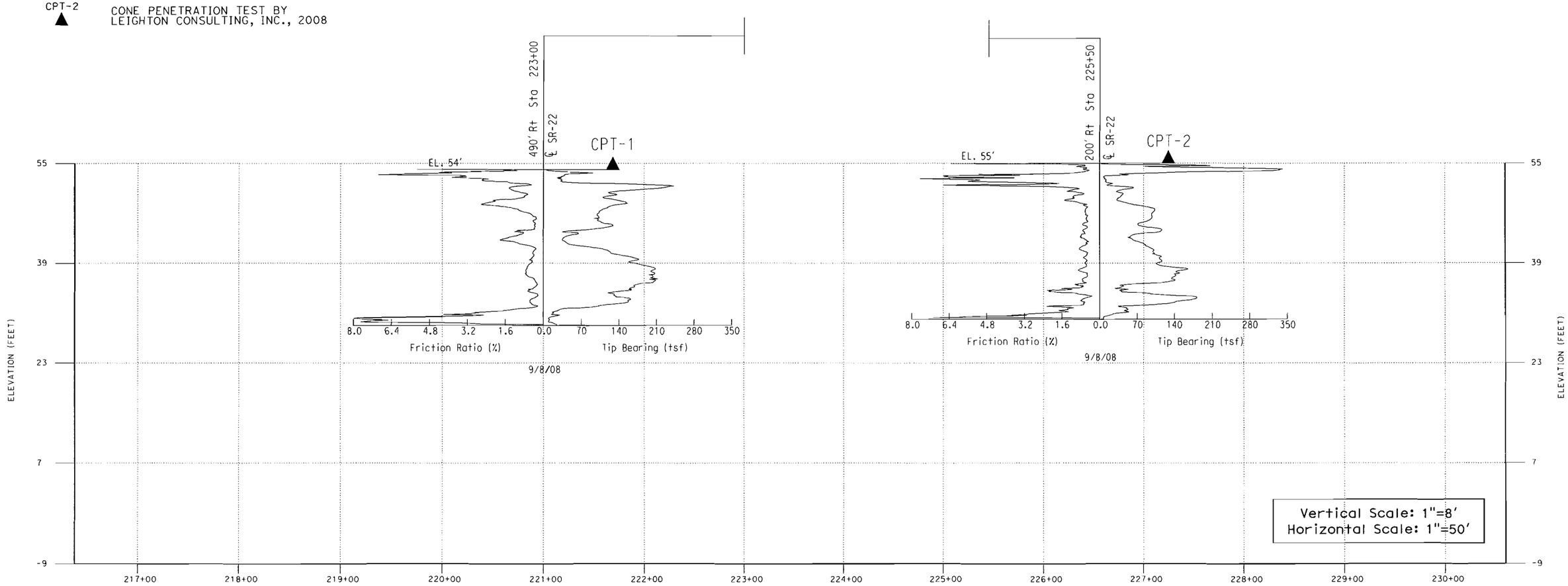


FIGURE 2 (SHEET 3 OF 11)

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILES R3.6/R12.9	SR-22 SOUNDWALLS LOG OF TEST BORINGS 3 OF 11
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY: S. PULIJALA			
NAME:	CHECKED BY: T. KIM				
DGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 12 EA 0J9601	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES SHEET OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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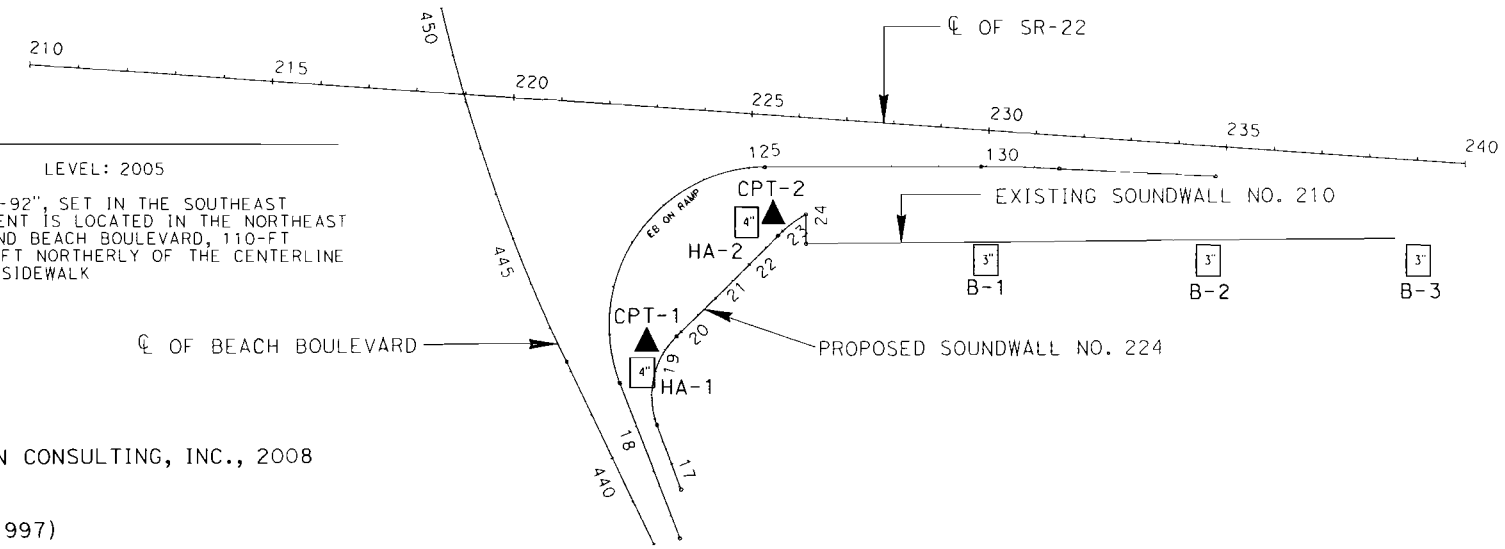
LEIGHTON CONSULTING INC.
17781 COWAN, IRVINE CA 92614
PHONE: 949-250-1421
FAX: 949-250-1114

THE BENCHMARK:

1C-135-92 ELEVATION: 44.39 FEET LEVEL: 2005

FOUND 3¼" OCS ALUMINUM BENCHMARK DISK STAMPED "1C-135-92", SET IN THE SOUTHEAST CORNER OF A 4-FT BY 18-FT CONCRETE CATCH BASIN. MONUMENT IS LOCATED IN THE NORTHEAST CORNER OF THE INTERSECTION OF WESTMINSTER BOULEVARD AND BEACH BOULEVARD, 110-FT EASTERLY OF THE CENTERLINE OF BEACH BOULEVARD AND 38-FT NORTHERLY OF THE CENTERLINE OF WESTMINSTER AVENUE. MONUMENT IS SET LEVEL WITH THE SIDEWALK



LEGEND

HA-2 — HAND AUGER BORING BY LEIGHTON CONSULTING, INC., 2008

B-3 — BORING BY OTHERS (CALTRANS, 1997)

CPT-2 — CONE PENETRATION TEST BY LEIGHTON CONSULTING, INC., 2008

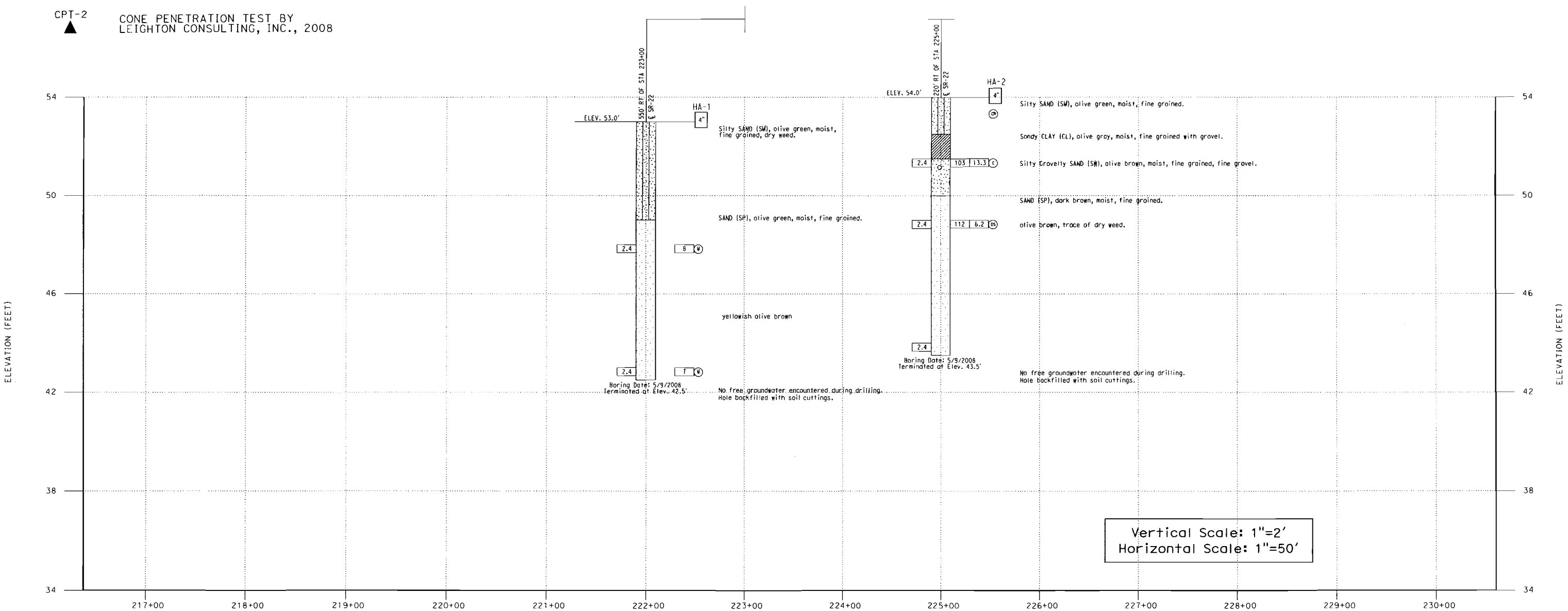


FIGURE 2 (SHEET 4 OF 11)

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILES R3.6/R12.9	SR-22 SOUNDWALLS LOG OF TEST BORINGS 4 OF 11
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY: S. PULIJALA			
NAME:	CHECKED BY: T. KIM				
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 12 EA 0J9601	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES / SHEET / OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — UJAN CHANDRA — No. 2376 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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LEIGHTON CONSULTING INC.
17781 COWAN, IRVINE CA 92614
PHONE: 949-250-1421
FAX: 949-250-1114

THE BENCHMARK :

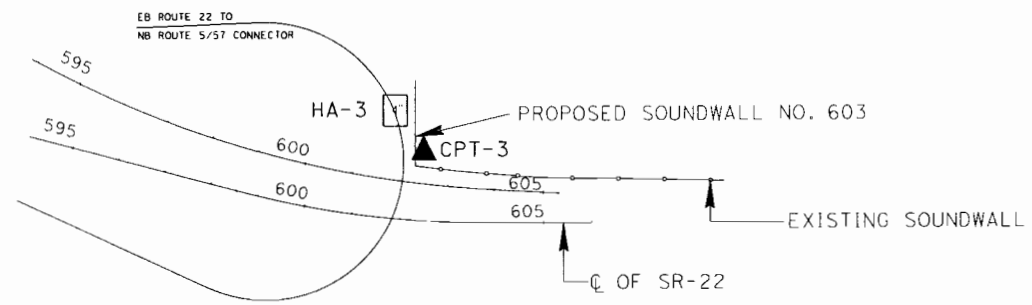
SA-307-83 ELEVATION: 139.67 FEET ADJUSTMENT: NAD88, LEVEL 1990

FOUND 3¾" OCS ALUMINUM BENCHMARK DISK STAMPED "SA-307-83", SET IN THE NORTHWESTERLY CORNER OF A 4-FT BY 11-FT CONCRETE CATCH BASIN. MONUMENT IS LOCATED IN THE SOUTHEASTERLY CORNER OF THE INTERSECTION OF FLOWER STREET AND LA VETA AVENUE, 39-FT SOUTHERLY OF THE CENTERLINE OF LA VETA AND 58.5-FT EASTERLY OF THE CENTERLINE OF FLOWER. MONUMENT IS SET LEVEL WITH THE SIDEWALK

LEGEND

HA-3 — HAND AUGER BORING BY LEIGHTON CONSULTING, INC., 2008

CPT-3 — CONE PENETRATION TEST BY LEIGHTON CONSULTING, INC., 2008



N

Scale: 1"=200'

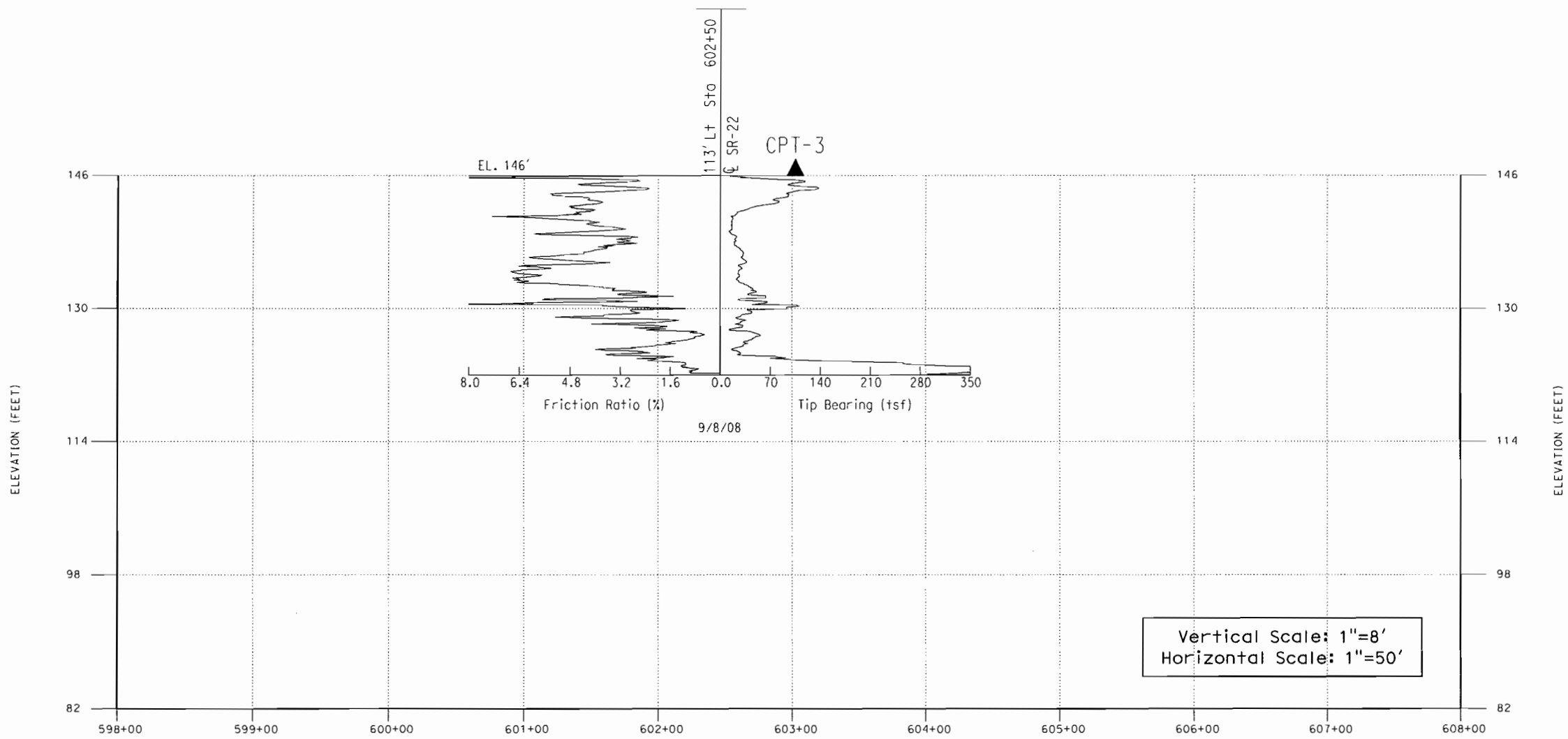


FIGURE 2 (SHEET 5 OF 11)

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-22 SOUNDWALLS
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY:	DESIGN BRANCH	POST MILES R3.6/R12.9	LOG OF TEST BORINGS 5 OF 11
NAME:	CHECKED BY: T. KIM	S. PULIJALA			

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12
EA 0J9601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DJAN CHANDRA No. 2376 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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LEIGHTON CONSULTING INC.
17781 COWAN, IRVINE CA 92614
PHONE: 949-250-1421
FAX: 949-250-1114

THE BENCHMARK :

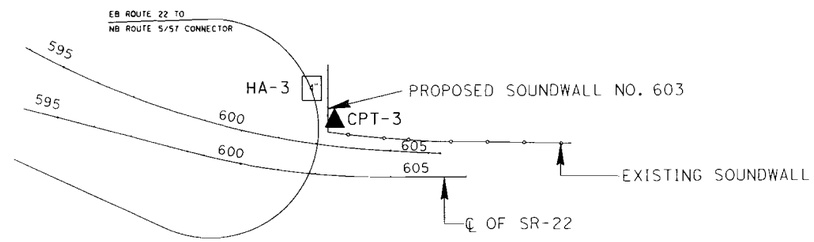
SA-307-83 ELEVATION: 139.67 FEET ADJUSTMENT: NAD88, LEVEL 1990

FOUND 3¾" OCS ALUMINUM BENCHMARK DISK STAMPED "SA-307-83", SET IN THE NORTHWESTERLY CORNER OF A 4-FT BY 11-FT CONCRETE CATCH BASIN. MONUMENT IS LOCATED IN THE SOUTHEASTERLY CORNER OF THE INTERSECTION OF FLOWER STREET AND LA VETA AVENUE, 39-FT SOUTHERLY OF THE CENTERLINE OF LA VETA AND 58.5-FT EASTERLY OF THE CENTERLINE OF FLOWER. MONUMENT IS SET LEVEL WITH THE SIDEWALK

LEGEND

HA-3 [4"] HAND AUGER BORING BY LEIGHTON CONSULTING, INC., 2008

CPT-3 ▲ CONE PENETRATION TEST BY LEIGHTON CONSULTING, INC., 2008



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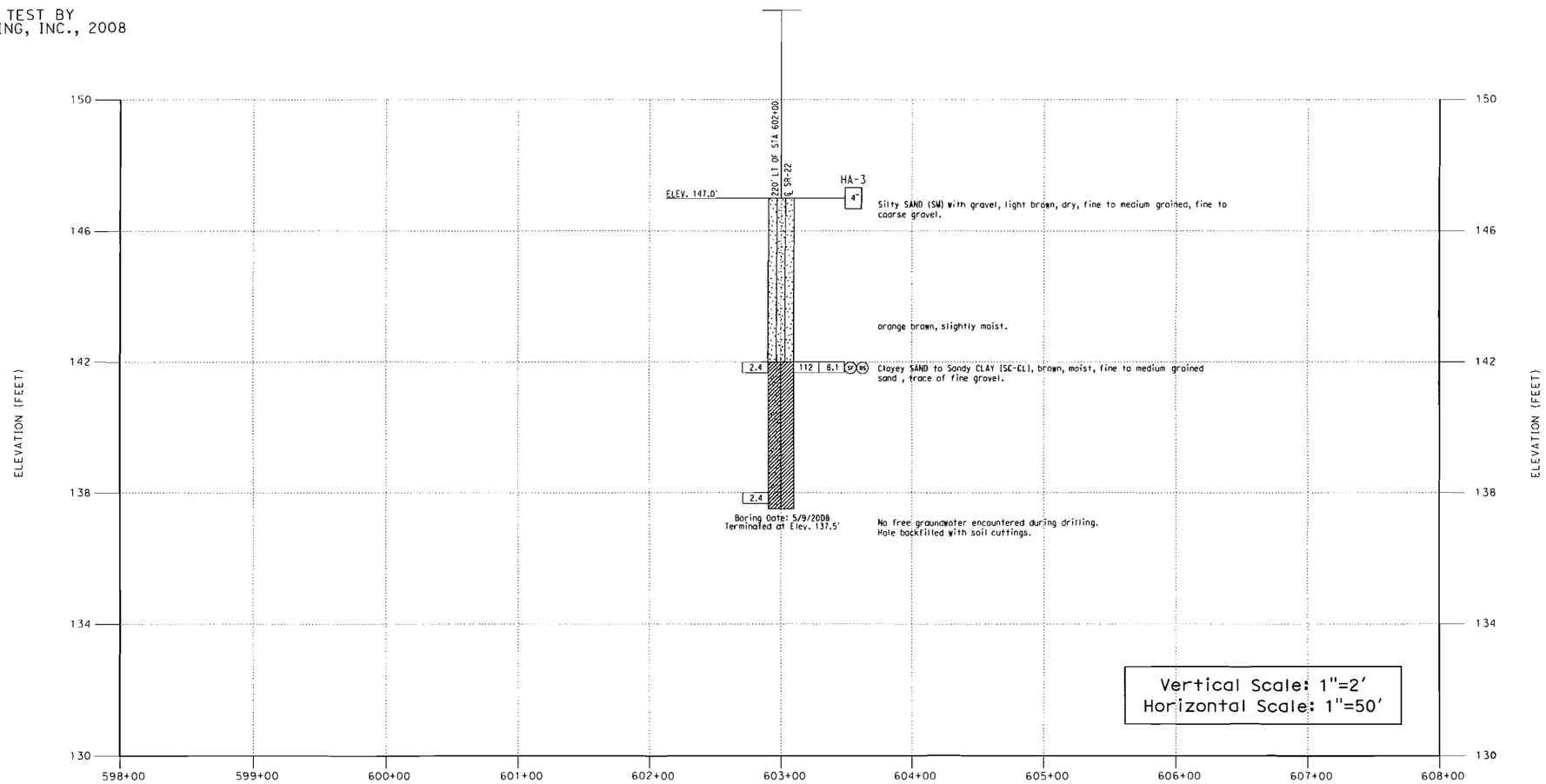

FIGURE 2 (SHEET 6 OF 11)

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILES R3.6/R12.9	SR-22 SOUNDWALLS LOG OF TEST BORINGS 6 OF 11
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY: S. PULIJALA			
NAME:	CHECKED BY: T. KIM				
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 12 EA 0J9601	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES SHEET OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DIAN CHANDRA No. 2376 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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LEIGHTON CONSULTING INC.
17781 COWAN, IRVINE CA 92614
PHONE: 949-250-1421
FAX: 949-250-1114

THE BENCHMARK :

SA-283-75 ELEVATION: 201.39 FEET ADJUSTMENT: NAD88, LEVEL 1992

FOUND 3¾" OCS ALUMINUM BENCHMARK DISK STAMPED "SA-283-75", SET IN THE SOUTHEASTERLY CORNER OF A 4-FT BY 8-FT CONCRETE CATCH BASIN. MONUMENT IS LOCATED IN THE SOUTHWESTERLY CORNER OF THE INTERSECTION OF CAMBRIDGE STREET AND ROSEWOOD AVENUE, 33-FT WESTERLY OF THE CENTERLINE OF CAMBRIDGE AND 106-FT SOUTHERLY OF THE CENTERLINE OF ROSEWOOD. MONUMENT IS SET LEVEL WITH THE SIDEWALK

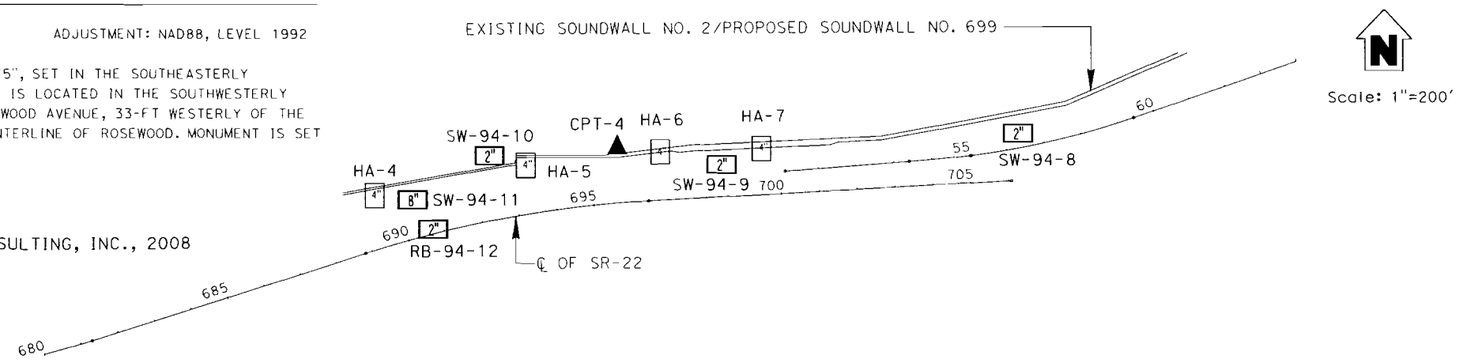
LEGEND

HA-7 [4"] HAND AUGER BORING BY LEIGHTON CONSULTING, INC., 2008

SW-94-11 [2"] BORING BY OTHERS (CALTRANS, 1994)

RB-94-12 [2"] BORING BY OTHERS (CALTRANS, 1994)

CPT-4 ▲ CONE PENETRATION TEST BY LEIGHTON CONSULTING, INC., 2008



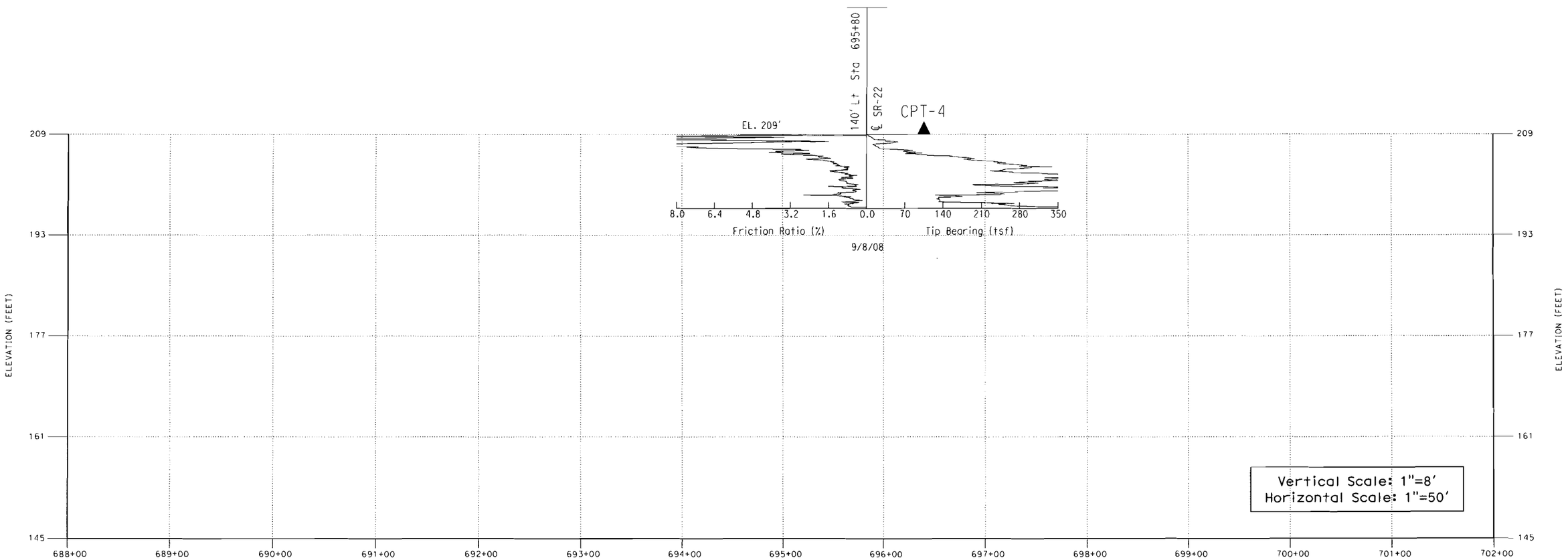


FIGURE 2 (SHEET 7 OF 11)

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-22 SOUNDWALLS
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN		DESIGN BRANCH	POST MILES	LOG OF TEST BORINGS 7 OF 11
NAME:	CHECKED BY: T. KIM	FIELD INVESTIGATION BY: S. PULIJALA		R3.6/R12.9	

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12
EA 0J9601

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET OF

FILE => P:\Drafting\602198\001\of_2008-06-03\Figure-2_sheet-3-8of11.dgn

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER DIAN CHANDRA No. 2376 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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

LEIGHTON CONSULTING INC.
17781 COWAN, IRVINE CA 92614
PHONE: 949-250-1421
FAX: 949-250-1114

THE BENCHMARK :

SA-283-75 ELEVATION: 201.39 FEET ADJUSTMENT: NAD88, LEVEL 1992

FOUND 3¾" OCS ALUMINUM BENCHMARK DISK STAMPED "SA-283-75", SET IN THE SOUTHEASTERLY CORNER OF A 4-FT BY 8-FT CONCRETE CATCH BASIN. MONUMENT IS LOCATED IN THE SOUTHWESTERLY CORNER OF THE INTERSECTION OF CAMBRIDGE STREET AND ROSEWOOD AVENUE, 33-FT WESTERLY OF THE CENTERLINE OF CAMBRIDGE AND 106-FT SOUTHERLY OF THE CENTERLINE OF ROSEWOOD. MONUMENT IS SET LEVEL WITH THE SIDEWALK

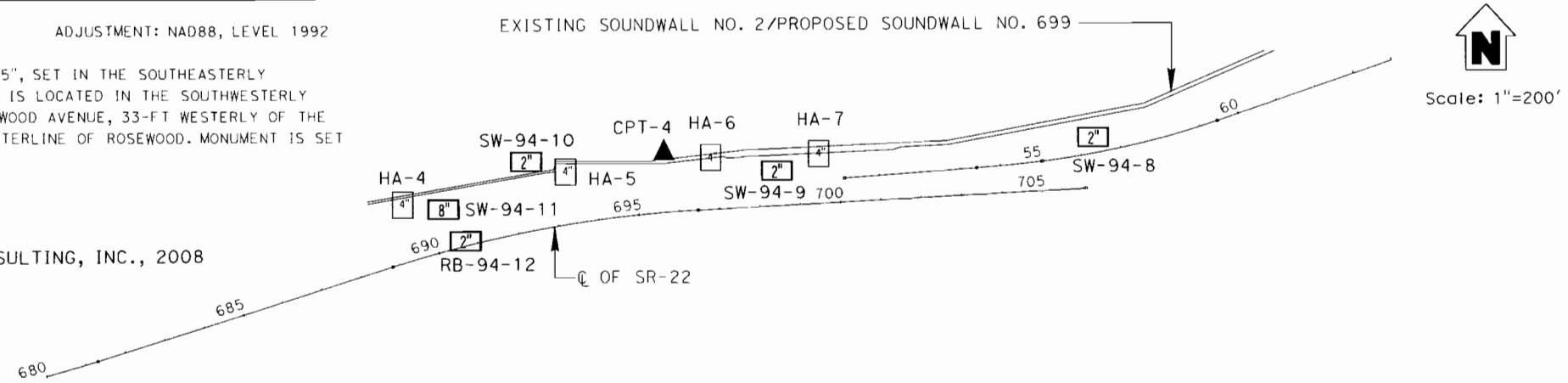
LEGEND

HA-7 [4"] HAND AUGER BORING BY LEIGHTON CONSULTING, INC., 2008

SW-94-11 [2"] BORING BY OTHERS (CALTRANS, 1994)

RB-94-12 [2"] BORING BY OTHERS (CALTRANS, 1994)

CPT-4 ▲ CONE PENETRATION TEST BY LEIGHTON CONSULTING, INC., 2008



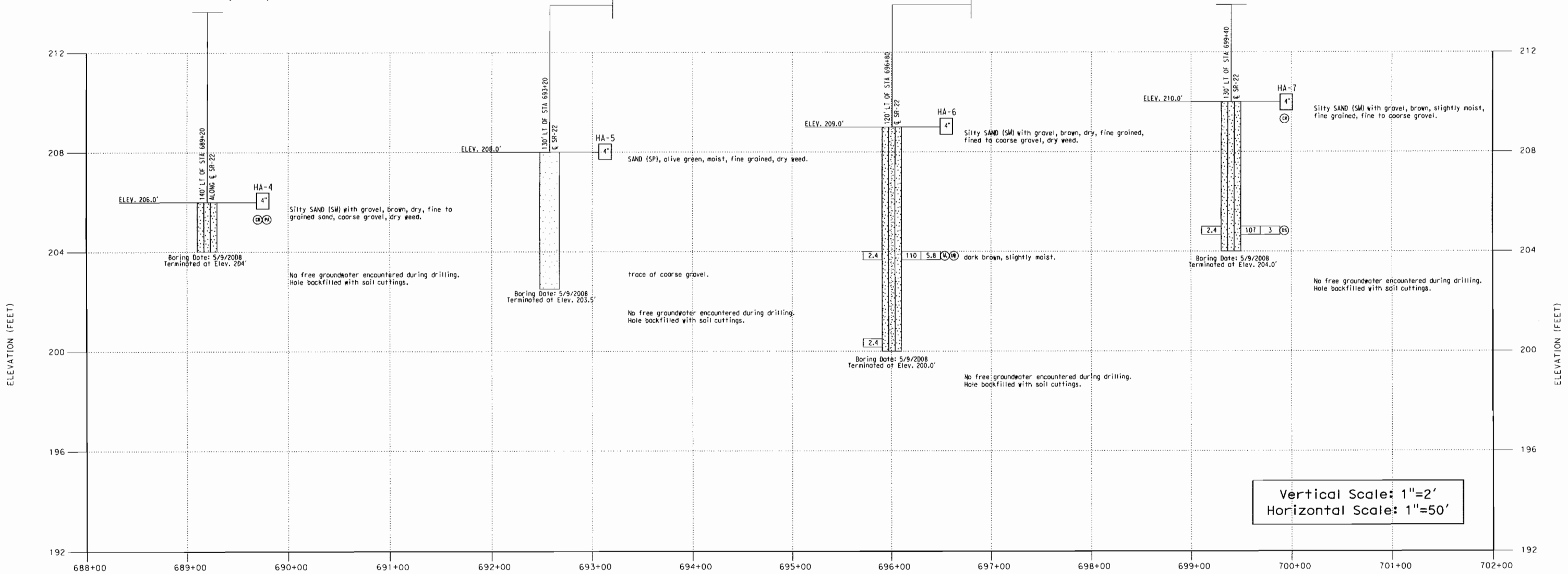


FIGURE 2 (SHEET 8 OF 11)

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. / POST MILES R3.6/R12.9	SR-22 SOUNDWALLS LOG OF TEST BORINGS 8 OF 11
FUNCTIONAL SUPERVISOR	DRAWN BY: BUU TRAN	FIELD INVESTIGATION BY: S. PULIJALA			
NAME:	CHECKED BY: T. KIM				
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 12 EA 0J9601	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES SHEET OF

FILE => P:\Drafting\602198\001\of_2008-06-03\Figure-2_sheet-3-8of11.dgn

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	22	R3.6/R4.2	22	29

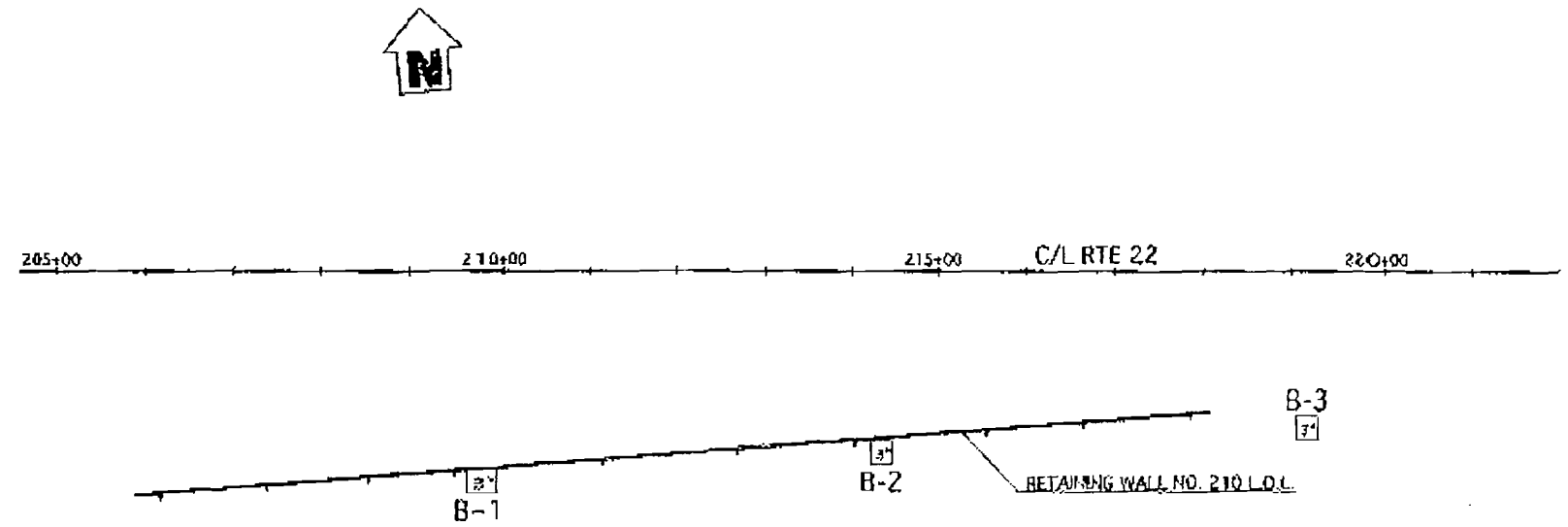
REGISTERED ENGINEER - CIVIL

12-11-95
PLANS APPROVAL DATE

PROFESSIONAL ENGINEER S. AHMI No. 45858 Exp. 6/30/97 CIVIL STATE OF CALIFORNIA

BENCH MARK

V8 (22H2127)
PROVIDED ON TOPOGRAPHIC PLAN.
LOCATED ON 240 FT SOUTH OF INTERSECTION OF NEWLAND ST. U.C. AND RTE 22 STATION LINE ON C/L OF NEWLAND ST.



PLAN
1" = 100'

NO CHANGES

AS BUILT
CORRECTIONS BY
CONTRACT NO.
DATE

REGISTERED PROFESSIONAL ENGINEER DYAN CHANDRA No. 2376 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER

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DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED ENGINEER-GEOTECHNICAL

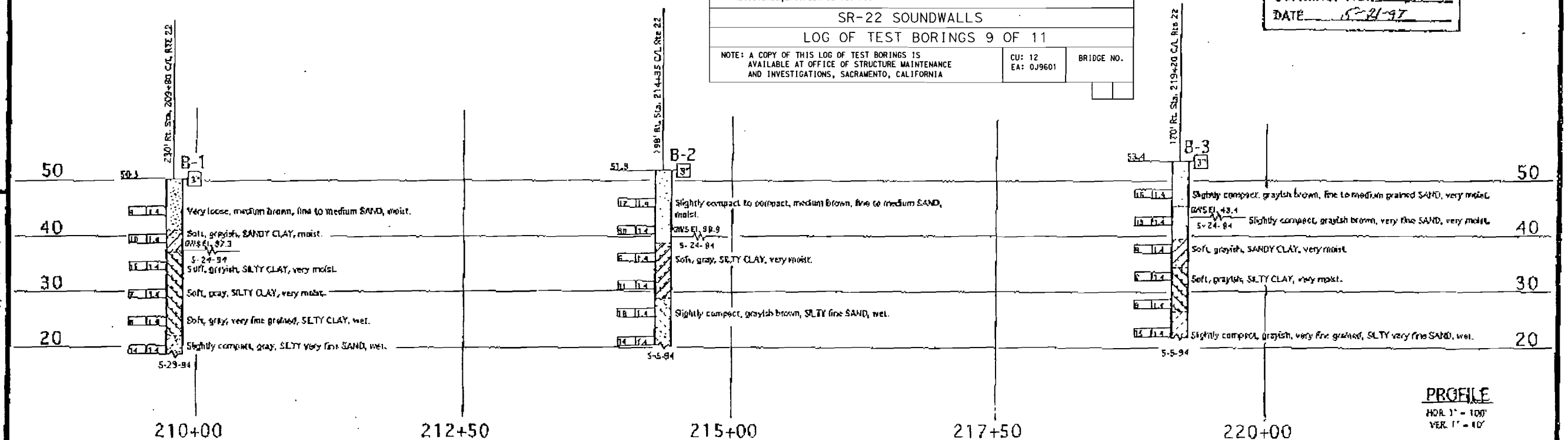
SR-22 SOUNDWALLS

LOG OF TEST BORINGS 9 OF 11

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

CU: 12
EA: 0J9601

BRIDGE NO.



PROFILE
HOR. 1" = 100'
VER. 1" = 10'

LEGEND OF EARTH MATERIALS: GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAY PIPE, PLASTIC CONCRETE, FILL MATERIAL, ORGANIC MATTER, SEDIMENTARY ROCK, METAMORPHIC ROCK, IGNEOUS ROCK

CONSISTENCY CLASSIFICATION FOR SOILS According to the Standard Penetration Test

Penetration Index (Blows/Ft)	Granular	Cohesive
0-4	Very loose	Very soft
5-9	Loose	Soft
10-19	Slightly compact	Firm
20-39	Compact	Very stiff
40-79	Very dense	Very dense
80+		

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

DIVISION OF NEW TECHNOLOGY, MATERIALS AND RESEARCH	OFFICE OF ENGINEERING GEOLOGY
DRAWN BY	9/84
CHECKED BY	9/14/94

FIELD INVESTIGATION BY: S. AMRI

State of CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN

BRIDGE NO.
POST MILE 3.6/4.3

SOUND WALL NO. 210
LOG OF TEST BORINGS SW-6

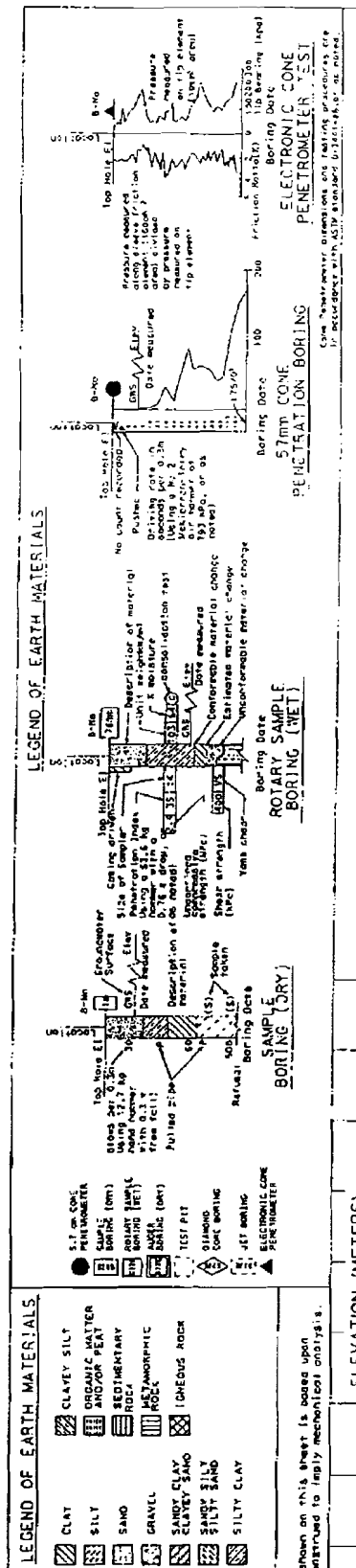
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12207
EA 0J2521

DISREGARD PRIOR BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

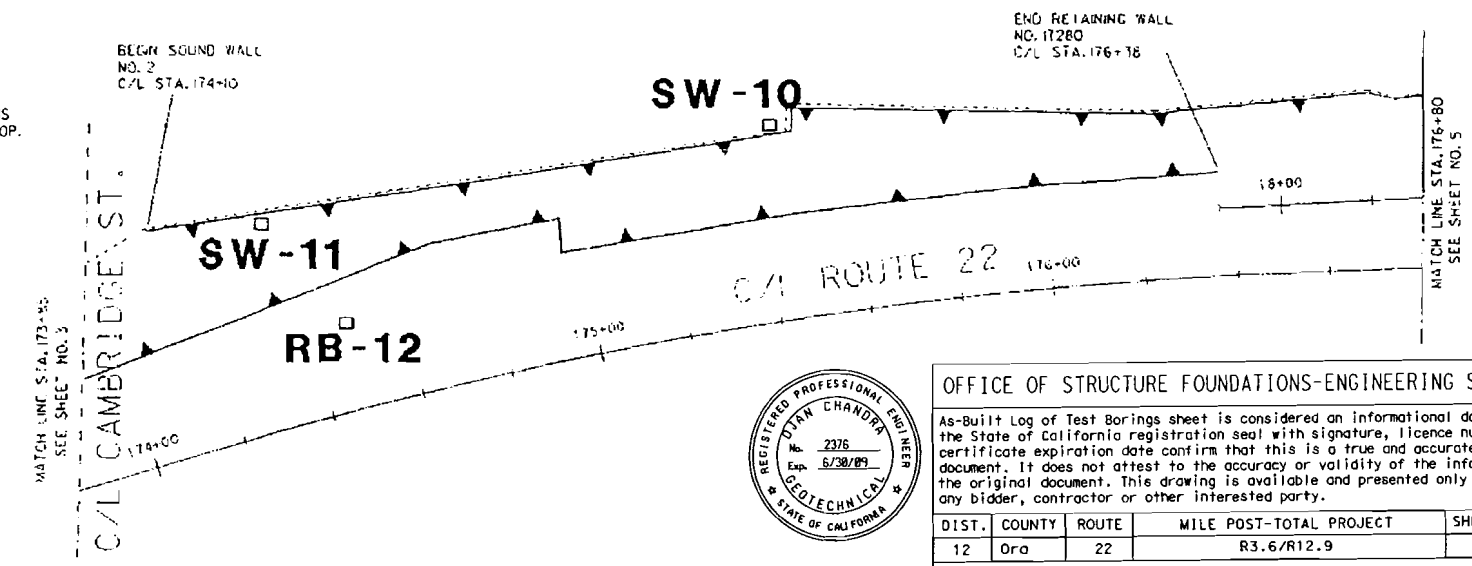
SHEET OF



REFERENCE:
BASE MAP ADAPTED FROM CAD FILE "STATE ROUTE 55/22 INTERCHANGE", BY SVERDRUP CIVIL, INC., DATED JUNE 16, 1995.

BENCHMARK:
672-C-68, 64.495', SET RAMSET ON SW COR. OF PCC BASE FOR ELECTROLIER #18323, 85' EAST OF CL STA. 672+00, 100'N OF FAIRHAVEN AVE. O.C.

NOTE:
SAMPLER IS EITHER THE STANDARD SPT SAMPLER WITH ID=3.6cm OR A MODIFIED SPLIT BARREL SAMPLER WITH ID=6.1cm AND OD=7.6cm, AS NOTED. PENETRATION INDEX IS BASED ON USING A 63.6 Kg HAMMER WITH A 0.76cm DROP.



DIST	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora				

REGISTERED CIVIL ENGINEER
PRINCIPAL ENGINEER
2-24-98

REGISTERED PROFESSIONAL ENGINEER JALAL FARHI No. 045350 Exp. 09-30-98 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

NINYO & MOORE
9272 JERONIMO RD. STE. 123A
IRVINE, CA 92718

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REGISTERED PROFESSIONAL ENGINEER DIAN CHANDRA No. 2376 Exp. 6/30/99 GEOTECHNICAL STATE OF CALIFORNIA

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER

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DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED ENGINEER-GEOTECHNICAL

STA. NO. 175+42 SR-22 SOUNDWALLS
40.6m LT OF SR22 C/L
LOG OF TEST BORINGS 10 OF 11

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

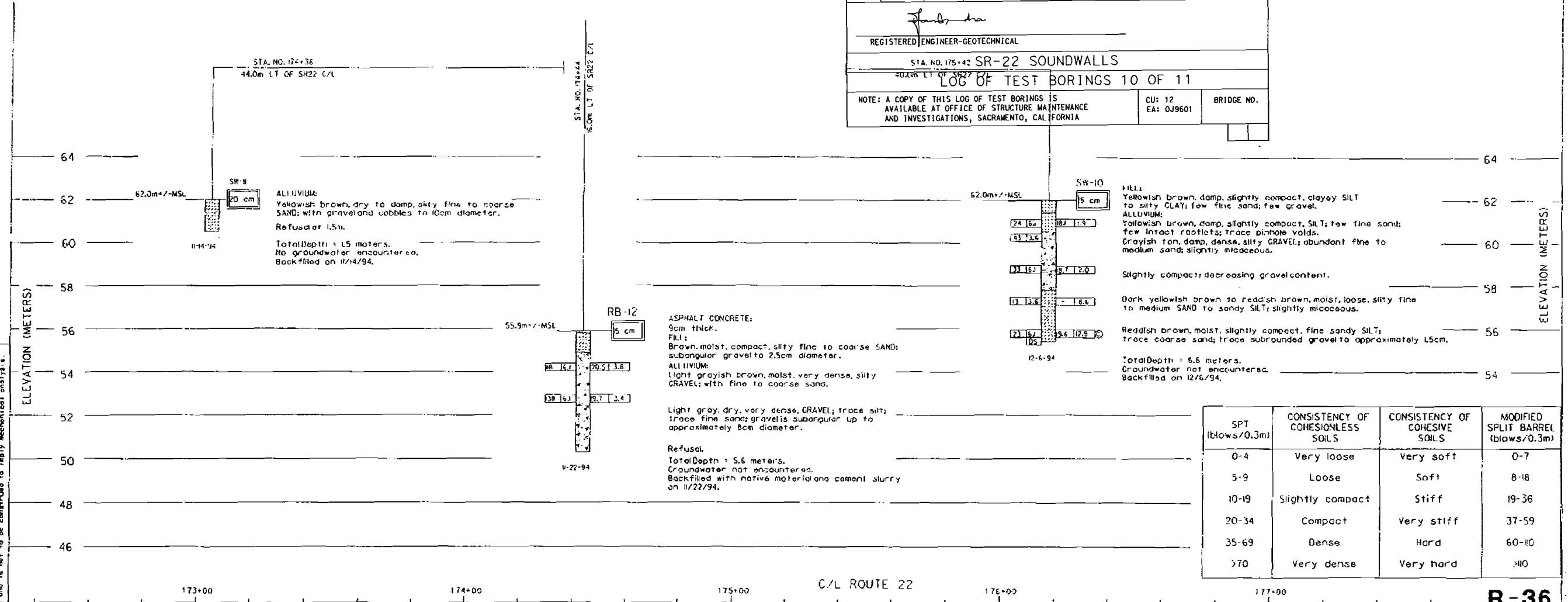
CU: 12
EA: 0J9601

BRIDGE NO.

N

SCALE:
PLAN VIEW
METER 0 25 50
SCALE 1:1000

PROFILE
VERTICAL PROFILE 1:100
HORIZONTAL PROFILE 1:1000



SPT (blows/0.3m)	CONSISTENCY OF COHESIONLESS SOILS	CONSISTENCY OF COHESIVE SOILS	MODIFIED SPLIT BARREL (blows/0.3m)
0-4	Very loose	Very soft	0-7
5-9	Loose	Soft	8-18
10-19	Slightly compact	Stiff	19-36
20-34	Compact	Very stiff	37-59
35-69	Dense	Hard	60-110
>70	Very dense	Very hard	>110

R-36

DRAWN BY	LR	FIELD INVESTIGATOR	ROB WHEELER, STAFF GEOLOGIST
CHECKED BY	MAS	MONTH, YEAR DATE	NOV. 1994

PREPARED FOR STATE OF:
CALIFORNIA
DEPARTMENT OF TRANSPORTATION

BRIDGE NO. -
KILOMETER POST -

STATE ROUTE 55/22 INTERCHANGE
ORANGE COUNTY, CALIFORNIA
SOUND WALLS AND RETAINING WALLS
LOG OF TEST BORINGS

ORIGINAL SCALE IS IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30

EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

CU 12209 | EA 013311

2-24-98

SI.

BASE MAP ADAPTED FROM CAD FILE "STATE ROUTE 55/22 INTERCHANGE", BY SVERDRUP CIVIL, INC., DATED JUNE 16, 1995.

BENCHMARK:
672-C-68. 64.495'. SET RAMSET ON SW COR. OF PCC BASE FOR ELECTROLIER #18373. 85' EAST OF CL STA. 672+00, 100'N OF FAIRHAVEN AVE. O.C.

NOTE:
SAMPLER IS EITHER THE STANDARD SPT SAMPLER WITH ID=3.6cm OR A MODIFIED SPLIT BARREL SAMPLER WITH ID=6.1cm AND OD=7.6cm. AS NOTED. PENETRATION INDEX IS BASED ON USING A 63.6 kg HAMMER WITH A 0.76cm DROP.

DIST	COUNTY	ROUTE	KILOMETER POSTS TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora				

REGISTERED CIVIL ENGINEER
PRINCIPAL ENGINEER
2-24-98

REGISTERED PROFESSIONAL ENGINEER JALAL YAKIN No. 045350 Exp. 09-30-98 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

NINYO & MOORE
9272 JERONIMO RD. STE. 125A
IRVINE, CA 92718

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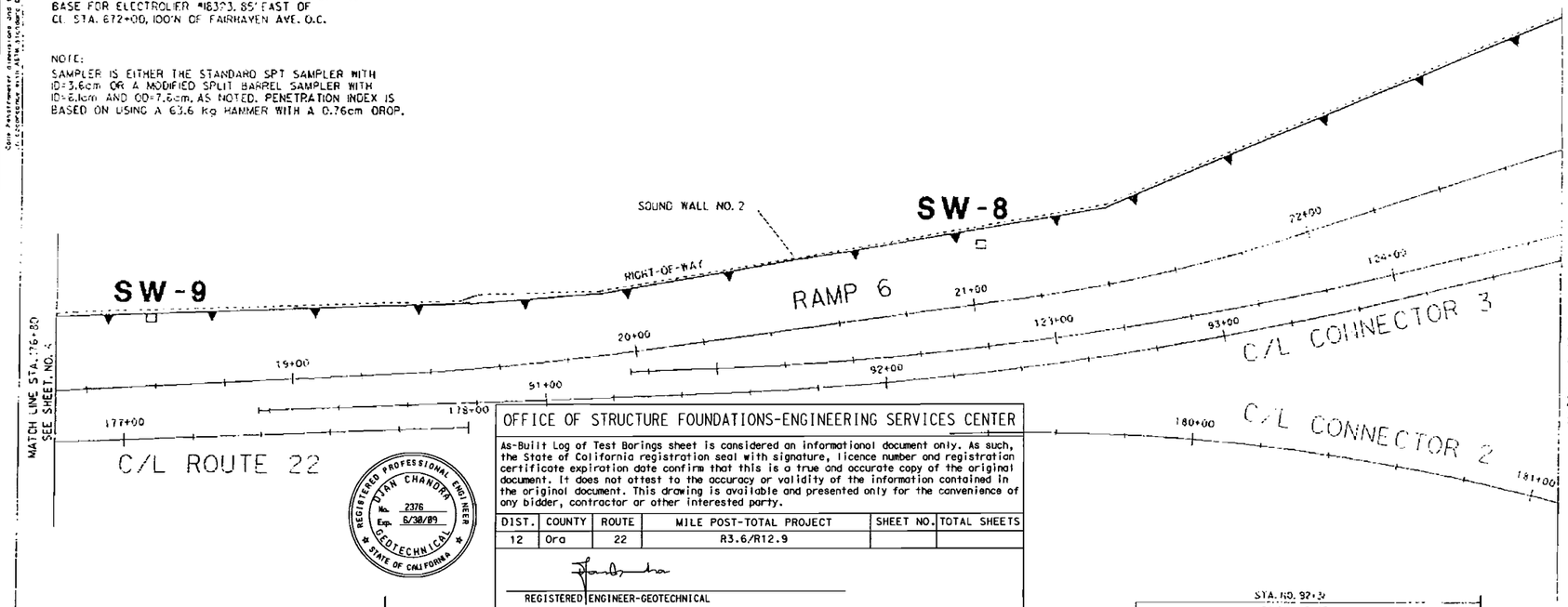

SCALE:
PLAN VIEW
METER
SCALE 1:1000
PROFILE
VERTICAL PROFILE 1:100
HORIZONTAL PROFILE 1:1000

OFFICE OF STRUCTURE FOUNDATIONS-ENGINEERING SERVICES CENTER

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DIST.	COUNTY	ROUTE	MILE POST-TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	22	R3.6/R12.9		

REGISTERED ENGINEER-GEOTECHNICAL

REGISTERED PROFESSIONAL ENGINEER DYAN CHANDRA No. 2376 Exp. 6/30/89 GEOTECHNICAL STATE OF CALIFORNIA

SR-22 SOUNDWALLS

LOG OF TEST BORINGS 11 OF 11

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

CU: 12
EA: 0J9601

BRIDGE NO.

STA. NO. 177+10
35.0m LT OF SR22 C/L

SW-9
5 cm
62.0m+/-MSL
11-21-94

FILL:
Light brown, damp, slightly compact, SILT; trace gravel; trace fine sand; few intact roots near surface.
Increase in gravel and cobble content.
Refusal at 0.66m.
Total Depth = 0.66 meters.
Groundwater not encountered.
Backfilled on 11/21/94.

STA. NO. 92+30
38.0m LT OF SR22 C/L

SW-8
5 cm
64.0m+/-MSL
44 6.1
93 3.6
50/23cm 16.1
11-21-94

FILL:
Light brown, damp, slightly compact, SILT; trace gravel; trace fine sand; few intact roots near surface.
Increasing gravel content.
ALLUVIUM:
Light brown, dry to damp, compact, silty fine SAND.
Fine to medium sand; subangular gravel to approximately 2.5cm diameter.
Increasing gravel content.
Light brown, dry to damp, very dense, gravelly SAND to sandy GRAVEL with silt.
Grayish brown, dry to damp, very dense, silty GRAVEL; with fine sand.
Refusal due to gravel and cobbles.
Total Depth = 5.5 meters.
Groundwater not encountered.
Backfilled on 11/21/94.

ELEVATION (METERS): 64, 62, 60, 58, 56, 54, 52, 50, 48

C/L ROUTE 22 177+00 — 90+00 C/L CONNECTOR 3 91+00 92+00 93+00

SPT (blows/0.3m)	CONSISTENCY OF COHESIONLESS SOILS	CONSISTENCY OF COHESIVE SOILS	MODIFIED SPLIT BARREL (blows/0.3m)
0-4	Very loose	Very soft	0-7
5-9	Loose	Soft	8-18
10-19	Slightly compact	Stiff	19-36
20-34	Compact	Very stiff	37-59
35-69	Dense	Hard	60-110
>70	Very dense	Very hard	>110

R-37

LEGEND OF EARTH MATERIALS

ELECTRONIC CONE PENETROMETER TEST

STATIC CONE PENETRATION BORING

ROTARY SAMPLE BORING (WET)

SAMPLE BORING (DRY)

LEGEND OF SAMPLE MATERIALS: CLAY, SILT, SAND, GRAVEL, CLAYEY SILT, SANDY CLAY, SANDY SILT, SILTY CLAY, CLAYEY SILT, ORGANIC MATTER AND/OR PEAT, SEDIMENTARY ROCK, METAMORPHIC ROCK, IGNEOUS ROCK.

CONSISTENCY CLASSIFICATION FOR SOILS According to the Standard Penetration test

Penetration Index (Blows/0.3m)	Granular	Cohesive
0-4	Very loose	Very soft
5-9	Loose	Soft
10-19	Slightly compact	Stiff
20-34	Compact	Very stiff
35-69	Dense	Hard
>70	Very dense	Very hard

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

DRAWN BY	LR	FIELD INVESTIGATOR	ROB WHEELER, STAFF GEOLOGIST
CHECKED BY	MAS	MONTH, YEAR DATE	NOV. 1994

PREPARED FOR STATE OF:
CALIFORNIA
DEPARTMENT OF TRANSPORTATION

BRIDGE NO -
KILOMETER POST -

STATE ROUTE 55/22 INTERCHANGE
ORANGE COUNTY, CALIFORNIA
SOUND WALLS AND RETAINING WALLS
LOG OF TEST BORINGS

ORIGINAL SCALE IS IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30

EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

2-24-98

APPENDIX A

Boring No.	HA-6							
Sample No.	R-1							
Depth (ft.)	5.0							
Sample Type	Drive							
Soil Identification	Dark brown Sity Sand with gravel (SM)							
Pocket Penetrometer (tons/ft^2)	0.00							
Weight Soil + Rings / Tube (g)	736.00							
Weight of Rings / Tube (g)	177.60							
Average Length (in.)	4.00							
Average Diameter (in.)	2.416							
Wet. Wt. of Soil + Cont. (g)	277.70							
Dry Wt. of Soil + Cont. (g)	264.70							
Weight of Container (g)	39.10							
Container No.								
Wet Density	116.0							
Moisture Content (%)	**5.8**							
Dry Density (pcf)	**109.7**							
Degree of Saturation (%)	29.0							

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: I-5 / SR-22 Soundwall
Project No.: 602198-001
Client Name: LCI / Irvine
Tested By: S. Felter Date: 05/27/08

Leighton

MOISTURE CONTENT

ASTM D 2216

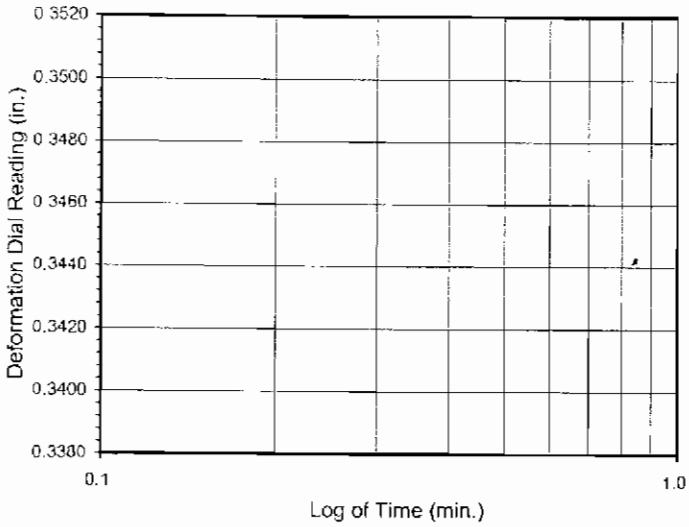
Project Name: **I-5 / SR-22 Soundwall**
Project No.: **602198-001**

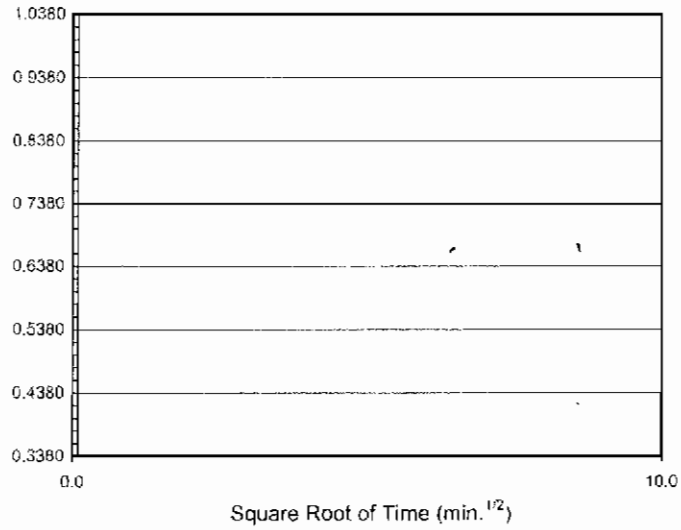
Tested By: S. Felter
Date: 05/27/08
Checked By: LF
Date: 05/30/08

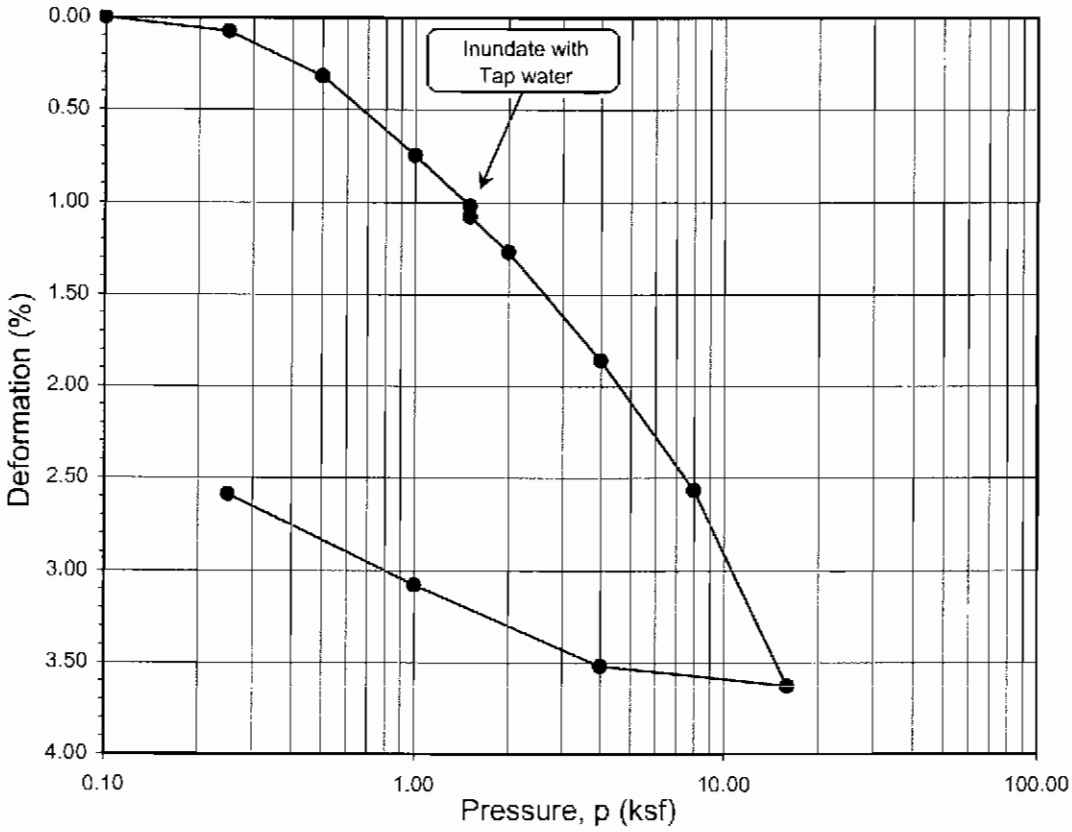
Boring No.	HA-1	HA-1			
Sample No.	R-1	R-2			
Depth (ft)	5	10			
Sample Type	Drive	Drive			
Sample Description	Olive green Sand (SP)	Yellowish olive brown poorly graded sand (SP)			
Wt. wet soil + container (g)	274.20	225.00			
Wt. dry soil + container (g)	256.70	212.90			
Weight of container (g)	38.93	38.95			
Moisture Content (%)	**8.0**	**7.0**			

Boring No.					
Sample No.					
Depth (ft)					
Sample Type					
Sample Description					
Wt. wet soil + container (g)					
Wt. dry soil + container (g)					
Weight of container (g)					
Moisture Content (%)					

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HA-2	**R-1**	**2.5**	**13.3**	**21.9**	**103.1**	**103.1**	**0.634**	**0.592**	**57**	**93**

Soil Identification: Olive brown Silty gravelly Sand (SW)

Leighton

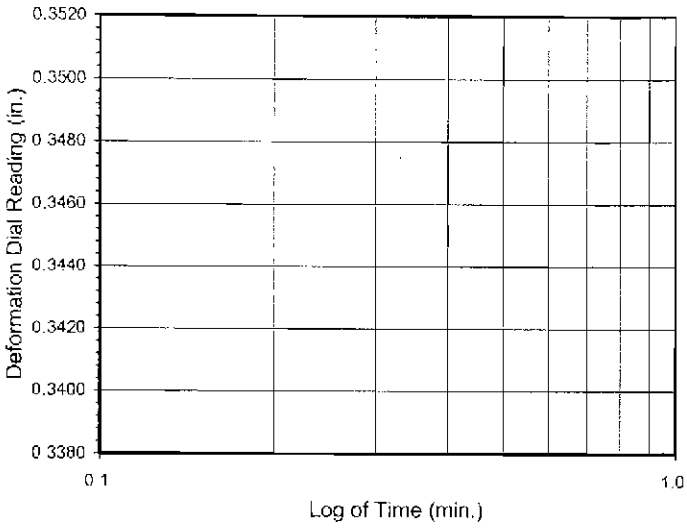
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

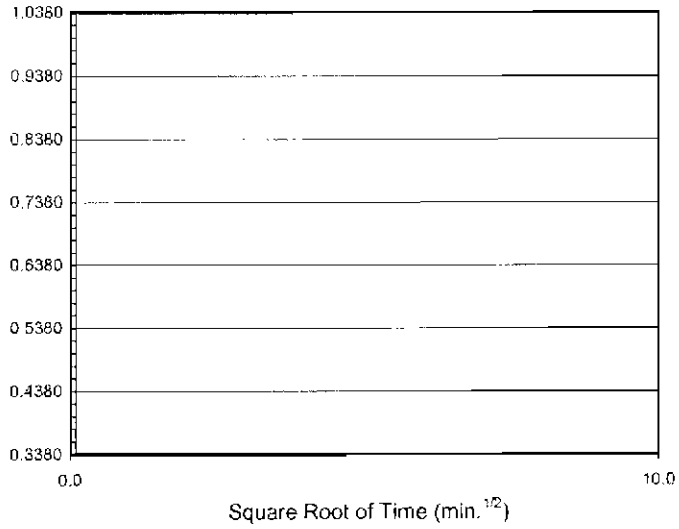
Project No.: 602198-001

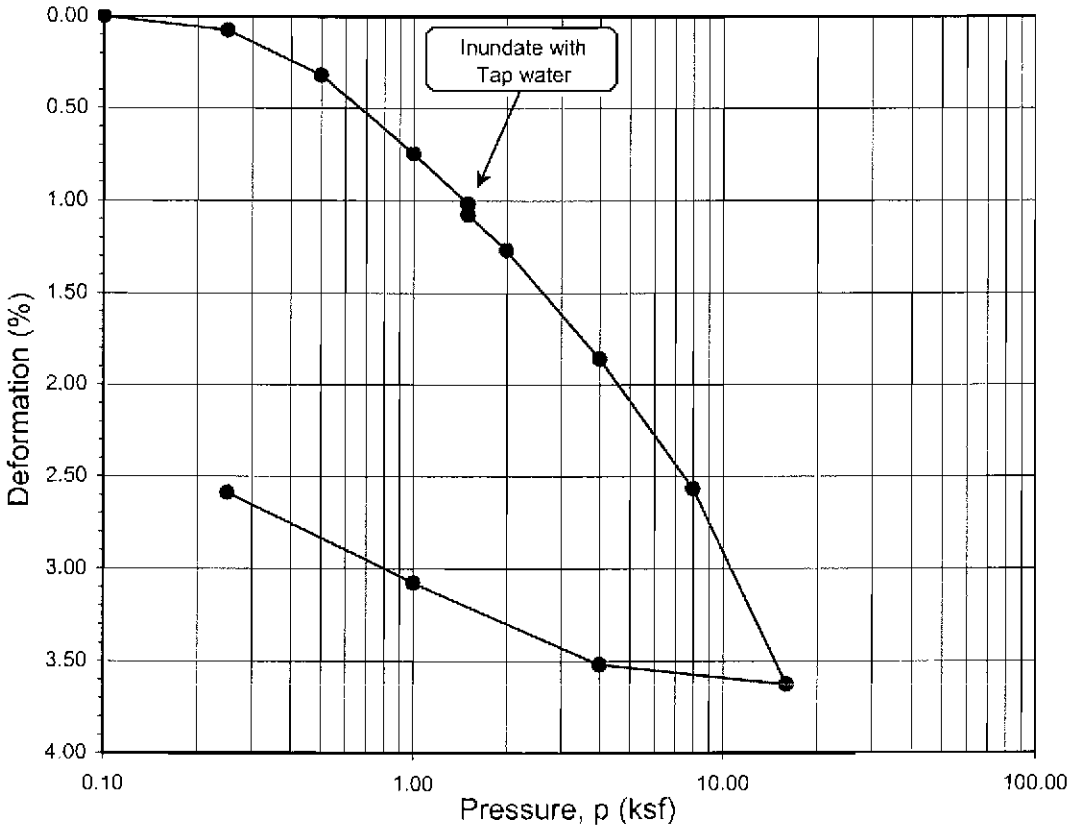
I-5 / SR-22 Soundwall

06-08

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
HA-2	**R-1**	**2.5**	**13.3**	**21.9**	**103.1**	**103.1**	**0.634**	**0.592**	**57**	**93**

Soil Identification: Olive brown Silty gravelly Sand (SW)

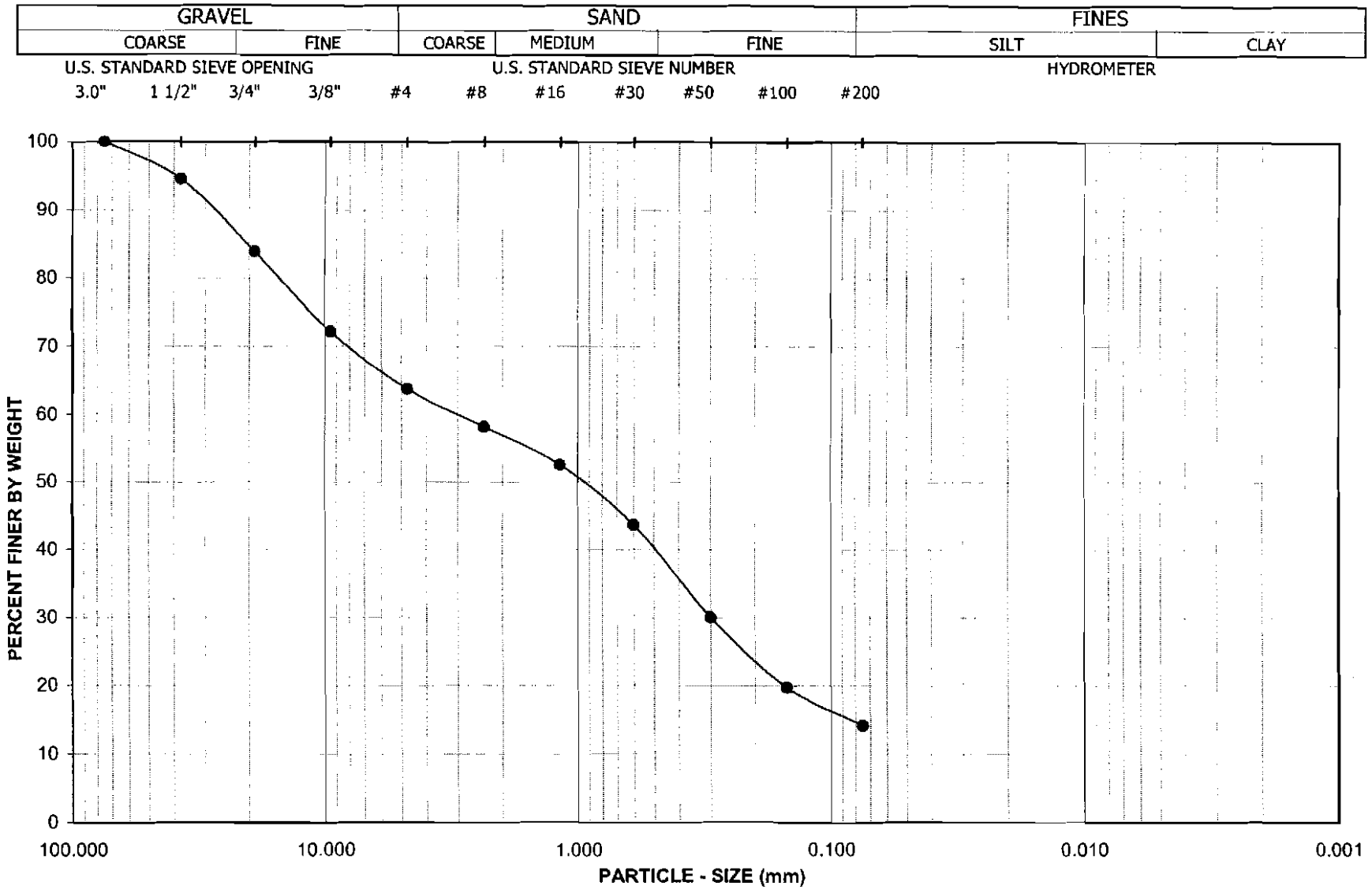
Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 602198-001

I-5 / SR-22 Soundwall

06-08



Project Name: I-5 / SR-22 Soundwall

Project No.: 602198-001

Exploration No.: HA-4 Sample No.: Bag-1

Depth (feet): 0-2 Soil Type : (SM)g

Soil Identification: Brown silty sand with gravel (SM)g and organic matter

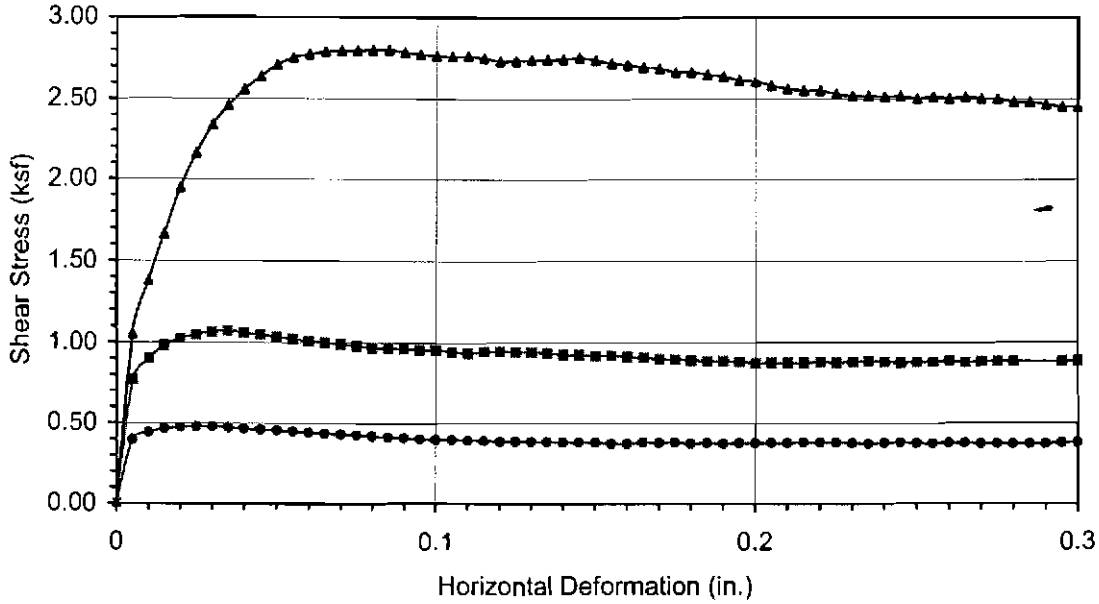
GR:SA:FI : (%) 36 : 50 : 14

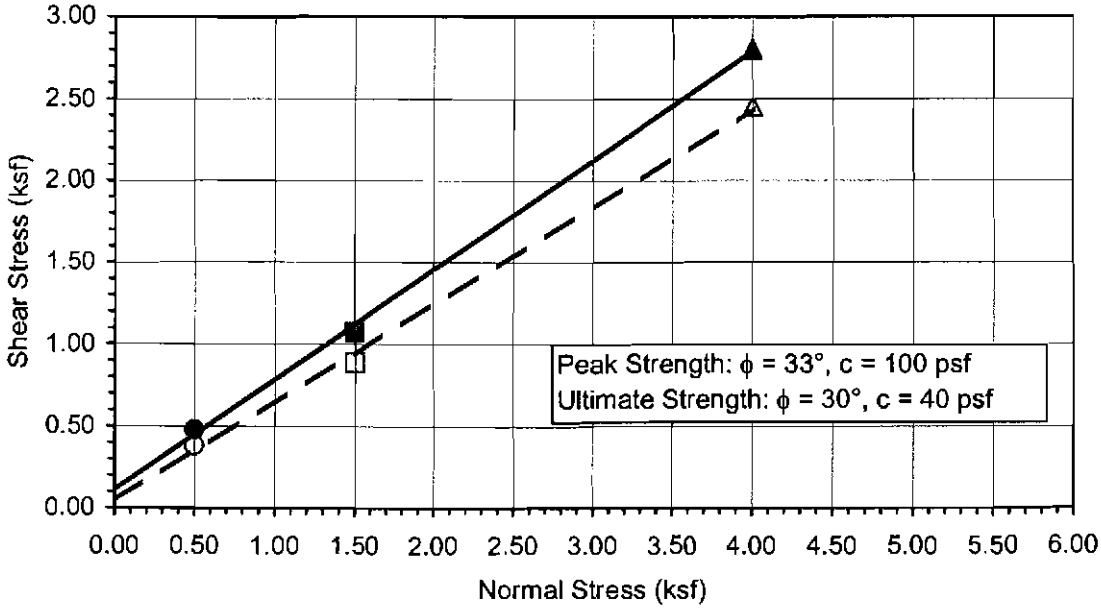
Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jul-08

SA HA-4 Bag-1





Boring No.	**HA-2**
Sample No.	**R-2**
Depth (ft)	**5**
Sample Type: Drive	
Soil Identification: Olive brown Sand (SP)	

Normal Stress (kip/ft²)	0.500	1.500	4.000
Peak Shear Stress (kip/ft²)	● 0.478	■ 1.072	▲ 2.801
Shear Stress @ End of Test (ksf)	○ 0.380	□ 0.887	△ 2.452
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	6.24	6.24	6.24
Dry Density (pcf)	109.6	112.0	113.4
Saturation (%)	31.3	33.3	34.7
Soil Height Before Shearing (in.)	0.9978	0.9915	0.9811
Final Moisture Content (%)	16.5	15.9	15.1

Leighton

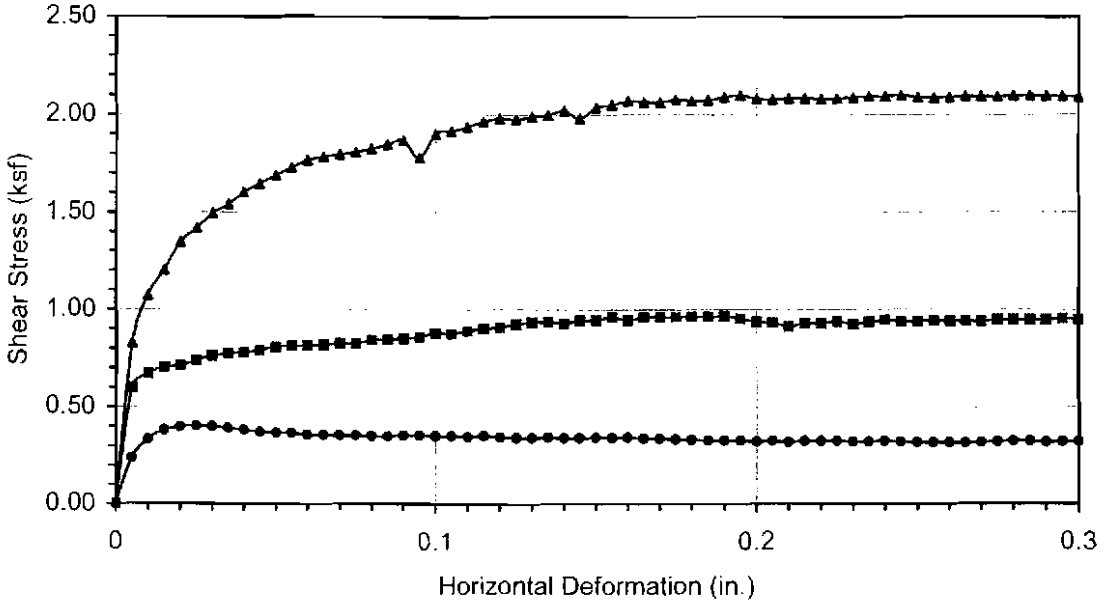
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

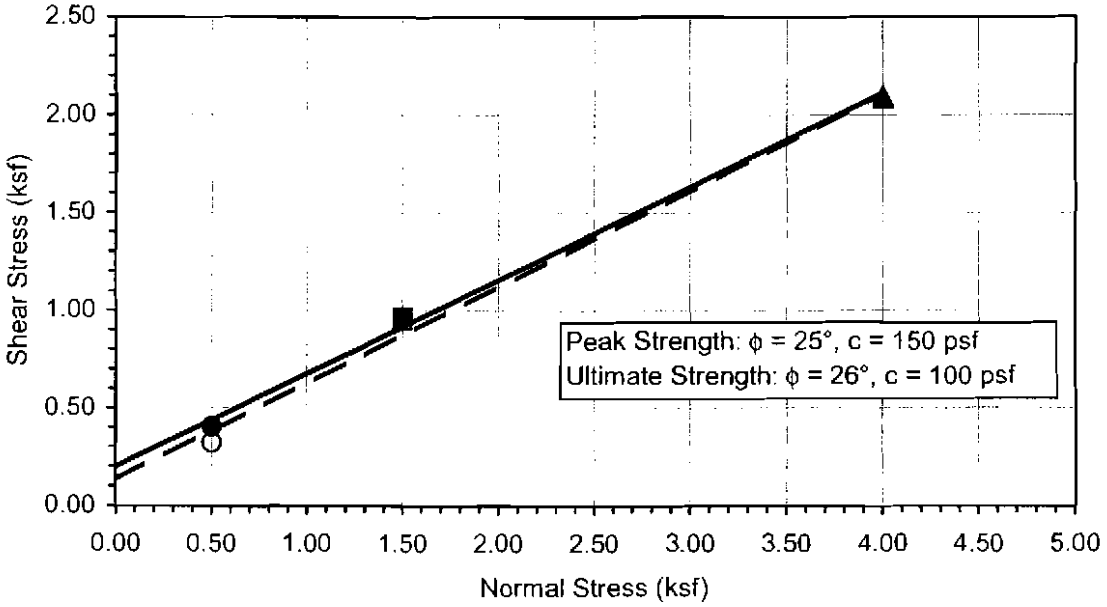
Project No.: 602198-001

I-5 / SR-22 Soundwall (Beach Blvd.)

05-08

DS HA-2 R-2





Boring No.	**HA-3**
Sample No.	**R-1**
Depth (ft)	**5**
Sample Type: Drive	
Soil Identification: Brown clayey sand / sandy lean clay (SC) / (CL)	

Normal Stress (kip/ft²)	0.500	1.500	4.000
Peak Shear Stress (kip/ft²)	● 0.402	■ 0.965	▲ 2.097
Shear Stress @ End of Test (ksf)	○ 0.321	□ 0.949	△ 2.087
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	8.12	8.12	8.12
Dry Density (pcf)	110.4	111.9	114.0
Saturation (%)	41.6	43.3	45.8
Soil Height Before Shearing (in.)	0.9956	0.9812	0.9832
Final Moisture Content (%)	19.2	18.2	15.9

Leighton

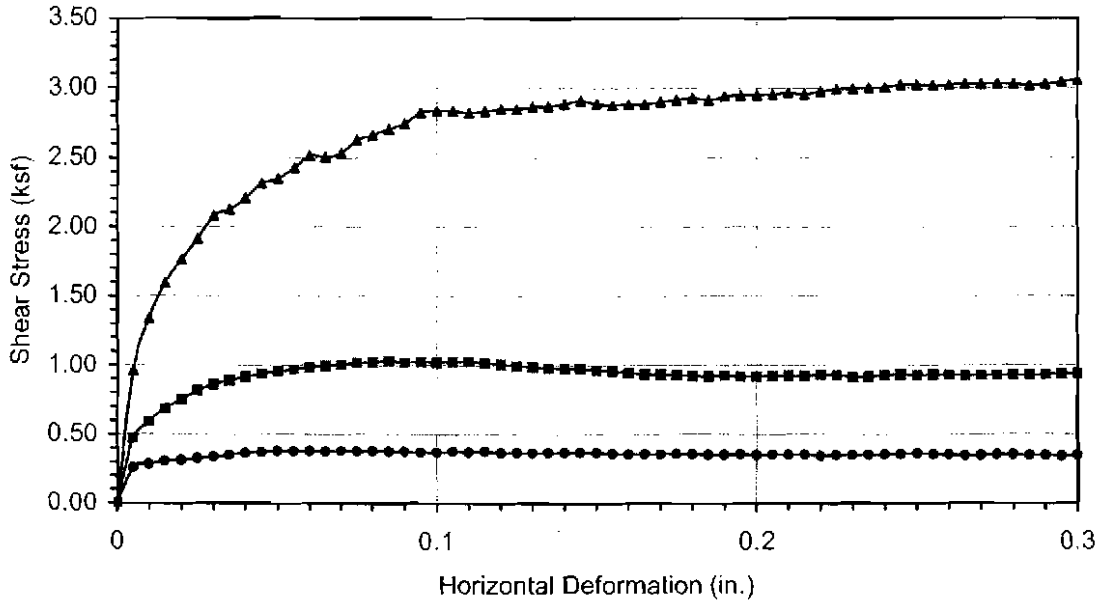
DIRECT SHEAR TEST RESULTS
Consolidated Undrained

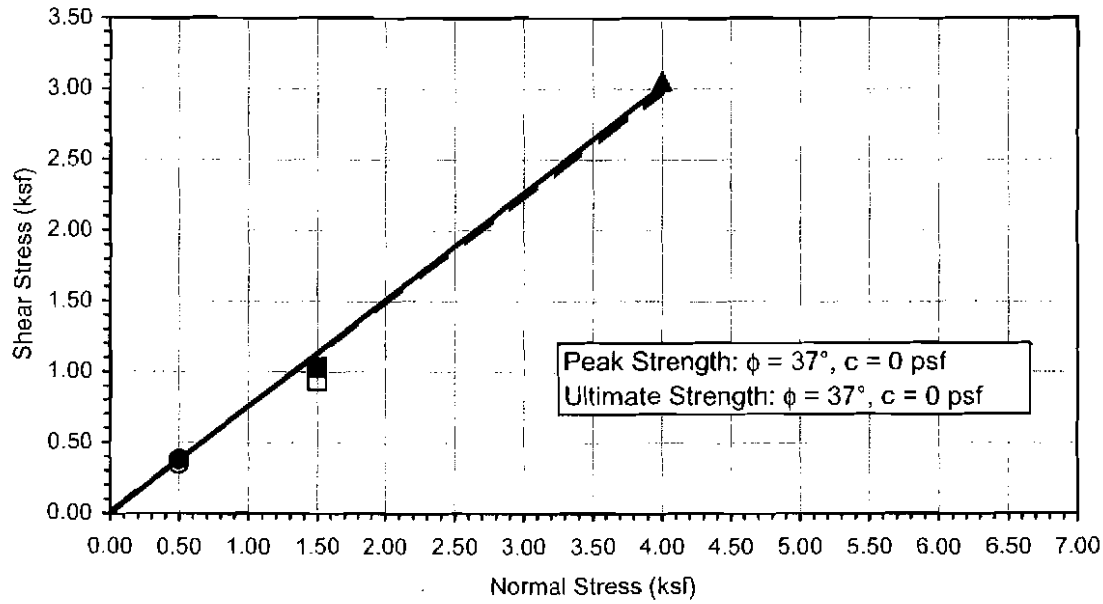
Project No.: 602198-001

I-5 / SR-22 Soundwall (I-5 Connector)

05-08

DS HA-3 R-1





Boring No.	**HA-7**
Sample No.	**R-1**
Depth (ft)	**5**
Sample Type: Drive	
Soil Identification: Brown silty sand with gravel (SM)g	

Normal Stress (kip/ft²)	0.500	1.500	4.000
Peak Shear Stress (kip/ft²)	● 0.380	■ 1.034	▲ 3.056
Shear Stress @ End of Test (ksf)	○ 0.346	□ 0.937	△ 3.056
Deformation Rate (in./min.)	0.0500	0.0500	0.0500
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	3.06	3.06	3.06
Dry Density (pcf)	103.1	107.1	110.9
Saturation (%)	13.0	14.4	15.9
Soil Height Before Shearing (in.)	0.9945	0.9836	0.9644
Final Moisture Content (%)	19.1	18.2	16.6

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DIRECT SHEAR TEST RESULTS
Consolidated Undrained

Project No.: 602198-001

I-5 / SR-22 Soundwall (Cambridge St.)

05-08

DS HA-7 R-1

Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

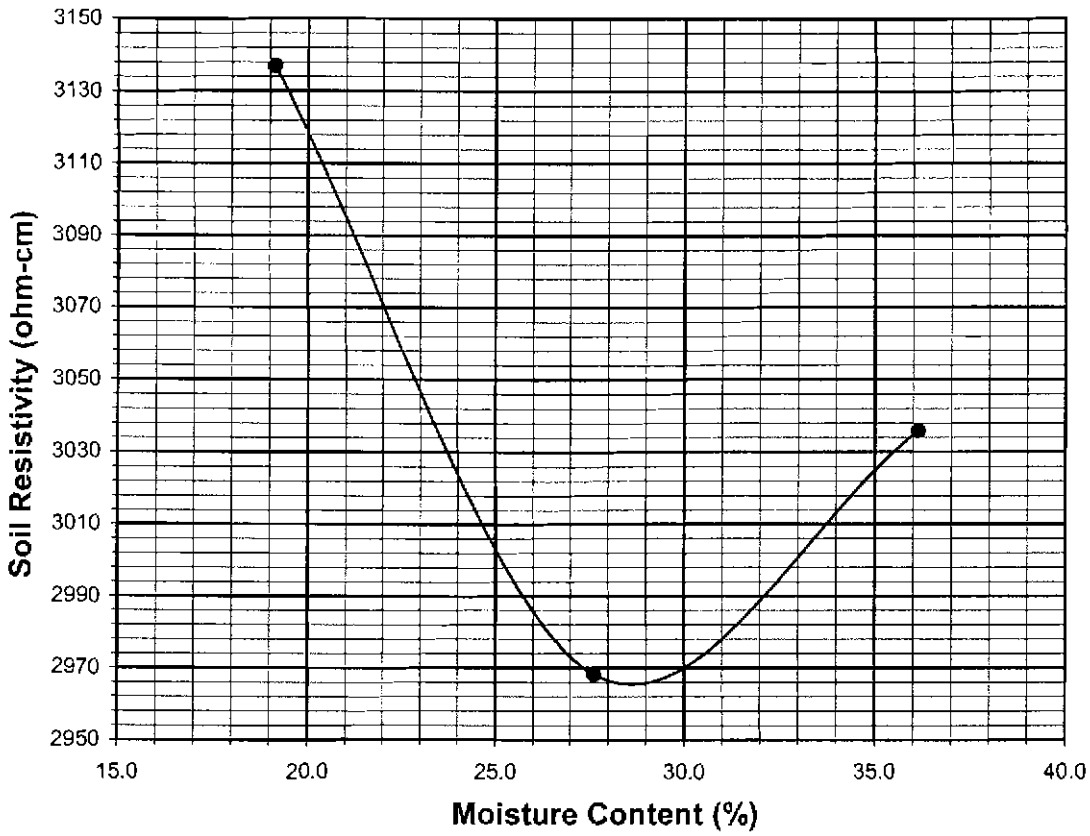
Project Name: I-5 / SR-22 Soundwall
Project No. : 602198-001
Boring No.: HA-2
Sample No. : Bag-1
Soil Identification: SM/CL

Tested By : V. Juliano Date: 05/23/08
Data Input By: LF Date: 05/30/08
Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	19.13	465	3137
2	200	27.64	440	2968
3	300	36.15	450	3036
4				
5				

Moisture Content (%) (MCi)	10.62
Wet Wt. of Soil + Cont. (g)	161.15
Dry Wt. of Soil + Cont. (g)	151.13
Wt. of Container (g)	56.78
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
2966	**28.7**	**115**	**56**	**7.39**	**22.4**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

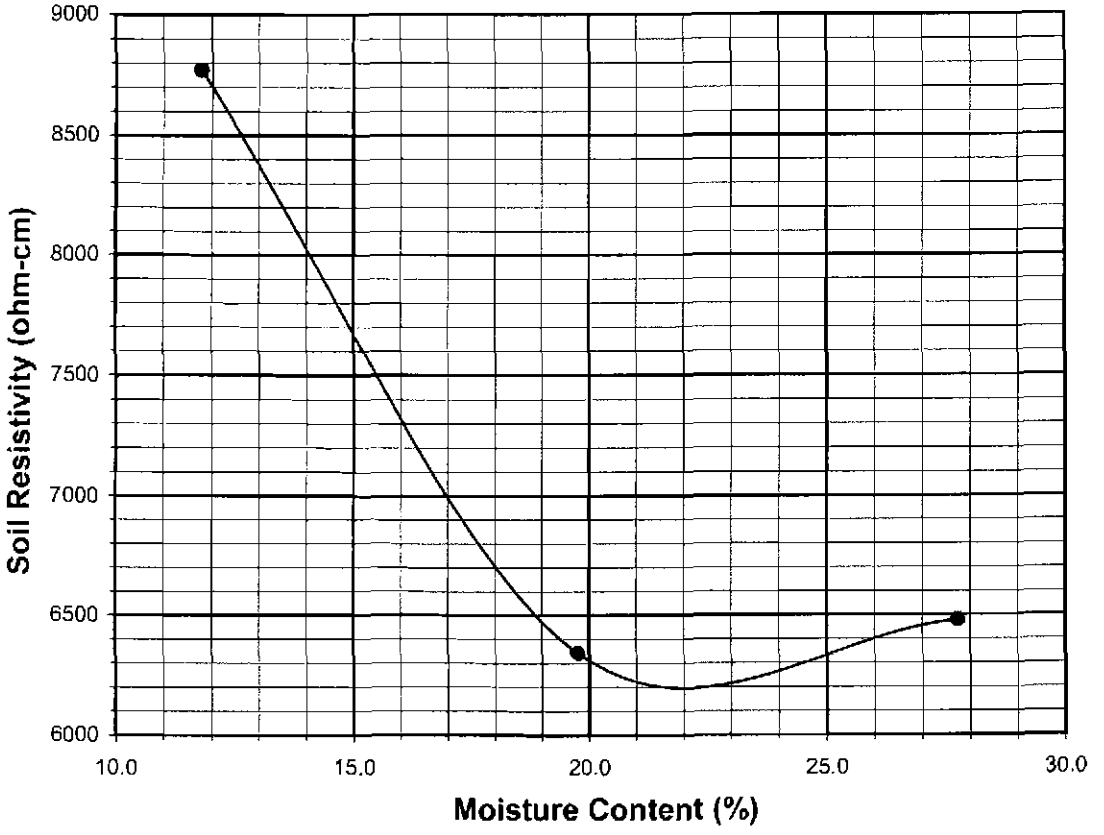
Project Name: I-5 / SR-22 Soundwall
Project No. : 602198-001
Boring No.: HA-4
Sample No. : Bag-1
Soil Identification: (SM)g

Tested By : V. Juliano Date: 05/23/08
Data Input By: LF Date: 05/30/08
Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	11.78	1300	8770
2	200	19.77	940	6341
3	300	27.75	960	6476
4				
5				

Moisture Content (%) (MCi)	3.80
Wet Wt. of Soil + Cont. (g)	199.68
Dry Wt. of Soil + Cont. (g)	194.83
Wt. of Container (g)	67.20
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
6200	**22.0**	**141**	**52**	**7.73**	**22.4**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

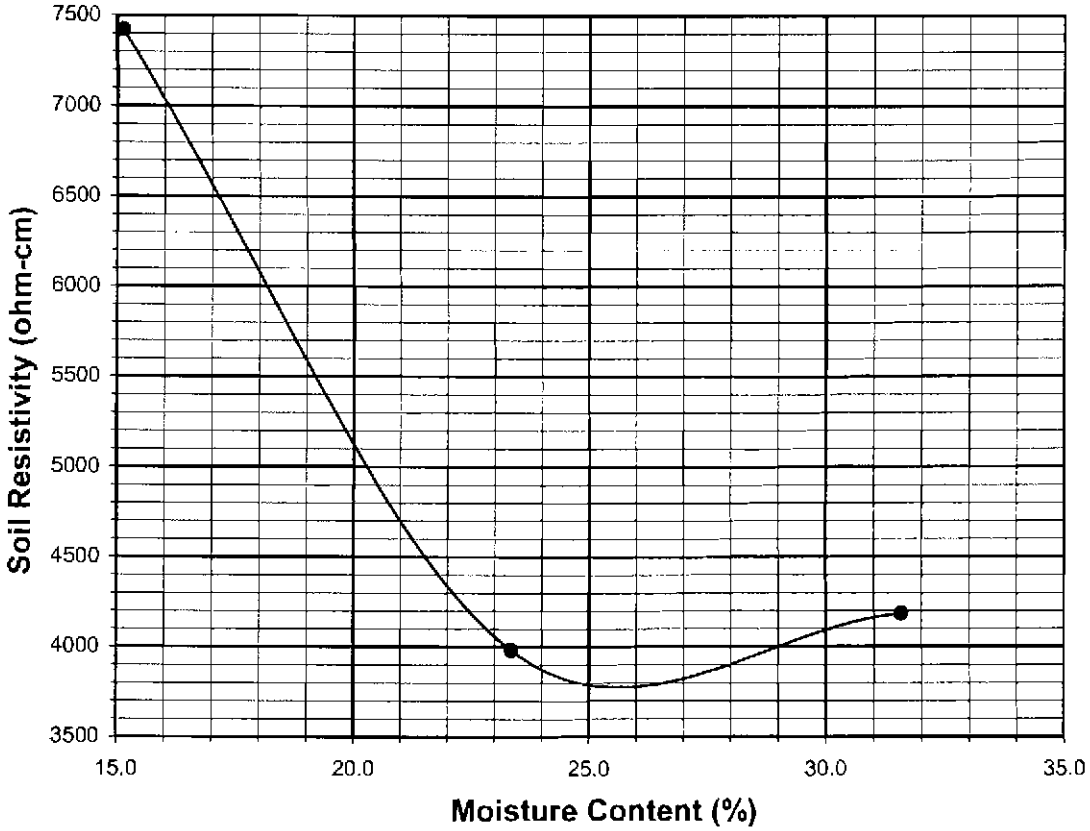
Project Name: I-5 / SR-22 Soundwall
Project No. : 602198-001
Boring No.: HA-7
Sample No. : Bag-1
Soil Identification: (SM)g

Tested By : V. Juliano Date: 05/23/08
Data Input By: LF Date: 05/30/08
Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	15.13	1100	7421
2	200	23.36	590	3980
3	300	31.58	620	4183
4				
5				

Moisture Content (%) (MCi)	6.91
Wet Wt. of Soil + Cont. (g)	167.06
Dry Wt. of Soil + Cont. (g)	160.84
Wt. of Container (g)	70.81
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
3780	**25.7**	**111**	**54**	**7.80**	**22.4**



Leighton

Soluble Sulfates

(Hach Sulfate Test Kit)

Project Name: I-5 / SR-22 Soundwall
Project Number: 602198-001
Date: 06/03/08
Technician: G. Bathala

Sample Identification		Dilution	Reading (PPM) Tube Reading		H_2O:Soil Ratio	% Sulfates
Boring No.:	HA-3	3 :1	55	X	3	**0.0165**
Sample No:	R-1		=	165		
Depth (ft.):	5					
Boring No.:						
Sample No:						
Depth (ft.):						
Boring No.:						
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Sample No:						
Depth (ft.):						

APPENDIX B

State Route 22 HOV Lane Design-Build
Orange County, California
URS Project Number 29866278

Key to Log of Boring

Elevation, meters	Depth, meters	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Moisture Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in meters referenced to indicated datum.

2 **Depth:** Depth in meters below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows required to advance driven sampler 300 mm beyond first 150-mm interval, or distance in mm noted, using a 63.5-kg hammer with a 760-mm drop. Sampling resistance of "50/115" indicates 50 blows for 115-mm drive.

6 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

7 **Material Description:** Classification and description of material encountered; may include relative density / consistency, color, moisture, grain size (f=fine, m=medium, c=coarse), plasticity, and secondary components.

8 **Moisture Content:** Moisture content of soil sample measured in laboratory, expressed as percentage of dry weight of specimen.

9 **Dry Unit Weight:** Dry weight per unit volume of soil sample measured in laboratory, in kiloNewtons per cubic meter.

10 **Remarks and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel. Other field and laboratory test results, using the following abbreviations:

COMP	Compaction test by modified effort
CORR	Chemical tests to assess corrosivity
CONS	One-dimensional consolidation test
DS	Direct shear test
HD	Hydrometer, % finer than 2 microns
LL	Liquid limit (from Atterberg limits test), %
PI	Plasticity index [LL - PL], %; NP=nonplastic
SA	Sieve analysis, %<#200 sieve
RV	Resistance value for trafficability
UC	Unconfined compressive strength test, kPa
WA	Wash on #200 sieve, %<#200 sieve

TYPICAL MATERIAL GRAPHIC SYMBOLS

SAND
SILT
CLAY
GRAVEL
SANDY SILT or SILTY SAND
SANDY CLAY or CLAYEY SAND
SILTY CLAY
CLAYEY SILT
FILL MATERIAL
PEAT and/or ORGANIC MATTER
IGNEOUS ROCK
SEDIMENTARY ROCK

TYPICAL SAMPLER GRAPHIC SYMBOLS

61-mm-ID California sampler with brass liners
35-mm-ID unlined split spoon (SPT)
51-mm-ID Modified California with brass liners
Bulk / bucket sample

OTHER GRAPHIC SYMBOLS

First water encountered at time of drilling and sampling (ATD)

Static water level measured in boring at specified time after drilling

--- Inferred or gradational contact between strata

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Report: GEO_10_SNAGMR_METRICKEY; File: SNA_SR22OCTA.GPJ; 7/10/2005 keycontrans

NOTES:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	22	R1.48/21.19		

NOT FOR CONSTRUCTION

Caltrans now has a web site! To get to the web site, go to: http://www.dot.ca.gov

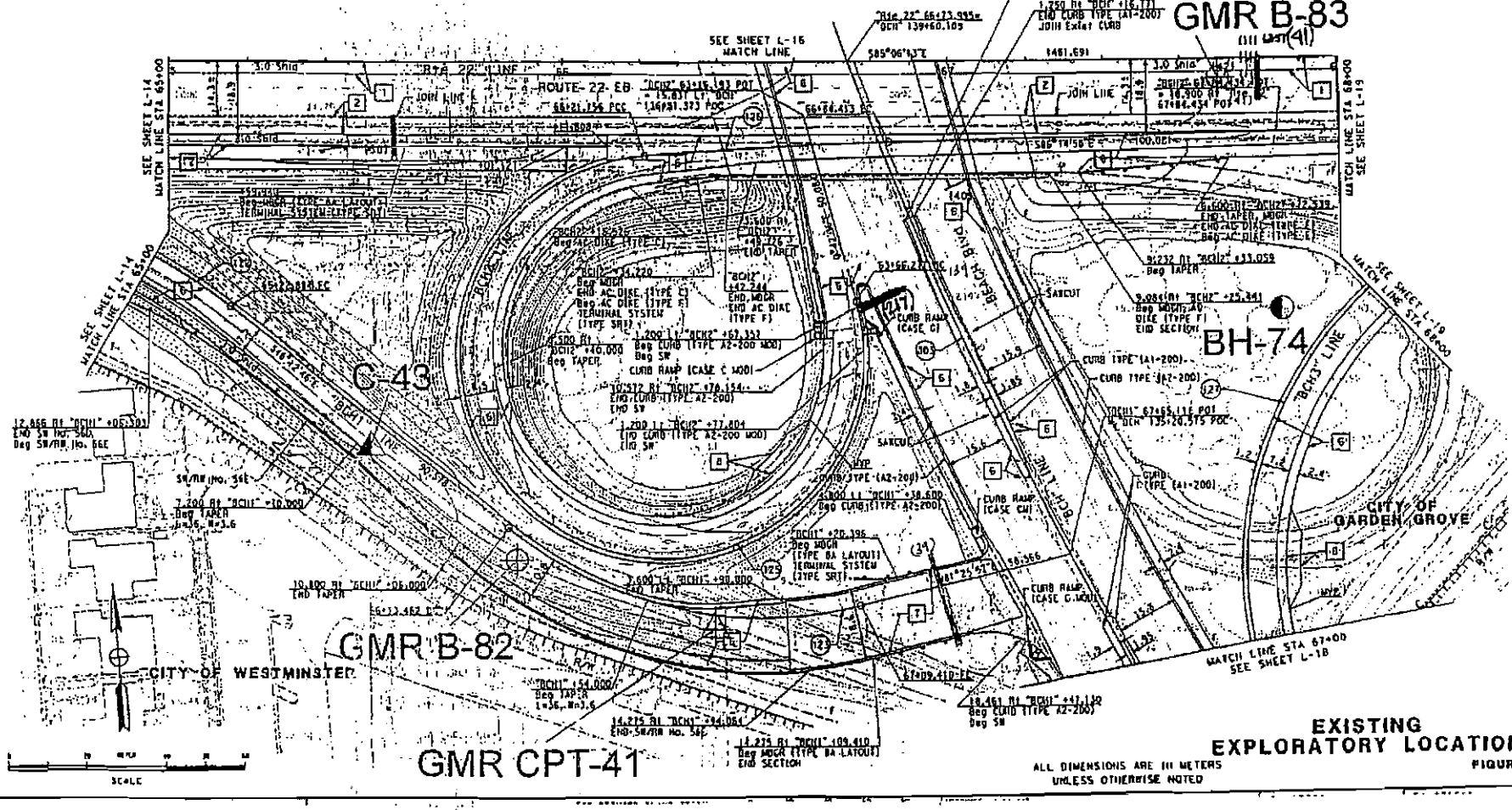
NO.	REVISIONS	DATE

LEGEND

- CPT Caltrans 2002
- CPT GMR 2004
- RW Caltrans 2002
- RW GMR 2004

CURVE DATA

NO.	R	Δ	T	L
(122)	138.000	34°00'42"	42.206	81.919
(123)	105.000	52°21'23"	51.617	95.948
(125)	52.000	280°50'11"	-	254.879
(126)	1000.000	3°37'28"	31.639	63.257
(127)	100.000	111°22'35"	146.530	194.386
(303)	1037.165	25°17'12"	241.632	475.394



EXISTING EXPLORATORY LOCATIONS

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED

FIGURE 2

URS

ORANGE COUNTY TRANSPORTATION AUTHORITY

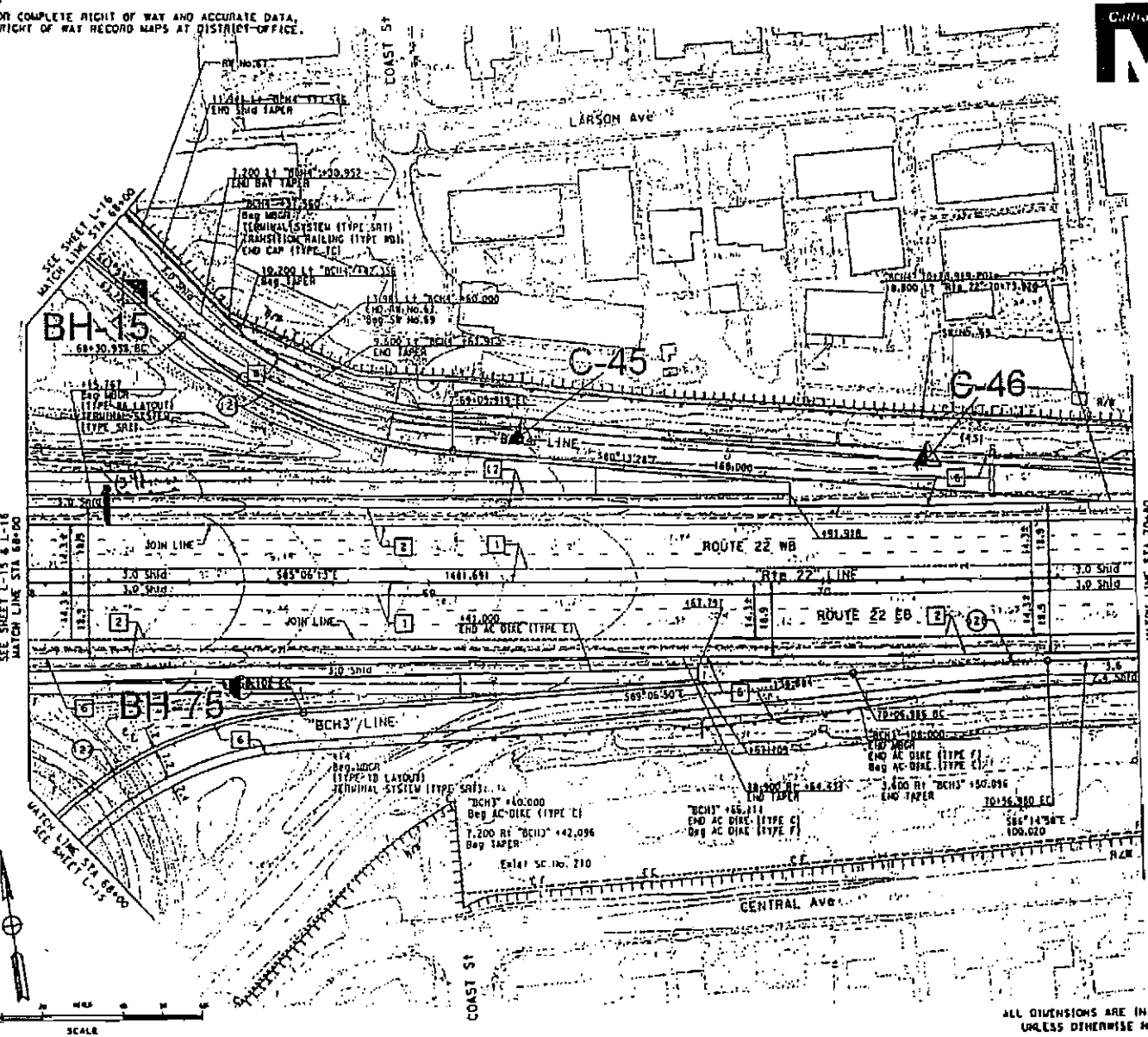
DATE | CALCULATED/DESIGNED BY | CHECKED BY | QUALITY ASSURANCE OVERSIGHT ENGINEER

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

NOTES:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.



DIST	COUNTY	ROUTE	PILOT PROJECT	SHEET No	TOTAL SHEETS
12	Ora	22	06.48/21.19		

NOT FOR CONSTRUCTION

No.	REVISIONS	DATE

CURVE DATA

NO.	R	Δ	T	L
(121)	118.200	36°20'22"	38.793	74.966
(127)	100.000	111°22'35"	146.530	194.388
(128)	1000.000	2°31'52"	25.002	49.994

LEGEND

- CPT CalTrans 2002
- HSA CalTrans 2002
- RW CalTrans 2002

EXISTING EXPLORATORY LOCATIONS

FIGURE 2

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED

URS

ORANGE COUNTY TRANSPORTATION AUTHORITY

DATE

CALCULATED/DESIGNED BY

CHECKED BY

QUALITY ASSURANCE OVERSIGHT ENGINEER

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

CalTrans

FOR REDUCED PLANS ORIGINAL

EA 071611

GEOTECHNICAL BORING LOG

Project Name: SR22 HOV Lane Widening
District/County/Route/KP: 12-ORA-22- 1.48-19.05
Project EA: 12-071611
Station(m): 67+85
Offset(m): 64.55R
Elevation(m): 15.57
Ground Water Elev.(m): 12.27

Date Started: 08/22/01
Date Finished: 08/22/01
Drive Weight (kg): 53.6
Drop(mm): 762
Type of Drill Rig: Rotary Wash
Boring Coordinates: N579215, E1838721
Engineer/Geologist: SS

Boring No.: BH-74

Caltrans

Elevation	Depth (ft / m)	Description	Symbol	Number	Type	N-Value	BL/305mm	Recovery(%)	PI(%)	MC(%)	LL(%)	Dry Unit Weight (kN/m3)	(%)Fines (%)Clay	Other Tests	REMARKS
15.6	0	Ground Surface													
	0	NATIVE: SILTY SAND (SM) brown													
15	2	SANDY SILT (ML) very soft, light brown		S-1	B	0,0,0									
	3 / 1														
14	5	SILTY SAND (SM) loose, light brown		S-2	D	4,5,4				21					
	6 / 2														
13	9														
	10 / 3	medium dense		S-3	S	5,6,9	15			20			15,3		
12	12														
	13 / 4														
11	15			S-4	D	8,12,17				19					
	16 / 5														
10	18														
	19 / 6	CLAYEY SAND (SC) soft, olive gray, medium plasticity		S-5	S	0,1,1	2								
9	22														
	23 / 7														
8	25			S-6	D	1,1,2				26		16.0	47,15	CS GS	
	26 / 8														
7	28														
	29 / 9														
	30														

SAMPLE TYPES:
C: Rock Core
S: Split Spoon
D: Drive Sample
T: Tube Sample
B: Bulk Sample

OTHER TESTS:
CS: Consolidation
DS: Direct Shear
CR: Corrosion
CT: Compaction
EI: Expansion Index
GS: Specific Gravity
UC: Unconfined Compression

OFFICE OF GEOTECHNICAL DESIGN SOUTH

GEOTECHNICAL BORING LOG

Project Name: SR22 HOV Lane Widening
District/County/Route/KP: 12-ORA-22- 1.48-19.05
Project EA: 12-071611
Station(m): 674+85
Offset(m): 64.55R
Elevation(m): 15.57
Ground Water Elev.(m): 12.27

Date Started: 08/22/01
Date Finished: 08/22/01
Drive Weight (kg): 63.5
Drop(mm): 762
Type of Drill Rig: Rotary Wash
Boring Coordinates: N679215, E1836721
Engineer/Geologist: SS

Boring No.: BH-74

Caltrans

Elevation	Depth	Description	Symbol	Number	Type	N-Value	BL/300mm	Recovery(%)	PI(%)	MC(%)	LL(%)	Dry Unit Weight (kN/m3)	(%)Fines (%)Clay	Other Tests	REMARKS
		SUBSURFACE PROFILE		SAMPLE					LAB DATA						
6	31	SANDY LEAN CLAY (CL) firm		S-7	S	1,2,3	5			16		18.1			
	32														
	33	10													
	34														
5	35														
	36	11		S-8	D	3,4,5				31				GS	
	37														
4	38														
	39	12													
	40	interbedded with silty sand													
3	41			S-9	S	5,5,5	10								
	42														
	43	13													
	44														
2	45														
	46	14		S-10	D	1,5,12				26			52,10		
	47	POORLY GRADED SAND (SP) gray, fine-grained													
1	48														
	49	15 Bottom of boring at 14.2 m													
	50	Groundwater encountered at 3.3 m													
0	51	Temporary piezometer installed													
	52	Not backfilled													
	53	16													
	54														
-1	55														
	56	17													
	57														
-2	58														
	59	18													
	60														

SAMPLE TYPES:
C: Rock Core
S: Split Spoon
D: Drive Sample
T: Tube Sample
B: Bulk Sample

OTHER TESTS:
CS: Consolidation
DS: Direct Shear
CR: Corrosion
CT: Compaction
EI: Expansion Index
GS: Specific Gravity
UC: Unconfined Compression

OFFICE OF GEOTECHNICAL DESIGN SOUTH

GEOTECHNICAL BORING LOG

Project Name: SR22 HOV Lane Widening
District/County/Route/KP: 12-ORA-22- 1.48-19.05
Project EA: 12-071611
Station(m): 68+53
Offset(m): 26.46R
Elevation(m): 19.63
Ground Water Elev.(m): Not estimated

Date Started: 08/27/01
Date Finished: 08/27/01
Drive Weight (kg): 63.6
Drop(mm): 762
Type of Drill Rig: Rotary Wash
Boring Coordinates: N679247, E1838793
Engineer/Geologist: SS

Boring No.: BH-75

Caltrans

Elevation	Depth (ft / m)	Description	Symbol	Sample Number	Type	N-Value	BL/305mm	Recovery(%)	PI(%)	MC(%)	LL(%)	Dry Unit Weight (kN/m3)	(%)Fines (%)Clay	Other Tests	REMARKS
19.6	0 / 0	Ground Surface													
		ASPHALT - 115 mm													
		Base - 180 mm													
19	2 / 1	SILTY SAND w/ GRAVEL(SM) medium dense, yellow-brown													
18	5 / 2			S-1	D	11,19,26				10					
17	9 / 3	CLAYEY SAND (SC) medium dense, with iron stains													
				S-2	S	5,7,9	16								
16	13 / 4														
15	14 / 5	NATIVE: POORLY GRADED SAND (SP) medium dense, light gray, fine-grained		S-3	D	6,12,13				20					
14	19 / 6	SANDY LEAN CLAY (CL) soft, olive gray, with few organics													
				S-4	S	0,1,3	4								
13	23 / 7														
12	24 / 8	POORLY GRADED SAND (SP) medium dense, light brown, firm- to medium-grained sand, with few gravels		S-5	D	13,21,29				18					
11	29 / 9	CLAY/SAND (CL/SP) dark gray clay, gray sand seams, thinly interbedded													

SAMPLE TYPES:
C: Rock Core
S: Split Spoon
D: Drive Sample
T: Tube Sample
B: Bulk Sample

OTHER TESTS:
CS: Consolidation
DS: Direct Shear
CR: Corrosion
CT: Compaction
EI: Expansion Index
GS: Specific Gravity
UC: Unconfined Compression

OFFICE OF GEOTECHNICAL DESIGN SOUTH

GEOTECHNICAL BORING LOG

Project Name: SR22 HOV Lane Widening
District/County/Route/KP: 12-ORA-22- 1.48-19.05
Project EA: 12-071611
Station(m): 68+53
Offset(m): 26.46R
Elevation(m): 19.63
Ground Water Elev.(m): Not estimated

Date Started: 08/27/01
Date Finished: 08/27/01
Drive Weight (kg): 63.5
Drop(mm): 762
Type of Drill Rig: Rotary Wash
Boring Coordinates: N679247, E1838793
Engineer/Geologist: SS

Boring No.: BH-75

Caltrans

Elevation	Depth	Description	Symbol	Number	Type	N-Value	BL/305mm	Recovery(%)	PI(%)	MC(%)	LL(%)	Dry Unit Weight (kN/m3)	(%)Fines (%)Clay	Other Tests	REMARKS
		SUBSURFACE PROFILE		**SAMPLE**					**LAB DATA**						
10	31	CLAY/SAND (CL/SP) dark gray clay, gray sand seams, thinly interbedded		S-6	S	5,6,10	16								
	32														
	33 10														
	34														
9	35	less sand seams		S-7	D	1,3,4				18					
	36 11														
	37														
8	38														
	39 12														
	40	clay		S-8	S	2,2,3	5			25					
7	41	SILTY SAND (SM) loose													
	42														
	43 13														
	44														
6	45	medium dense, clay seams (50-75 mm thick)		S-9	D	5,8,13				25					
	46 14														
	47														
5	48														
	49 15														
	50	LEAN CLAY (CL) very soft, olive gray		S-10	S	5,0,0	0								
4	51														
	52														
	53 16	SILTY SAND (SM) medium dense, with mica		S-11	D	12,13,21				26					
	54														
3	55														
	56 17	LEAN CLAY (CL) firm, olive gray		S-12	S	1,3,3	6			35			96,41		
	57														
2	58														
	59 18	SILTY SAND (SM) medium dense, olive brown, fine-grained													
	60														

SAMPLE TYPES:
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OFFICE OF GEOTECHNICAL DESIGN SOUTH

GEOTECHNICAL BORING LOG

Project Name: SR22 HOV Lane Widening
District/County/Route/KP: 12-ORA-22- 1.48-19.05
Project EA: 12-071611
Station(m): 68+53
Offset(m): 26.46R
Elevation(m): 19.63
Ground Water Elev.(m): Not estimated

Date Started: 08/27/01
Date Finished: 08/27/01
Drive Weight (kg): 63.6
Drop(mm): 762
Type of Drill Rig: Rotary Wash
Boring Coordinates: N679247, E1838793
Engineer/Geologist: SS

Boring No.: BH-75

Caltrans

Elevation	Depth	Description	Symbol	Sample Number	Type	N-Value	BL/305mm	Recovery(%)	PI(%)	MC(%)	LL(%)	Dry Unit Weight (kN/m3)	(%)Fines (%)Clay	Other Tests	REMARKS
		SUBSURFACE PROFILE		SAMPLE					LAB DATA						
1	61	SILTY SAND (SM) medium dense, olive brown, fine-grained		S-13	D	9,10,15				24					
	62														
	63														
	64	LEAN CLAY w/ SAND (CL) olive gray													
0	65														
	66			S-14	S	3,8,16	24								
	67	SILTY SAND (SM) olive gray, fine-grained													
-1	68														
	69	Bottom of boring at 20.3 m													
	70	Groundwater not estimated													
-2	71	Boring backfilled with bentonite-cement slurry													
	72														
	73														
-3	74														
	75														
	76														
	77														
-4	78														
	79														
	80														
-5	81														
	82														
	83														
-6	84														
	85														
	86														
	87														
-7	88														
	89														
	90														

SAMPLE TYPES:
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OTHER TESTS:
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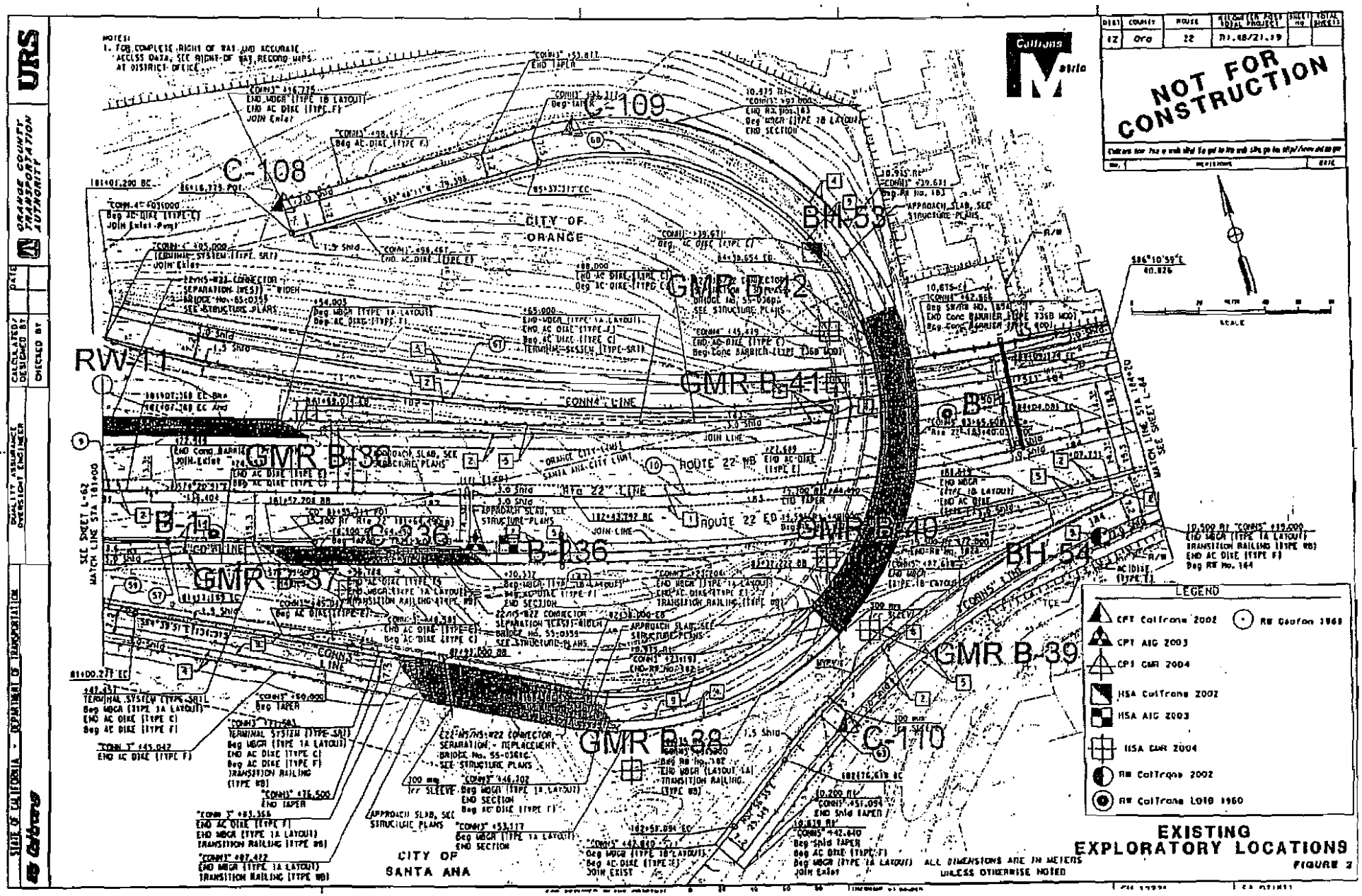
OFFICE OF GEOTECHNICAL DESIGN SOUTH



EXISTING EXPLORATORY LOCATIONS

FIGURE 2

State Route 22 HOV Lane Design-Build

E22-N5 / 22 Connector Separation (55-1086G)

URS Project Number 29866278

Log of Boring GMR-B-41

Date(s) Drilled	11/4/2004	Logged By	R. Pirathiviraj	Checked By	R. Stroop
Drilling Method	Hollow-Stem Auger	Drill Bit Size/Type	203-mm auger bit	Total Depth of Borehole	30.94 m
Drill Rig Type	CME 85	Drilling Contractor	Prosonic	Approximate Surface Elevation	45.5 m MSL
Groundwater Level and Date Measured	Not encountered	Sampling Method(s)	Bulk, SPT, Standard California	Hammer Data	Automatic hammer; 63.5 kg, 760-mm drop
Borehole Backfill	Soil cuttings with bentonite chip plug	Location	Refer to site plan (183+25 30L)		

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	0					FILL: CLAYEY SAND / SILTY SAND (SC/SM), dark brown, moist			Hand auger to 1.5 m. Retain bulk sample of cuttings.
45			SK-1						
	1					SANDY LEAN CLAY (CL), very stiff, dark brown, moist			
44						POORLY GRADED SAND (SP), medium dense, brown, moist			
			1	29		ALLUVIUM: SANDY LEAN CLAY (CL), very stiff, dark brown, moist	17.0	17.6	CONS CORR
43	2								
	3		2	7		... becomes firm	16.3		LL=30, PI=12 WA: 63%<#200
42	4								
41			3	18		... becomes stiff	18.3	16.8	DS
	5								
40	6		4A 4B 4C	9		CLAYEY SAND (SC), loose, brown, moist ... becomes dark brown	9.6		
39	7					SANDY LEAN CLAY (CL), very stiff, brown, moist			
38			5	36		SILTY SAND (SM), medium dense, brown, moist, f-c sand, few f gravel	9.4	19.0	WA: 20%<#200
37	8								
	9		6	24			7.6		
36	10								

State Route 22 HOV Lane Design-Build
E22-N5 / 22 Connector Separation (55-1066G)
URS Project Number 29866278

Log of Boring GMR-B-41

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	10					CLAYEY SAND (SC), dense, brown, moist, f-c sand, few f gravel			
35									
	11		7	57			8.1	14.1	CORR
34									
	12					... becomes medium dense, dark brown			
			8A	16					
33			8B			LEAN CLAY with SAND (CL), very stiff, dark brown, moist	18.1		LL=30, PI=12 WA: 85%<#200
	13								
32						POORLY GRADED GRAVEL with SAND / POORLY GRADED SAND with GRAVEL (GP/SP), dense, brown, moist, f gravel, m-c sand			
	14		9	60			4.4		SA: 4%<#200
31									
	15								
30			10	54		... becomes very dense	4.1		
	16								
29						SANDY LEAN CLAY (CL), hard, brown, moist			
	17		11	48			18.8	17.5	
28									
	18					POORLY GRADED SAND (SP), very dense, yellowish white, moist			
27			12	53			2.8		
	19								
26						CLAYEY SAND (SC), medium dense, yellowish brown, moist			
	20		13	50		POORLY GRADED SAND (SP), medium dense, olive brown, moist, m sand	2.4	16.2	SA: 2%<#200
25						LEAN CLAY (CL), hard, brown, moist			
	21					CLAYEY SAND (SC), medium dense, brown, moist			
24			14A	26					
			14B			SANDY LEAN CLAY (CL), very stiff, brown, moist	18.8		
	22								

State Route 22 HOV Lane Design-Build
E22-N5 / 22 Connector Separation (55-1999G)
URS Project Number 29866278

Log of Boring GMR-B-41

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
						SANDY LEAN CLAY (CL), very stiff, brown, moist (continued)			
23	23		15	32			16.0	18.2	
22	24								
21	25		16	27			14.2		LL=28, PI=12 WA: 57%<#200
20									
19	26		17	38		... seam of SILTY SAND (SM), light brown, moist	16.2	16.0	
	27								
18	28		18A 18B	25		... seam of SILTY SAND (SM), brown, moist	11.0		
17									
16	29		19	27			33.0	14.0	
15	30		20A 20B 20C	28		... seam of SILT with SAND (ML)	26.2		WA: 84%<#200
14	31					**Bottom of boring at 30.94 m bgs** Groundwater not encountered during sampling or at end of drilling.			
13	32								
12	33								
	34								

State Route 22 HOV Lane Design-Build
E22-N5 / 22 Connector Separation (55-1080G)
URS Project Number 29866278

Log of Boring GMR-B-42

Date(s) Drilled	10/5/2004	Logged By	R. Pirathiviraj	Checked By	R. Stroop
Drilling Method	Hollow-Stem Auger	Drill Bit Size/Type	203-mm auger bit	Total Depth of Borehole	30.04 m
Drill Rig Type	CME 85	Drilling Contractor	Prosonic	Approximate Surface Elevation	53.5 m MSL
Groundwater Level and Date Measured	Not encountered	Sampling Method(s)	SPT, Standard California	Hammer Data	Automatic hammer; 63.5 kg, 760-mm drop
Borehole Backfill	Cement-bentonite grout	Location	Refer to site plan (183+25 46L)		

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	0					FILL: CLAYEY SAND (SC), medium dense, light brown, moist, f-m sand, some organics			
53	1		1	13			3.5		WA: 27%<#200
52	2		2	24			2.3	17.0	CORR LL=25, PI=9 WA: 19%<#200
	2					SANDY LEAN CLAY (CL), very stiff, light brown, moist			
51	3					SILTY SAND with GRAVEL (SM), dense, light brown, moist, f-c sand			
			3A	32			3.8		WA: 17%<#200
50			3B			SANDY LEAN CLAY (CL), hard, brown, moist	11.7		
	4					CLAYEY SAND (SC), medium dense, brown, moist, f-m sand			
49	5		4	25			6.8	18.5	CORR CONS LL=29, PI=11 WA: 41%<#200
48	6		5	50		... becomes dense, with trace gravel	8.5		
47	7					WELL-GRADED SAND with SILT (SW-SM), medium dense, light brown, moist, f-m sand, trace f gravel			
46	8		6	40			4.0		SA: 9%<#200
45	9					ALLUVIUM: CLAYEY SAND (SC), dense, light brown, moist, f-m sand			
44	10		7	37			9.3		

State Route 22 HOV Lane Design-Build
E22-N5 / 22 Connector Separation (55-1000G)
URS Project Number 29866278

Log of Boring GMR-B-042

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	10					SANDY LEAN CLAY (CL), very stiff, olive brown, moist			
43	11		8	26			14.2	18.4	CORR CONS LL=28, PI=11 WA: 58%<#200
42	12		9	10		... becomes stiff, brown	10.7		
41	13								
40	14		10	18		CLAYEY SAND (SC), loose, dark brown, moist, f-m sand	9.7	17.7	WA: 35%<#200
39	15					POORLY GRADED SAND with SILT (SP-SM), medium dense, light brown, moist, f-m sand			
38			11A 11B	27		SANDY LEAN CLAY (CL), very stiff, brown, moist	3.8 16.3		SA: 10%<#200
37	16					SILTY SAND with GRAVEL (SM), medium dense, light brown, moist, f-m sand, c gravel			
36	17		12	34			1.8		SA: 26%<#200
35	18		13A 13B	12		POORLY GRADED SAND with SILT (SP-SM), medium dense, light brown, moist, f-m sand, trace f gravel	2.4		
34	19					LEAN CLAY (CL), stiff, brown, moist	15.4		
33	20		14	31		SANDY LEAN CLAY (CL), very stiff, brown, moist	14.2	18.5	LL=32, PI=14
32	21		15A 15B	50/125		POORLY GRADED SAND with SILT and GRAVEL (SP-SM), very dense, light brown, moist, f-m sand, f gravel	12.5 3.0		
	22								

State Route 22 HOV Lane Design-Build
E22-N5 / 22 Connector Separation (SS-10000)
URS Project Number 29866278

Log of Boring GMR-B-42

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
						POORLY GRADED SAND with SILT and GRAVEL (SP-SM), very dense, light brown, moist, f-m sand, f gravel (continued)			
31									
	23		16	50/125			5.5		SA: 7%<#200
30									
	24					... becomes dark brown; f-c sand, increasing gravel content			
29			17A	52			4.1		WA: 9%<#200
			17B			SANDY LEAN CLAY (CL), hard, brown, moist, few f gravel	15.7		
	25								
28									
	26		18	74			18.1	18.1	LL=43, PI=24
27									
	27					SILTY SAND (SM), dense, brown, moist, f-m sand, few clay seams			
26			19A	48			7.2		WA: 16%<#200
			19B			POORLY GRADED SAND with SILT (SP-SM), dense, olive brown, moist, f-c sand	3.3		WA: 6%<#200
	28								
25									
						SANDY LEAN CLAY (CL), hard, light brown, moist			
	29		20	44			27.5	15.0	
24									
	30								
23			21	60			16.1		
	31					Bottom of boring at 30.94 m bgs Groundwater not encountered during sampling or at end of drilling.			
22									
	32								
21									
	33								
20									
	34								

GEOTECHNICAL BORING LOG

Project Name: SR22 HOV Lane Widening
District/County/Route/KP: 12-ORA-22- 1.48-19.05
Project EA: 12-071611
Station(m): 183+28
Offset(m): 71.01L
Elevation(m): 55.09
Ground Water Elev.(m): Not Encountered

Date Started: 08/10/01
Date Finished: 08/10/01
Drive Weight (kg): 63.6
Drop(mm): 762
Type of Drill Rig: Hollow Stem
Boring Coordinates: N679978, E1849781
Engineer/Geologist: SS

Boring No.: BH-53

Caltrans

Elevation	Depth (ft / m)	Description	Symbol	Sample Number	Type	N-Value	BL/305mm	Recovery(%)	PI(%)	MC(%)	LL(%)	Dry Unit Weight (kN/m3)	(%)Fines (%)Clay	Other Tests	REMARKS
55	0 / 0	Ground Surface													
		ASPHALT - 100 mm													
		BASE - 230 mm													
		FILL: SILTY SAND (SM) medium dense to dense, brown, with 1" to 2" GRAVEL			B								34,12	CT CR	
54	3 / 1			S-1	S	5,7,6	13								
53	7 / 2				B									CR	
52	10 / 3			S-2	D	14,27,18								CR	
51	13 / 4														
				S-3	D	7,6,9				9.1					
50	16 / 5														
49	20 / 6	CLAYEY SAND (SC) medium dense, brown, with GRAVEL		S-4	S	16,18,10	28		8.0	11	24		42,17		
48	23 / 7														
				S-5	D	10,15,21				5.0			11,3		
47	26 / 8	dry light brown sand (0.4 to 0.5 m thick)													
46	30 / 9														

SAMPLE TYPES:
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OTHER TESTS:
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OFFICE OF GEOTECHNICAL DESIGN SOUTH

GEOTECHNICAL BORING LOG

Project Name: SR22 HOV Lane Widening
District/County/Route/KP: 12-ORA-22- 1.48-19.05
Project EA: 12-071611
Station(m): 183+28
Offset(m): 71.01L
Elevation(m): 55.09
Ground Water Elev.(m): Not Encountered

Date Started: 08/10/01
Date Finished: 08/10/01
Drive Weight (kg): 63.6
Drop(mm): 762
Type of Drill Rig: Hollow Stem
Boring Coordinates: N679978, E1849781
Engineer/Geologist: SS

Boring No.: BH-S3

Caltrans

Elevation	Depth	Description	Symbol	Sample Number	Type	N-Value	BL/300mm	Recovery(%)	PI(%)	MC(%)	LL(%)	Dry Unit Weight (kN/m3)	(%)Fines (%)Clay	Other Tests	REMARKS
	31	CLAYEY SAND (SC) medium dense, brown, with GRAVEL		S-6	S	4,9,7	16		7.0	12	24		36,15		
	32														
45	33 10														
	34														
	35														
44	36 11			S-7	D	1,2,5				18		17.7		DS CS GS	
	37														
	38														
43	39 12														
	40			S-8	S	5,3,4	7								
	41														
	42														
42	43 13														
	44														
	45														
41	46 14	NATIVE: SILTY SAND (SM) medium dense, brown		S-9	D	2,6,7				8.0			40,10		
	47														
	48														
40	49 15														
	50														
	51	CLAYEY SILT with SAND (CL-ML) soft, brown, wet, medium plasticity, with GRAVEL		S-10	S	1,2,	2								
39	52 16														
	53														
	54														
	55	CLAYEY SAND (SC) medium dense, brown, wet, with gravel													
38	56 17			S-11	D	2,4,16			3.0	14	21		45,10		
	57														
	58														
37	59 18														
	60														

SAMPLE TYPES:
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GS: Specific Gravity
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OFFICE OF GEOTECHNICAL DESIGN SOUTH

GEOTECHNICAL BORING LOG

Project Name: SR22 HOV Lane Widening
District/County/Route/KP: 12-ORA-22- 1.48-19.05
Project EA: 12-071511
Station(m): 183+28
Offset(m): 71.01L
Elevation(m): 55.09
Ground Water Elev.(m): Not Encountered

Date Started: 08/10/01
Date Finished: 08/10/01
Drive Weight (kg): 63.5
Drop(mm): 762
Type of Drill Rig: Hollow Stem
Boring Coordinates: N679978, E1849781
Engineer/Geologist: SS

Boring No.: BH-53

Caltrans

Elevation	Depth	Description	Symbol	Number	Type	N-Value	BL/305mm	Recovery(%)	PI(%)	MC(%)	LL(%)	Dry Unit Weight (kN/m3)	(%)Fines (%)Clay	Other Tests	REMARKS
	61	CLAYEY SAND (SC) medium dense, brown, wet, with gravel		S-12	S	1,2,7	9								
36	62 19														
	63														
	64														
	65														
35	66 20			S-13	D	1,5,7				18			84,33		
	67														
	68														
34	69 21														
	70														
	71	very dense		S-14	S	10,50,	50								
33	72 22	Bottom of Boring at 21.7 m Groundwater not encountered Boring backfilled with Cuttings													
	73														
	74														
	75														
32	76 23														
	77														
	78														
31	79 24														
	80														
	81														
30	82 25														
	83														
	84														
29	85 26														
	86														
	87														
	88														
28	89 27														
	90														

SAMPLE TYPES:
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OTHER TESTS:
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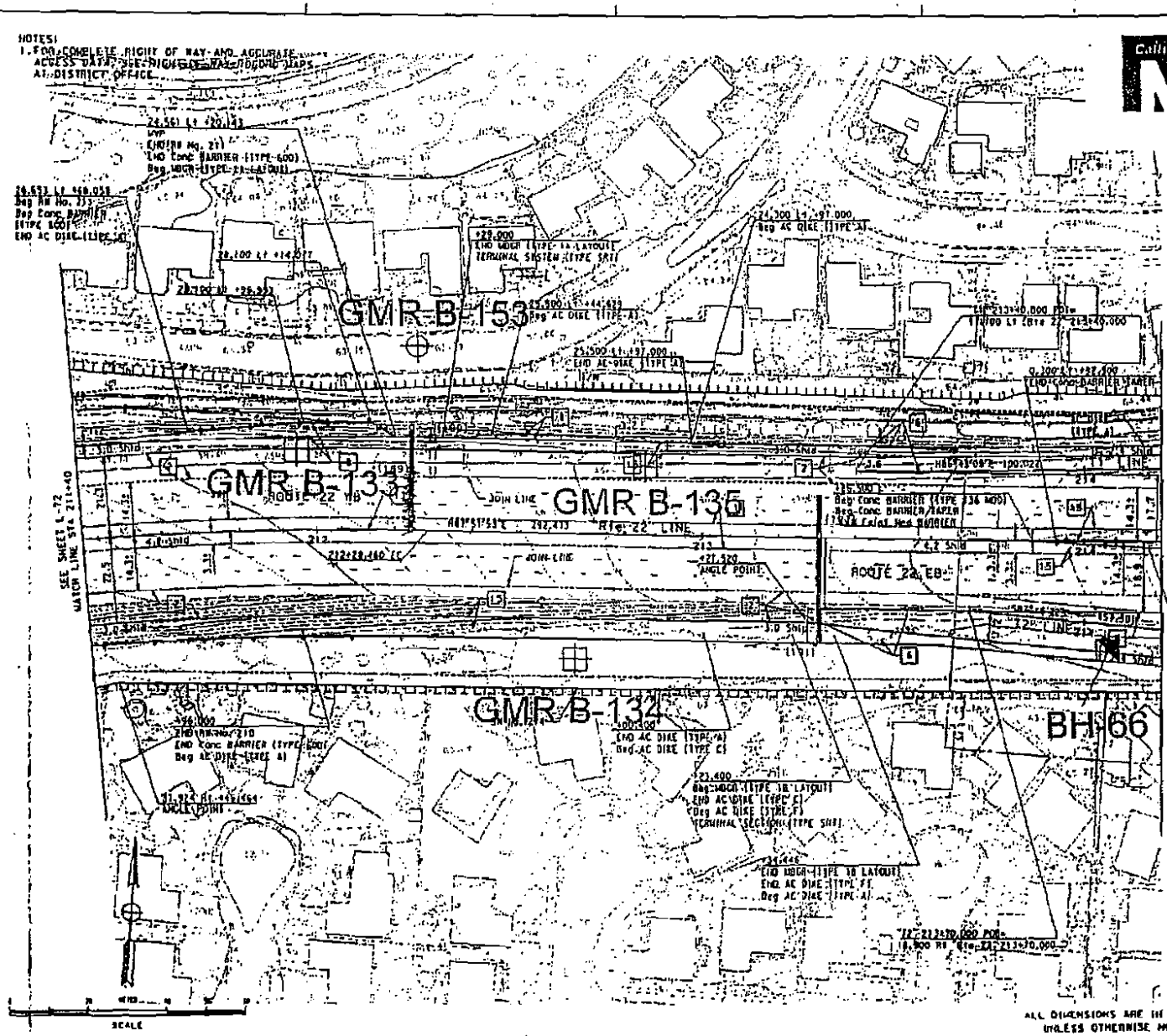
OFFICE OF GEOTECHNICAL DESIGN SOUTH



NOTES:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.

DIST.	COUNTY	ROUTE	RELATIVE POST MILE (REF. ENGINEER)	SHEET NO.	TOTAL SHEETS
12	Ora	22	R1.48/21.19		

NOT FOR CONSTRUCTION

No.	REVISIONS	DATE

CURVE DATA				
NO.	R	Δ	T	L
13	914.402	14° 56'40"	117.227	233.161

LEGEND
- HSA AID 2002
- HSA GMR 2004
- RN GMR 2004

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED

EXISTING EXPLORATORY LOCATIONS

FIGURE 2

URS

ORANGE COUNTY TRANSPORTATION AUTHORITY

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

DATE | CALCULATED/DESIGNED BY | CHECKED BY | QUALITY ASSURANCE OVERSIGHT ENGINEER

NOTES:
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE

LEGEND

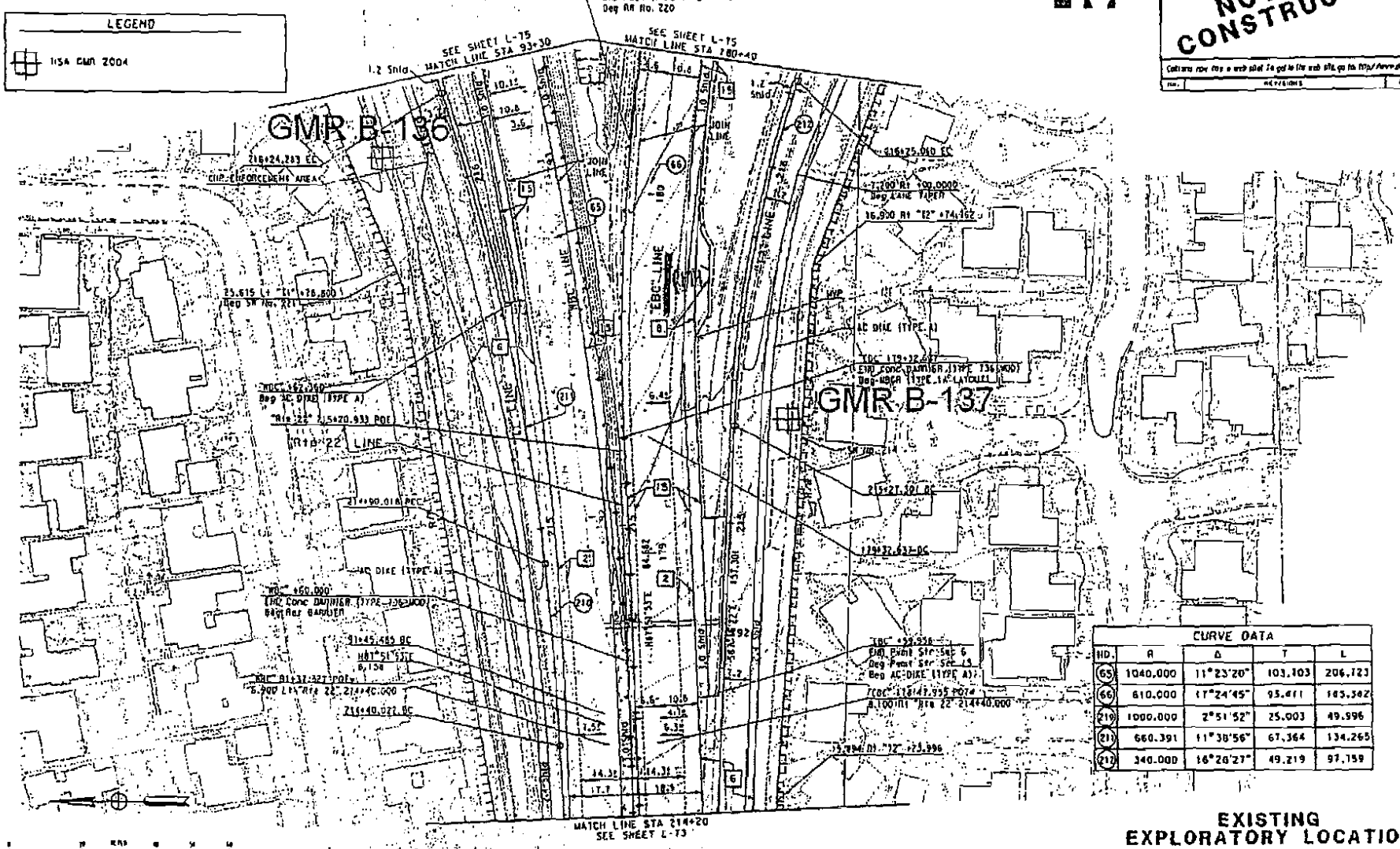
USA GMR 2004

DIST	COUNTY	ROUTE	PREFIX (EA POST TOTAL PROJECT)	SHEET NO	TOTAL SHEETS
12	Ora	22	71.48/21.19		

NOT FOR CONSTRUCTION

Caltrans now has a web site! To get to the web site, go to http://www.dot.ca.gov

NO.	REVISIONS	DATE



CURVE DATA				
NO.	R	Δ	T	L
65	1040.000	11°23'20"	103.103	206.723
66	610.000	17°24'45"	93.411	185.362
219	1000.000	2°51'52"	25.003	49.996
211	660.391	11°38'56"	67.364	134.265
212	340.000	16°26'27"	49.219	97.159

EXISTING EXPLORATORY LOCATIONS

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE NOTED

FIGURE 2

URS

ORANGE COUNTY TRANSPORTATION AUTHORITY

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

Caltrans

QUALITY ASSURANCE OVERSIGHT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE

State Route 22 Design-Build
Retaining Wall 211
URS Project Number 29866278

Log of Boring GMR-B-133

Date(s) Drilled	11/16-17/04	Logged By	N. Luebbers	Checked By	P. Pratheep
Drilling Method	Hollow-Stem Auger	Drill Bit Size/Type	203-mm auger bit	Total Depth of Borehole	13.26 m
Drill Rig Type	CME 85	Drilling Contractor	Prosonic	Approximate Surface Elevation	58.7 m MSL
Groundwater Level and Date Measured	Not encountered	Sampling Method(s)	Bulk, SPT, Standard California	Hammer Data	Manual trip hammer; 63.5 kg, 760-mm drop
Borehole Backfill	Soil cuttings, asphalt cold patch	Location	WB SR-22 shoulder near Tustin Avenue on-ramp (211+95 21L)		

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	0					Asphalt 200 mm thick			Hand auger upper 1.5 m.
						ALLUVIUM: POORLY GRADED SAND with GRAVEL (SP), olive brown, moist, m-c sand, f-c gravel			
58	1		SK-1						CORR
57	2		1	41		... medium dense	3.3	17.6	SA: 3%<#200
									Cuttings mostly gravel to 65 mm down to 7 m.
56						LEAN CLAY with SAND and GRAVEL (CL), very stiff to hard, brown, moist			
	3		2A	50/75			7.7		
			2B			POORLY GRADED GRAVEL with CLAY and SAND (GP-GC), very dense, brown, moist, f-c gravel, f-c sand	4.1		WA: 10%<#200
55	4								
54			3	50/150			3.1		WA: 11%<#200
	5								Large gravel piece wedged in shoe; disturbed sample.
53						POORLY GRADED SAND with CLAY and GRAVEL (SP-SC), very dense, brown, moist, m-c sand, f-c gravel			
	6		4	60			4.4		SA: 11%<#200
52	7								
						LEAN CLAY with SAND (CL), firm, brown, moist to wet			
51	8		5	11			19.6	17.3	LL=28, PI=13 CONS
							19.5	16.9	DS WA: 72%<#200
50						SANDY LEAN CLAY with GRAVEL (CL), very stiff, reddish brown, moist			
	9		6	27			14.5		
49	10								

State Route 22 Design-Build
Retaining Wall 211
URS Project Number 29866278

Log of Boring GMR-B-133

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	10					SANDY LEAN CLAY with GRAVEL (CL), very stiff, reddish brown, moist (continued)			
46	11		7	24			15.0	18.0	LL=29, PI=12 UC=194.0 kPa LL=30, PI=12
47	12					LEAN CLAY (CL), stiff, reddish brown, moist			
46	13		6	15			18.6		LL=28, PI=11
45	14					**Boring terminated at 13.25 m bgs (hammer lost downhole)** *Groundwater not encountered during sampling or at end of drilling.*			Downhole hammer cable snapped. *Terminated drilling* and abandoned hammer in hole.
44	15								
43	16								
42	17								
41	18								
40	19								
39	20								
38	21								
37	22								

State Route 22 HOV Lane Design-Build
Retaining Barrier
URS Project Number 29866278

Log of Boring GMR-B-135

Date(s) Drilled	11/15-16/04	Logged By	N. Luebbers	Checked By	P. Pratheep
Drilling Method	Hollow-Stem Auger	Drill Bit Size/Type	203-mm auger bit	Total Depth of Borehole	17.22 m
Drill Rig Type	CME 85	Drilling Contractor	Prosonic	Approximate Surface Elevation	60.4 m MSL
Groundwater Level and Date Measured	Not encountered	Sampling Method(s)	Bulk, SPT, Standard California	Hammer Data	Automatic hammer; 63.5 kg, 760-mm drop
Borehole Backfill	Soil cuttings, asphalt cold patch	Location	Main Street WB off-ramp (212+85 18L)		

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	0					Asphalt 200 mm thick			Hand auger upper 1.5 m.
60						ALLUVIUM: SILTY SAND with GRAVEL (SM), brown, moist, f-c sand, f-c gravel			
	1		SK-1						
59									
	2		1 [NR]	31		... medium dense			No recovery at 1.5 m.
58			2	83		... becomes dense, slightly moist	2.7	18.1	No recovery in tube #1; large amount of gravel in tube #2.
	3		3	129		... becomes very dense, with iron oxide staining	2.6		CORR
57									
	4					SANDY LEAN CLAY with GRAVEL (CL), very stiff, brown, moist			
56			4	36			12.0		Rock in sampler shoe. Hard drilling.
	5								
55						SILTY SAND with GRAVEL (SM), very dense, brown, dry to moist			
	6		5	70			2.8		Rock in sampler shoe.
54									
	7					SANDY LEAN CLAY (CL), stiff, brown, moist, trace gravel			
53			6	14			15.4 15.9	17.2 16.4	CORR DS LL=24, PI=10 WA: 67%<#200
	8								
52									
	9		7	33		... becomes hard, reddish brown; no gravel	16.8		
51									
	10								

Report: GEO_10_SNAGMR_METRIC; File: SNA_SR22OCTA.GPJ; 7/10/2005 GMR-B-135

State Route 22 HOV Lane Design-Build
Retaining Barrier
URS Project Number 29866278

Log of Boring GMR-B-135

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	10					SANDY LEAN CLAY (CL), hard, reddish brown, moist (continued)			
50									
	11		8	30		... becomes very stiff, brown	15.5	17.9	
49									
	12								
48			9	48		... becomes hard	14.7		
	13								
47						LEAN CLAY (CL), stiff, brown, moist to wet			
	14		10	17			24.8	15.5	DS LL=32, PI=10
46									
	15					SILTY SAND with GRAVEL (SM), medium dense, brown, moist, f-m sand, f-c gravel			
45			11A	24			5.1		SA: 12% <#200
			11B			CLAYEY SAND (SC), medium dense, brown, moist, f sand			
	16								
44						SANDY LEAN CLAY (CL), stiff, reddish brown, moist, few gravel			
	17		12	17			17.9	17.0	
43						Bottom of boring at 17.22 m bgs Groundwater not encountered during sampling or at end of drilling.			
	18								
42									
	19								
41									
	20								
40									
	21								
39									
	22								

State Route 22 HOV Lane Design-Build
Sound Wall 221
URS Project Number 29866278

Log of Boring GMR-B-136

Date(s) Drilled	10/29/2004	Logged By	C. Behnam	Checked By	P. Pratheep
Drilling Method	Hollow-Stem Auger	Drill Bit Size/Type	203-mm auger bit	Total Depth of Borehole	15.39 m
Drill Rig Type	CME 85	Drilling Contractor	Prosonic	Approximate Surface Elevation	65.7 m MSL
Groundwater Level and Date Measured	Not encountered	Sampling Method(s)	SPT, Standard California	Hammer Data	Automatic hammer; 63.5 kg, 760-mm drop
Borehole Backfill	Soil cuttings capped with bentonite chips in upper 6.1 m	Location	Tustin Avenue EB off-ramp (216+05 60L)		

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	0					ALLUVIUM: SILTY CLAYEY SAND (SC-SM), loose, light brown, moist, f sand			
65	1		1	9			6.8		LL=21, PI=6 WA: 39%<#200
						POORLY GRADED SAND with SILT and GRAVEL (SP-SM), loose, grayish brown, slightly moist, f-m sand, f-c gravel			Rig chatter.
64	2		2	15			2.5	15.8	CORR SA: 6%<#200
						SILTY CLAYEY SAND (SC-SM), medium dense, light brown, moist, f sand			
63	3		3	13			3.3		LL=21, PI=5 WA: 43%<#200
62	4								
61	5		[NR]	27					No recovery.
			4	34			3.3	17.5	
						SILTY SAND with GRAVEL (SM), medium dense, olive brown, dry	1.9	16.3	DS
60	6		5	59		POORLY GRADED SAND with CLAY and GRAVEL (SP-SC), very dense, grayish brown, slightly moist, f-m sand, f gravel, few c gravel	2.3		Rig chatter. SA: 8%<#200
59	7								
58						... becomes medium dense			
	8		6	21		CLAYEY SAND (SC), medium dense, reddish brown, moist, f-m sand	13.8	15.9	WA: 34%<#200
57	9		7	50/100		CLAYEY SAND with GRAVEL (SC), very dense, brown, slightly moist, f-c sand, f-c gravel	2.6		SA: 12%<#200
56	10								

Report: GEO_10_SNAGMR_METRIC; File: SNA_SR22OCTA.GPJ; 7/18/2005 GMR-B-136

State Route 22 HOV Lane Design-Build
Sound Wall 221
URS Project Number 29866278

Log of Boring GMR-B-136

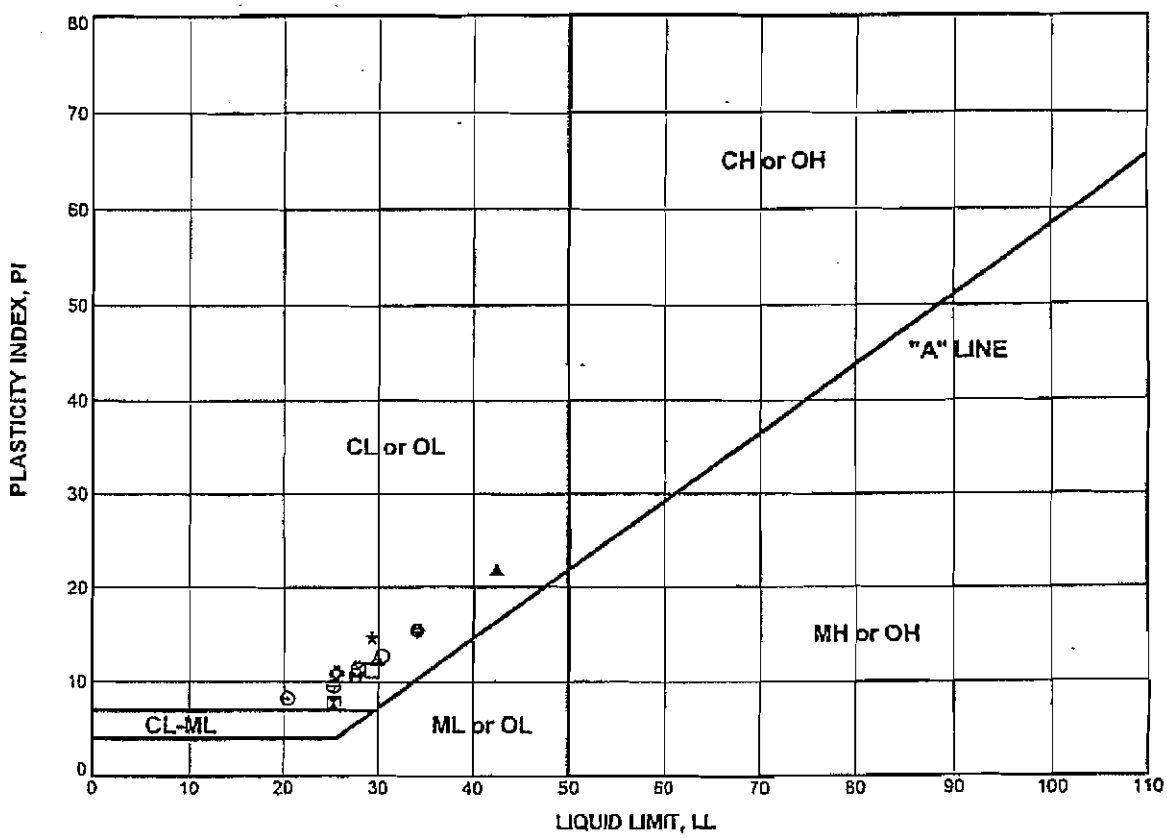
Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	10					CLAYEY SAND with GRAVEL (SC), very dense, brown, slightly moist, f-c sand, f-c gravel (continued)			
55	11		[NR]	70					Rig chatter. No recovery.
			8	26		SANDY LEAN CLAY (CL), very stiff, reddish brown, moist	16.0		
54	12		9	30			13.6		
53	13								
52	14		10	41			15.6	16.4	
51	15					CLAYEY SAND (SC), very dense, dark brown, dry to moist, f sand			
			11	50/100			9.6		WA: 41%<#200
50	16					Bottom of boring at 15.39 m bgs Groundwater not encountered during sampling or at end of drilling.			
49	17								
48	18								
47	19								
46	20								
45	21								
44	22								

State Route 22 Design-Build
Retaining Wall 211
URS Project Number 29866278

Log of Boring GMR-B-153

Date(s) Drilled	4/29/2005	Logged By	N. Luebbers	Checked By	P. Pratheep
Drilling Method	Rotary Wash	Drill Bit Size/Type	124-mm tricone roller bit	Total Depth of Borehole	4.27 m
Drill Rig Type	Mayhew 1000	Drilling Contractor	C & L Drilling	Approximate Surface Elevation	63.8 m MSL
Groundwater Level and Date Measured	Not measured	Sampling Method(s)	SPT, Standard California	Hammer Data	Manual hammer; 63.5 kg, 760-mm drop
Borehole Backfill	Cement grout, asphalt cold patch	Location	Refer to site plan (212+25 46L)		

Elevation, meters	Depth, meters	SAMPLES Type	Number	Sampling Resistance, blows/300 mm	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, kN/m³	REMARKS AND OTHER TESTS
	0					Asphalt surface			
						SILTY CLAY (CL-ML), firm, brown, moist, trace gravel, roots			
63	1								
62	2		1	5					Poor recovery.
			2	27		... becomes firm to stiff; increasing gravel content			Drive sampler without rings. Rock in sampler shoe. Poor sample recovery.
61	3					POORLY GRADED GRAVEL with SAND (GP), very dense, brown, moist			
			3	67					Poor recovery. Hard drilling. Approximately 40 min. to drive from 3 m to 4.3 m. Driller reports possible boulder.
60	4								
						Bottom of boring at 4.27 m bgs (refusal) Groundwater not measured in borehole at end of drilling.			
59	5								
58	6								
57	7								
56	8								
55	9								
54	10								

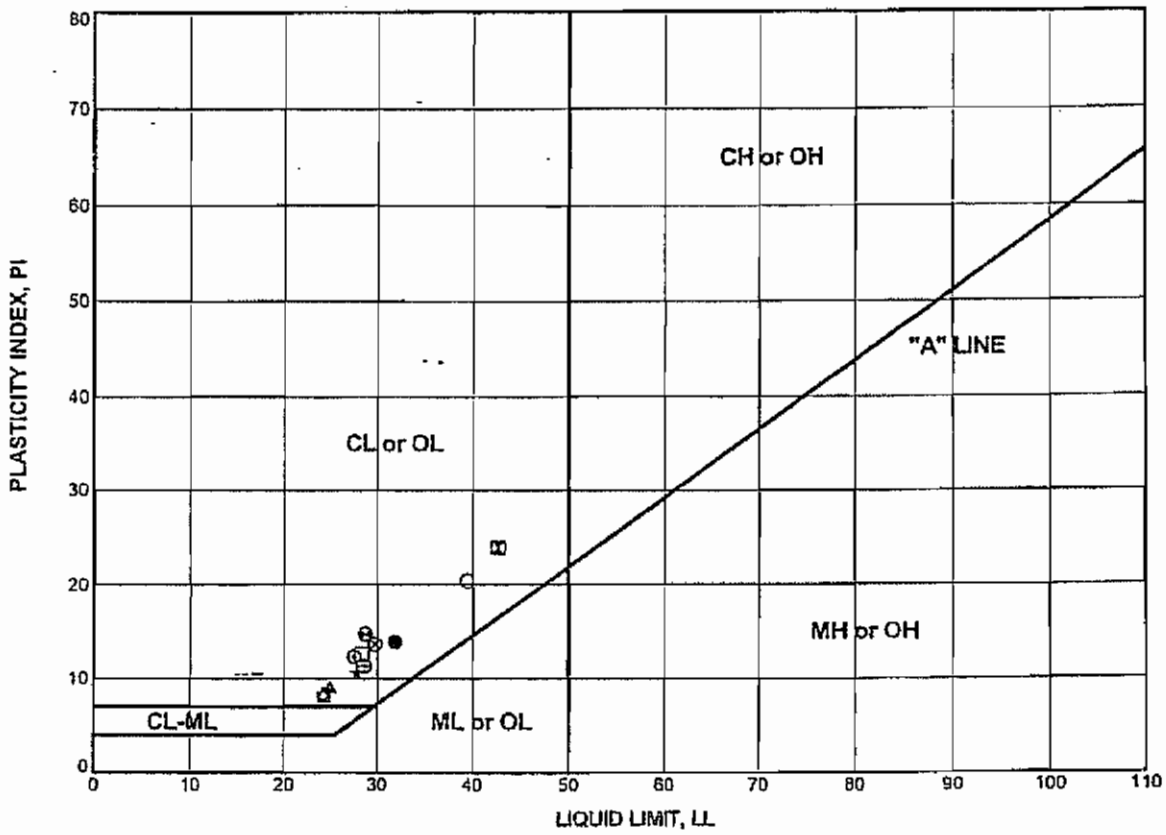


Boring Number	Sample Number	Depth (meters)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
GMR-B-39	4	4.72	●		34	19	15	Sandy Lean Clay (CL)
GMR-B-39	11	15.39	⊠	16	25	17	8	Sandy Lean Clay (CL)
GMR-B-39	13	18.44	▲	21	42	21	21	Lean Clay (CL)
GMR-B-40	4	4.72	★	19	29	15	14	Lean Clay with Sand (CL)
GMR-B-40	8	10.82	⊙	9	20	12	8	Clayey Sand (SC)
GMR-B-40	9B	12.50	✿		26	15	11	Sandy Lean Clay (CL)
GMR-B-41	2	3.20	○	16	30	18	12	Sandy Lean Clay (CL)
GMR-B-41	8B	12.50	△	18	30	18	12	Lean Clay with Sand (CL)
GMR-B-41	16	24.54	⊗	14	28	16	12	Sandy Lean Clay (CL)
GMR-B-42	2	1.68	⊕	2	25	16	9	Clayey Sand (SC)
GMR-B-42	4	4.72	□	7	29	18	11	Clayey Sand (SC)
GMR-B-42	8	10.82	⊖	14	28	17	11	Sandy Lean Clay (CL)

Report: SR22_ATTERBERG_PLOT_12PTS; File: SNA_SR22OCTA.GPJ; 7/11/2005 GMR-B-042

State Route 22 HOV Lane Design-Build
Orange County, California
URS Project Number 29866278

PLASTICITY CHART

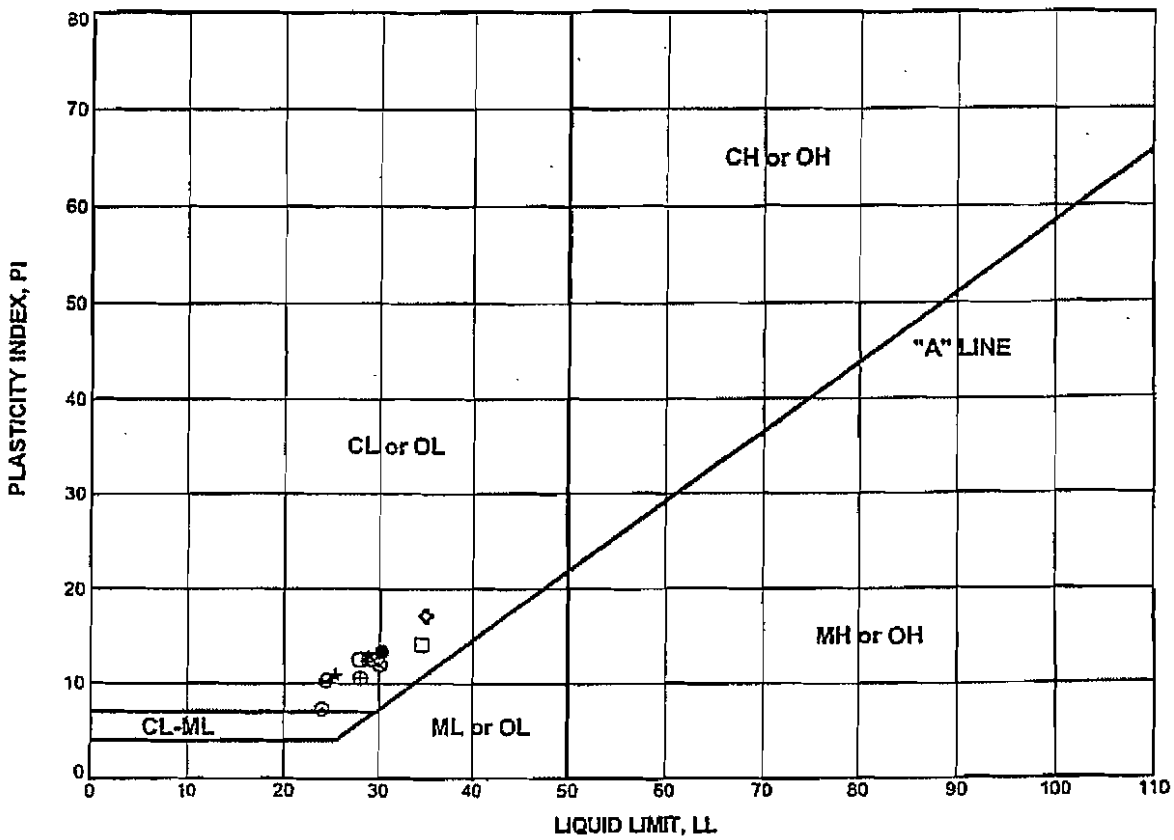


Boring Number	Sample Number	Depth (meters)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
GMR-B-42	14	19.95	●	14	32	18	14	Sandy Lean Clay (CL)
GMR-B-42	16	26.06	⊠	16	43	19	24	Sandy Lean Clay (CL)
GMR-B-43	1	0.76	▲	5	25	16	9	Sandy Lean Clay (CL)
GMR-B-43	6	7.92	★	17	28	17	11	Lean Clay (CL)
GMR-B-43	8	10.82	⊙	19	27	15	12	Lean Clay with Sand (CL)
GMR-B-43	10	14.02	✿	14	24	16	8	Sandy Lean Clay (CL)
GMR-B-43	12	16.92	○	18	39	19	20	Lean Clay with Sand (CL)
GMR-B-43	16	23.01	△	14	24	16	8	Lean Clay (CL)
GMR-B-44	8	10.82	⊗	6	30	16	14	Sandy Lean Clay (CL)
GMR-B-44	10	13.87	⊕	4	29	17	12	Sandy Lean Clay (CL)
GMR-B-45	3	3.20	□	5	28	16	12	Sandy Lean Clay (CL)
GMR-B-45	13-2	14.48	⊖	15	29	14	15	Sandy Lean Clay (CL)

Report: SR22_ATTERBERG_PLOT_12PTS; File: SNA_SR22OCTA.GPJ; 7/11/2005 GMR-B-045

State Route 22 HOV Lane Design-Build
Orange County, California
URS Project Number 29866278

PLASTICITY CHART



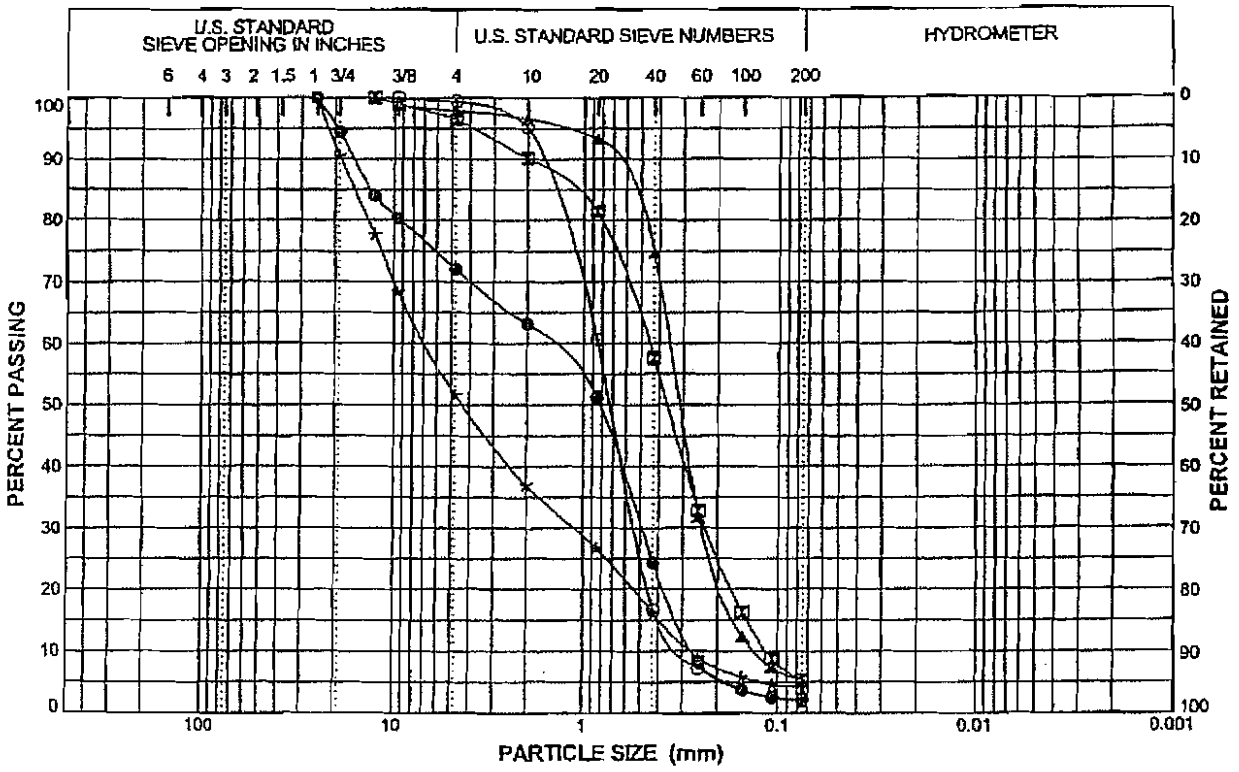
Boring Number	Sample Number	Depth (meters)	Test Symbol	Water Content (%)	LL	PL	PI	Classification
GMR-B-129	4-1	4.88	●	13	30	17	13	Sandy Lean Clay (CL)
GMR-B-129	15	19.96	⊠	20	29	16	13	Sandy Lean Clay (CL)
GMR-B-129	21	29.11	▲	26	29	16	13	Sandy Lean Clay (CL)
GMR-B-130	2A	3.05	★	15	25	15	10	Clayey Sand (SC)
GMR-B-131	4-2	4.72	⊙	10	24	17	7	Silty Clayey Sand (SC-SM)
GMR-B-132	9	12.34	◇	21	35	18	17	Lean Clay (CL)
GMR-B-133	5-2	7.77	○	20	28	15	13	Lean Clay with Sand (CL)
GMR-B-133	7-2	10.67	△		29	17	12	Sandy Lean Clay with Gravel (CL)
GMR-B-133	7-1	10.82	⊗	15	30	18	12	Sandy Lean Clay with Gravel (CL)
GMR-B-133	8	12.34	⊕	19	28	17	11	Lean Clay (CL)
GMR-B-134	12	16.92	□	11	35	20	15	Lean Clay (CL)
GMR-B-135	6-1	7.92	⊖	16	24	14	10	Sandy Lean Clay (CL)

Report: SR22_ATTERBERG_PLOT_12PTS; File: SNA_SR22DCTA.GPJ; 7/11/2005 GMR-B-135

State Route 22 HOV Lane Design-Build
Orange County, California
URS Project Number 29866278

PLASTICITY CHART

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



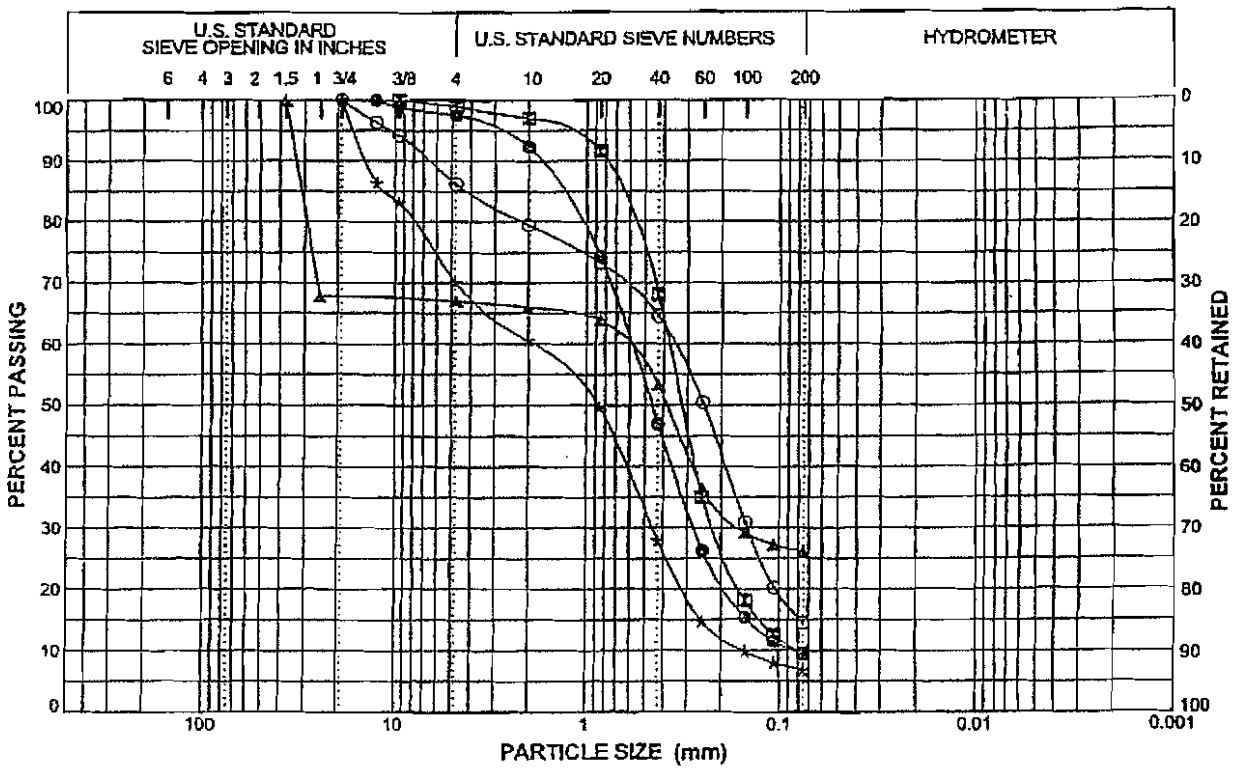
Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
GMR-B-39	7	9.30	●			Poorly Graded Sand with Gravel (SP)
GMR-B-39	15	21.40	⊠			Poorly Graded Sand with Silt (SP-SM)
GMR-B-40	9A	12.19	▲			Poorly Graded Sand with Silt (SP-SM)
GMR-B-41	9	13.87	★			Poorly Graded Gravel with Sand (GP)
GMR-B-41	13	19.95	⊙			Poorly Graded Sand (SP)

Report: SR22_SIEVE_5_CURVES; File: SNA_SR22OCTA.GPJ; 7/11/2005 GMR-B-041

State Route 22 HOV Lane Design-Build
Orange County, California
URS Project Number 29866278

PARTICLE SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



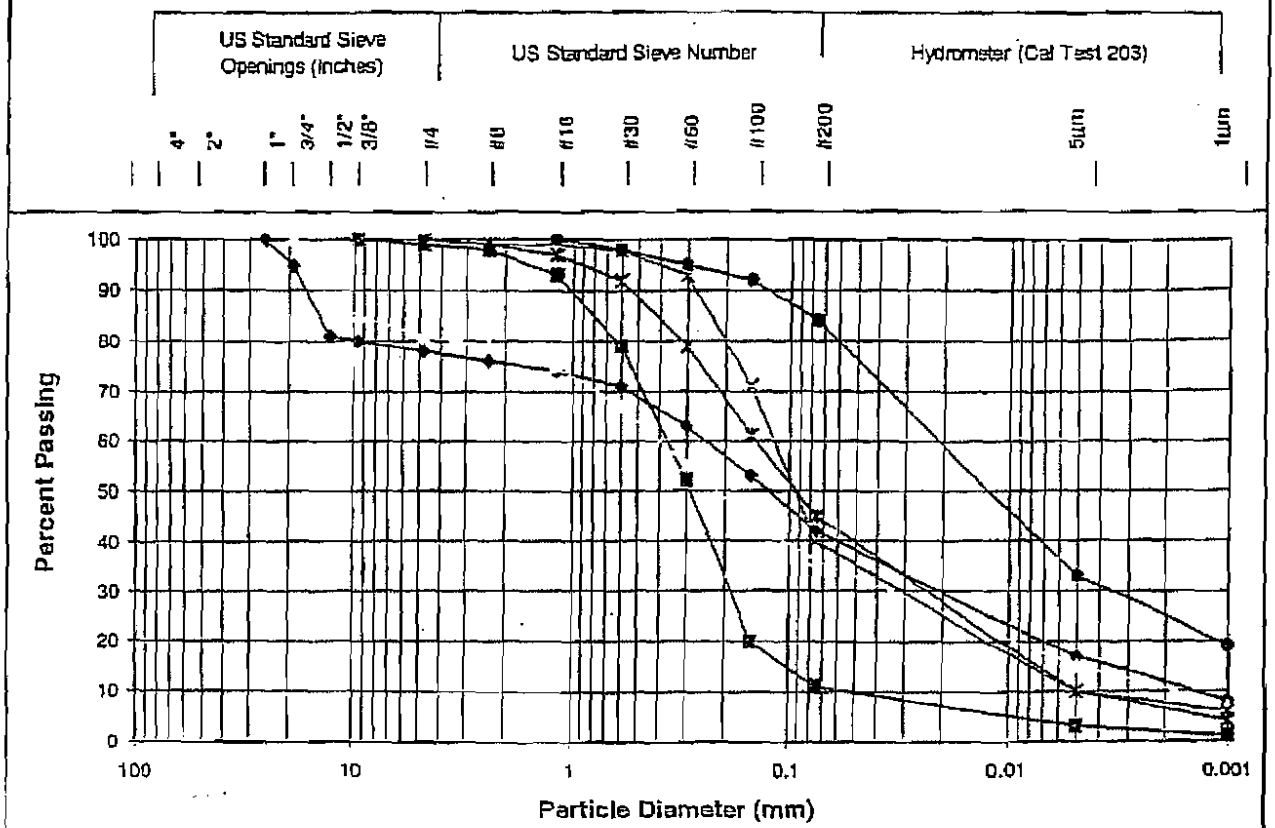
Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
GMR-B-42	6	7.77	●			Well-Graded Sand with Silt (SW-SM)
GMR-B-42	11A	15.24	⊠			Poorly Graded Sand with Silt (SP-SM)
GMR-B-42	12	16.92	▲			Silty Sand with Gravel (SM)
GMR-B-42	16	22.92	★			Poorly Graded Sand with Silt and Gravel (SP-SM)
GMR-B-43	2	1.68	⊙			Silty Sand (SM)

Report: SR22_SIEVE_5_CURVES; File: SNA_SR22OCTA.GPJ; 7/11/2005 GMR-B-043

State Route 22 HOV Lane Design-Build
Orange County, California
URS Project Number 29866278

PARTICLE SIZE DISTRIBUTION CURVES

Gradation Analysis Test Results



Sample ID:

BH53-4 BH53-5 BH53-6 BH53-9

BH53-11 BH53-13

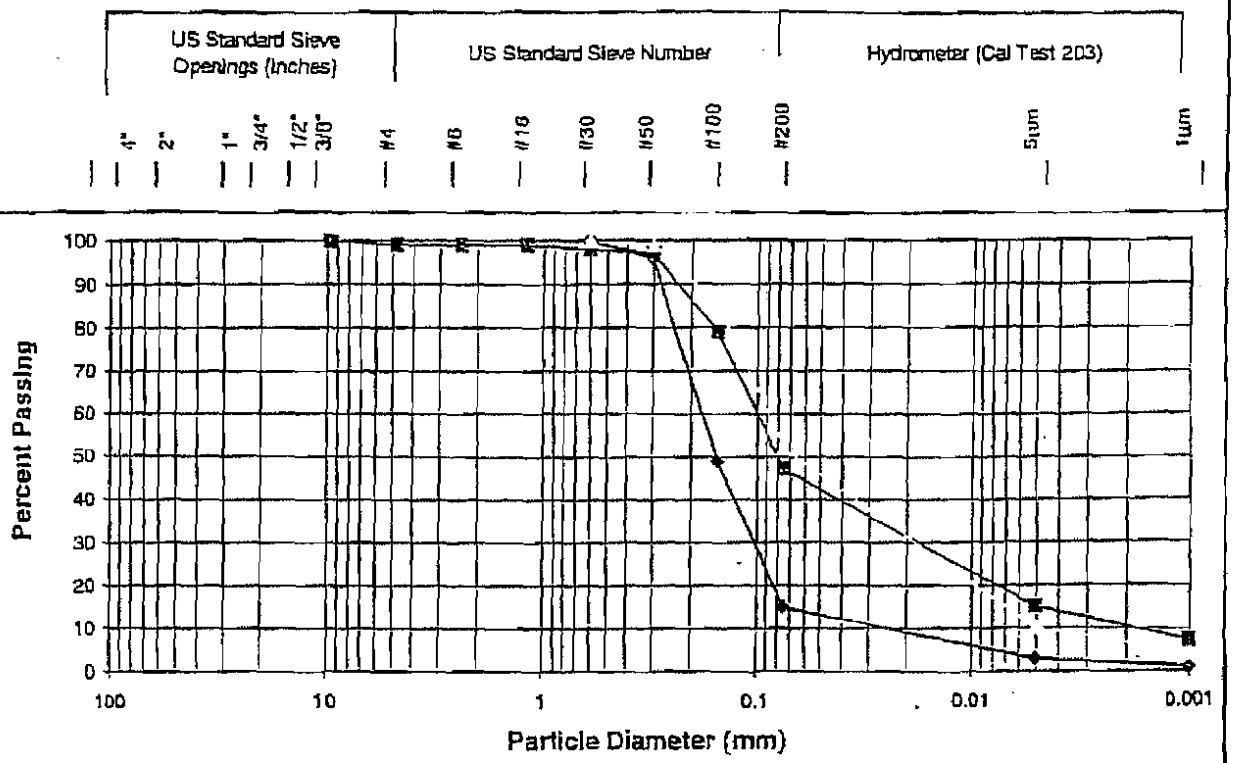
GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Caltrans

Engineering Services
Division of Geotechnical Services
Office of Geotechnical
Design - South

Project:	SR22 HOV Lane Widening
EA:	12-071611
D.-Co.-Rt.-Kp:	12-ORA-22-1.48-19.05

Gradation Analysis Test Results



Sample ID:

BH74-3 BH74-6 BH74-10

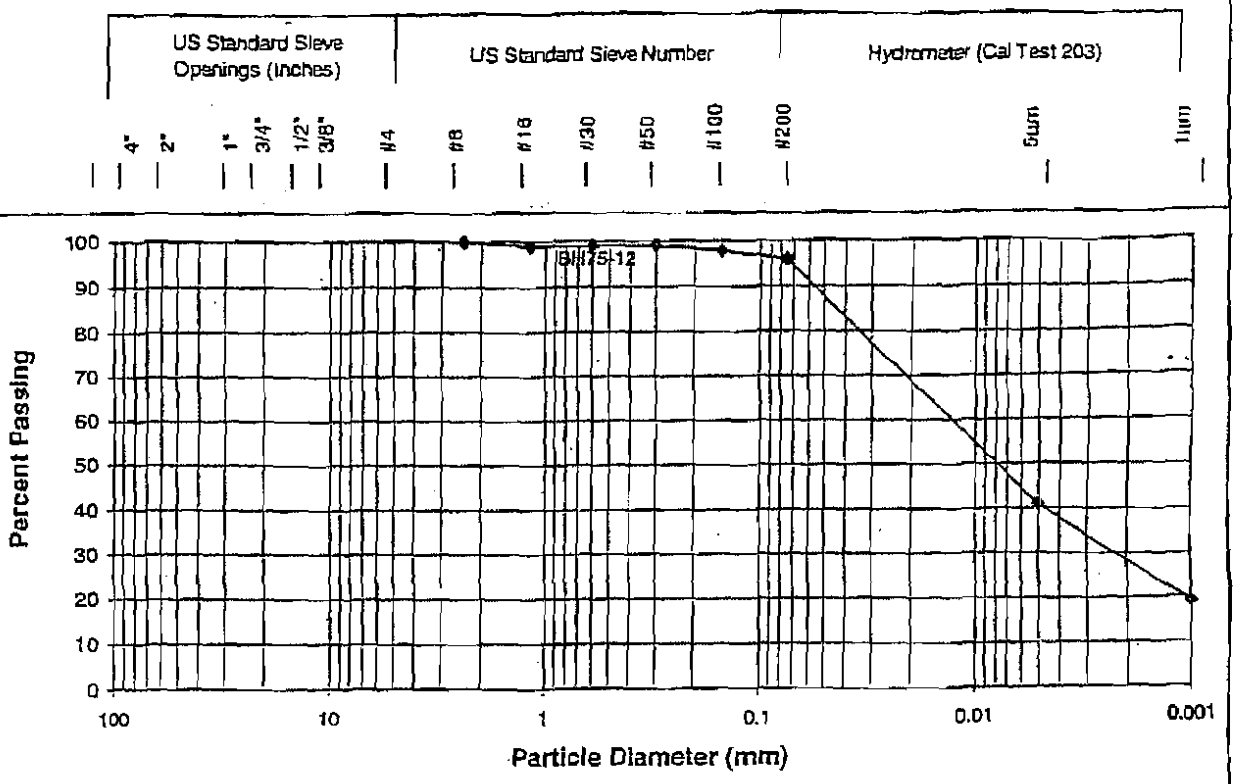
GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Caltrans

Engineering Services
Divsion of Geotechnical Services
Office of Geotechnical
Design - South

Project:	SR22 HOV Lane Widening
EA:	12-071611
D.-Co.-Rt.-Kp:	12-ORA-22-1.48-19.05

Gradation Analysis Test Results



Sample ID:

—◇— BH75-12

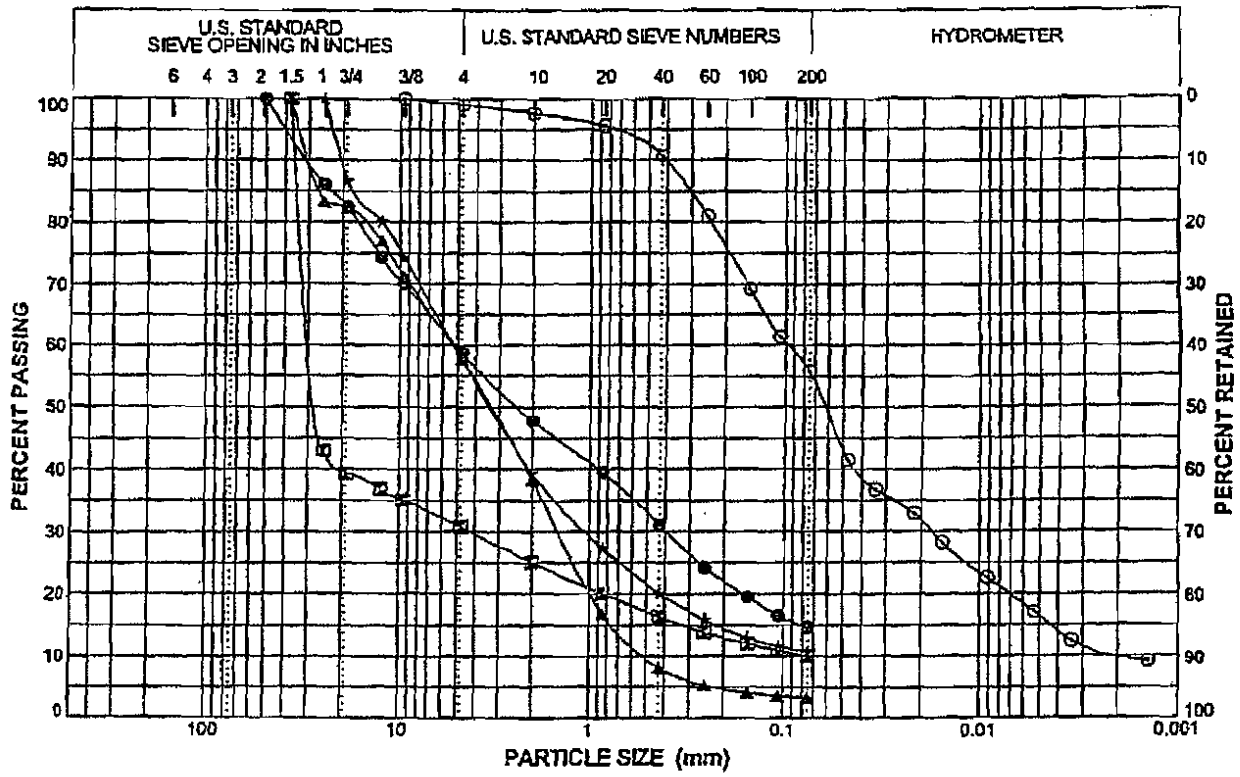
GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Caltrans

Engineering Services
Division of Geotechnical Services
Office of Geotechnical
Design - South

Project:	SR22 HOV Lane Widening
EA:	12-071611
D.-Co.-Rt.-Kp:	12-ORA-22-1.48-19.05

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



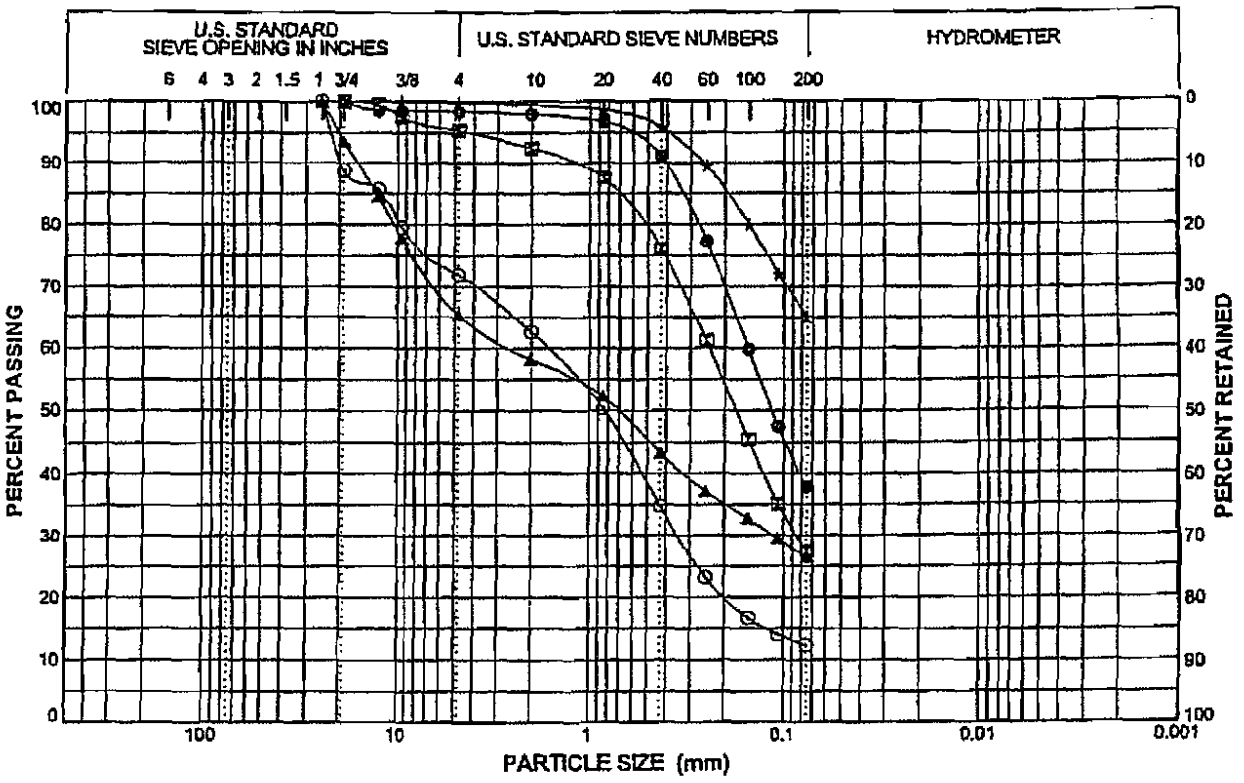
Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
GMR-B-132	1	1.68	●			Silty Sand with Gravel (SM)
GMR-B-132	6	7.62	▣			Poorly Graded Gravel with Silt and Sand (GP-GM)
GMR-B-133	1	1.68	▲			Poorly Graded Sand with Gravel (SP)
GMR-B-133	4	6.25	★			Poorly Graded Sand with Clay and Gravel (SP-SC)
GMR-B-134	1	0.76	⊙			Sandy Lean Clay (CL)

Report: SR22_SIEVE_5_CURVES; File: SNA_SR22OCTA.GPJ; 7/11/2005 GMR-B-134

State Route 22 HOV Lane Design-Build
Orange County, California
URS Project Number 29866278

PARTICLE SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

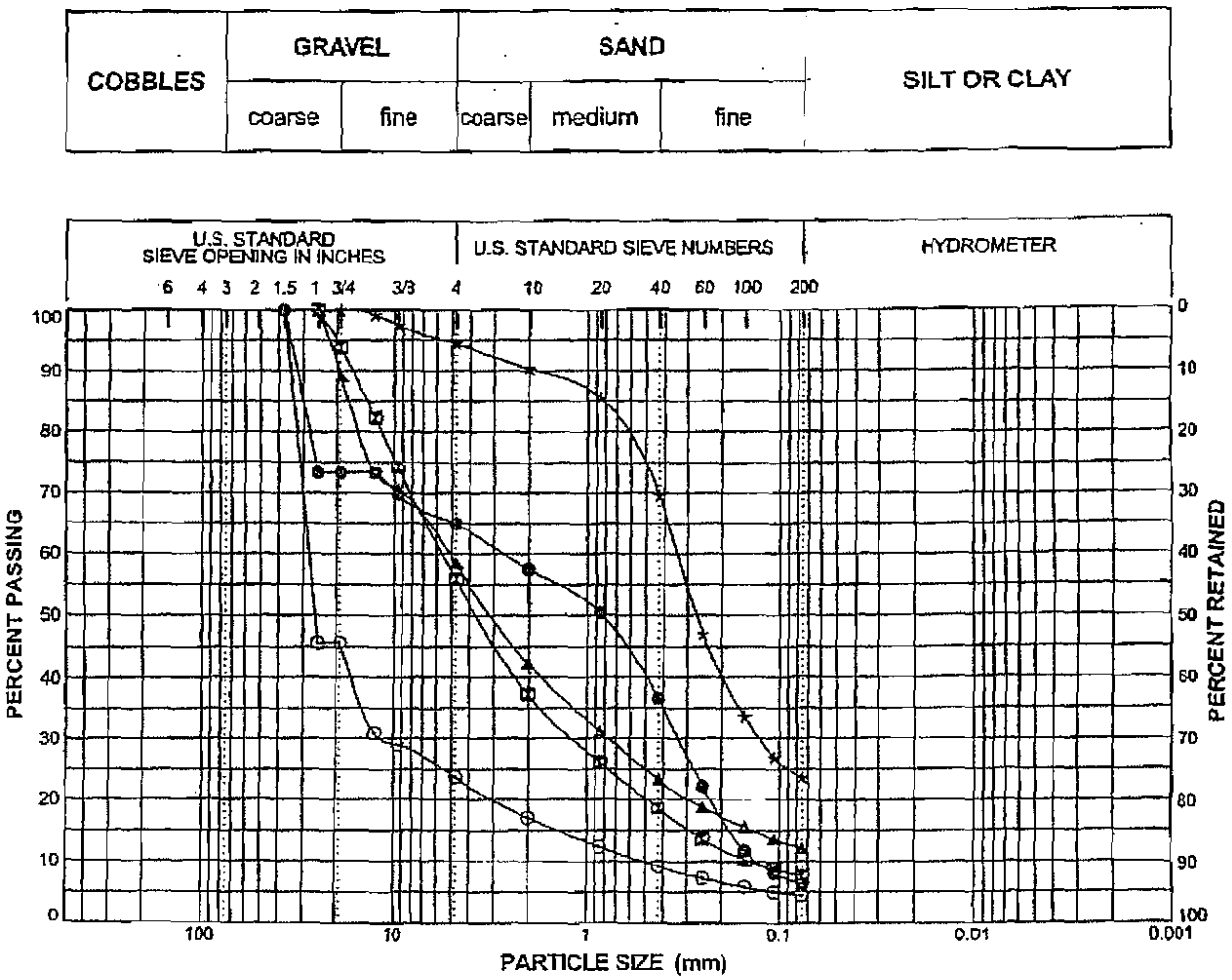


Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
GMR-B-134	2	1.68	●			Clayey Sand (SC)
GMR-B-134	4	4.72	⊠			Silty Sand with Gravel (SM)
GMR-B-134	6	7.77	▲			Silty Clayey Sand with Gravel (SC-SM)
GMR-B-134	14	19.96	★			Sandy Lean Clay (CL)
GMR-B-135	11A	15.24	⊙			Silty Sand with Gravel (SM)

Report: SR22_SIEVE_B_CURVES; File: SNA_SR22\CTA.GPJ; 7/11/2005 GMR-B-135

State Route 22 HOV Lane Design-Build
Orange County, California
URS Project Number 29866278

PARTICLE SIZE DISTRIBUTION CURVES

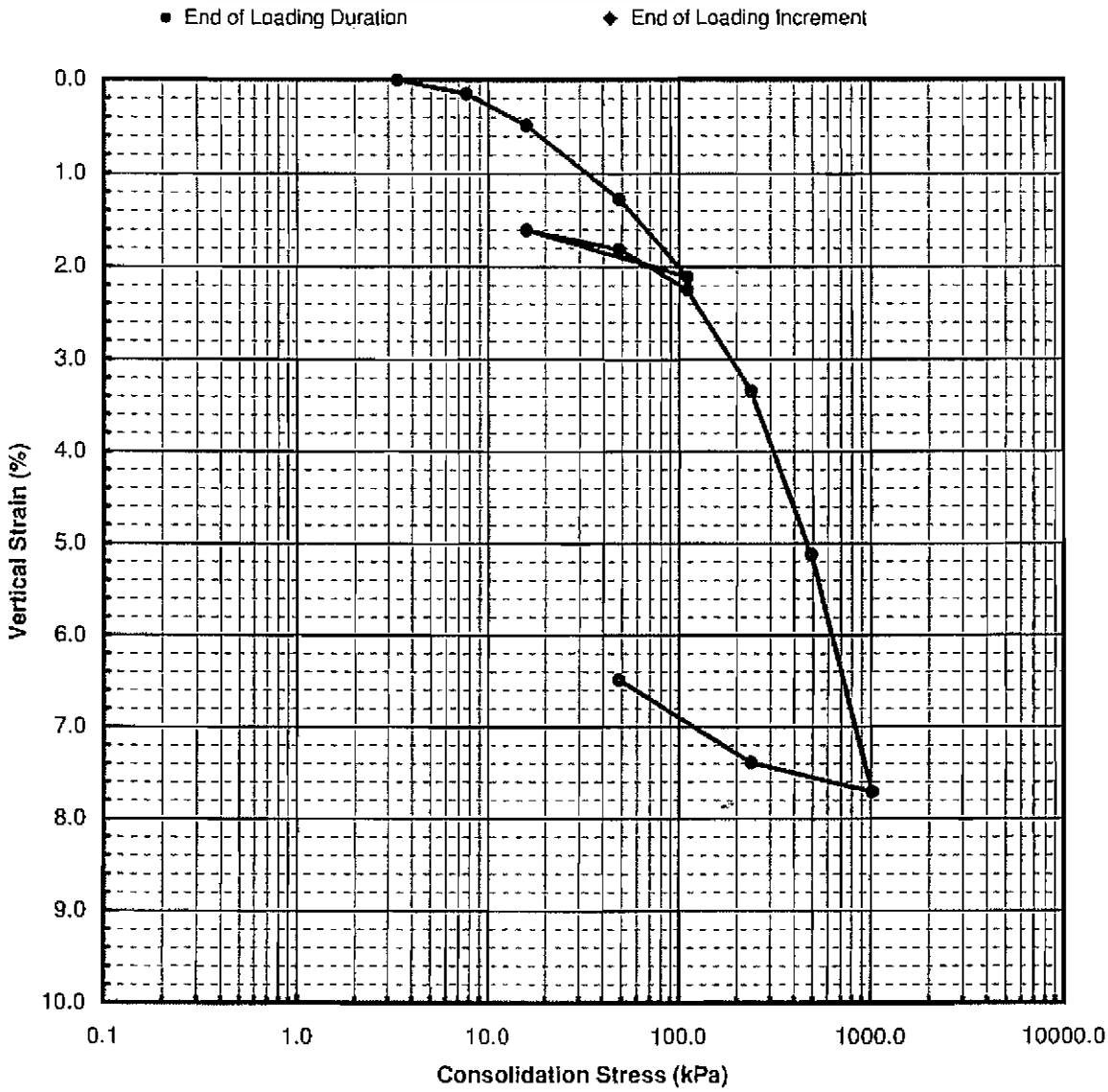


Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
GMR-B-136	2-1	1.83	●			Poorly Graded Sand with Silt and Gravel (SP-SM)
GMR-B-136	5	6.25	⊠			Poorly Graded Sand with Clay and Gravel (SP-SC)
GMR-B-136	7	9.14	▲			Clayey Sand with Gravel (SC)
GMR-B-137	3	4.88	★			Silty Sand (SM)
GMR-B-137	4M	6.25	⊙			Poorly Graded Gravel with Sand (GP)

State Route 22 HOV Lane Design-Build
Orange County, California
URS Project Number 29866278

PARTICLE SIZE DISTRIBUTION CURVES

Report: SR22_SIEVE_S_CURVES; File: SNA_SR22OCTA.GPJ; 7/11/2005 GMR-B-137



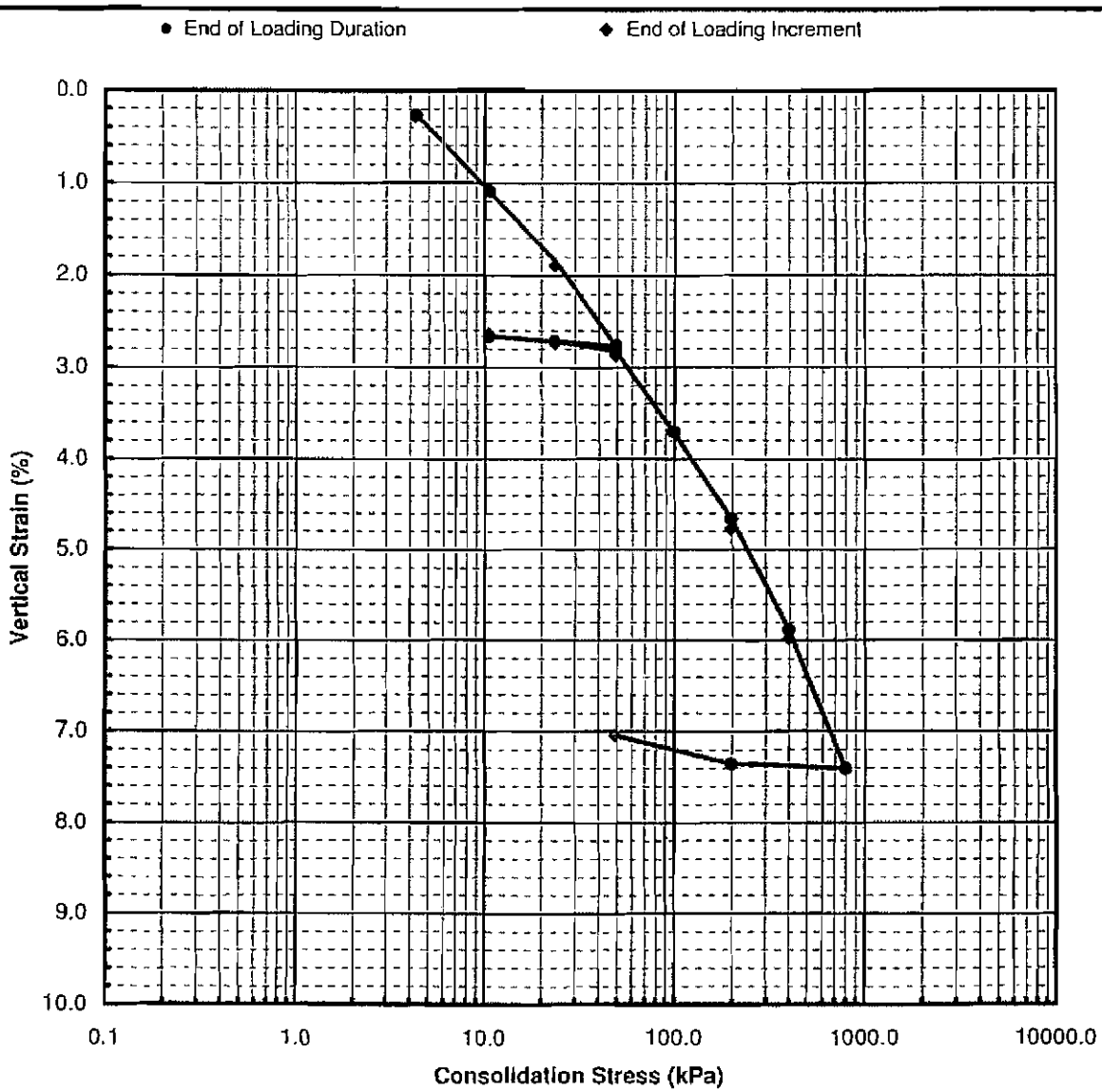
Exploration No.: GMR B-41 Sample No.: 1 Depth (m): 1.5

Description/ Classification: Brown Clay (CL)

	Water Content, %	Total Unit Weight, kN/m³	Dry Unit Weight, kN/m³	Void Ratio	Saturation %	Height cm	Diameter cm	Specific Gravity	Liquid Limit	Plasticity Index
Initial:	17.0	20.6	17.6	0.53	88.4	2.06	6.15	2.75		
Final:	17.6	21.4	18.2	0.48	100.8	1.99		assumed		

Project Name: E22-N5/22 Connector Separation (55-1086G)
Project Number: 298666278

CONSOLIDATION TEST
Figure: B-7



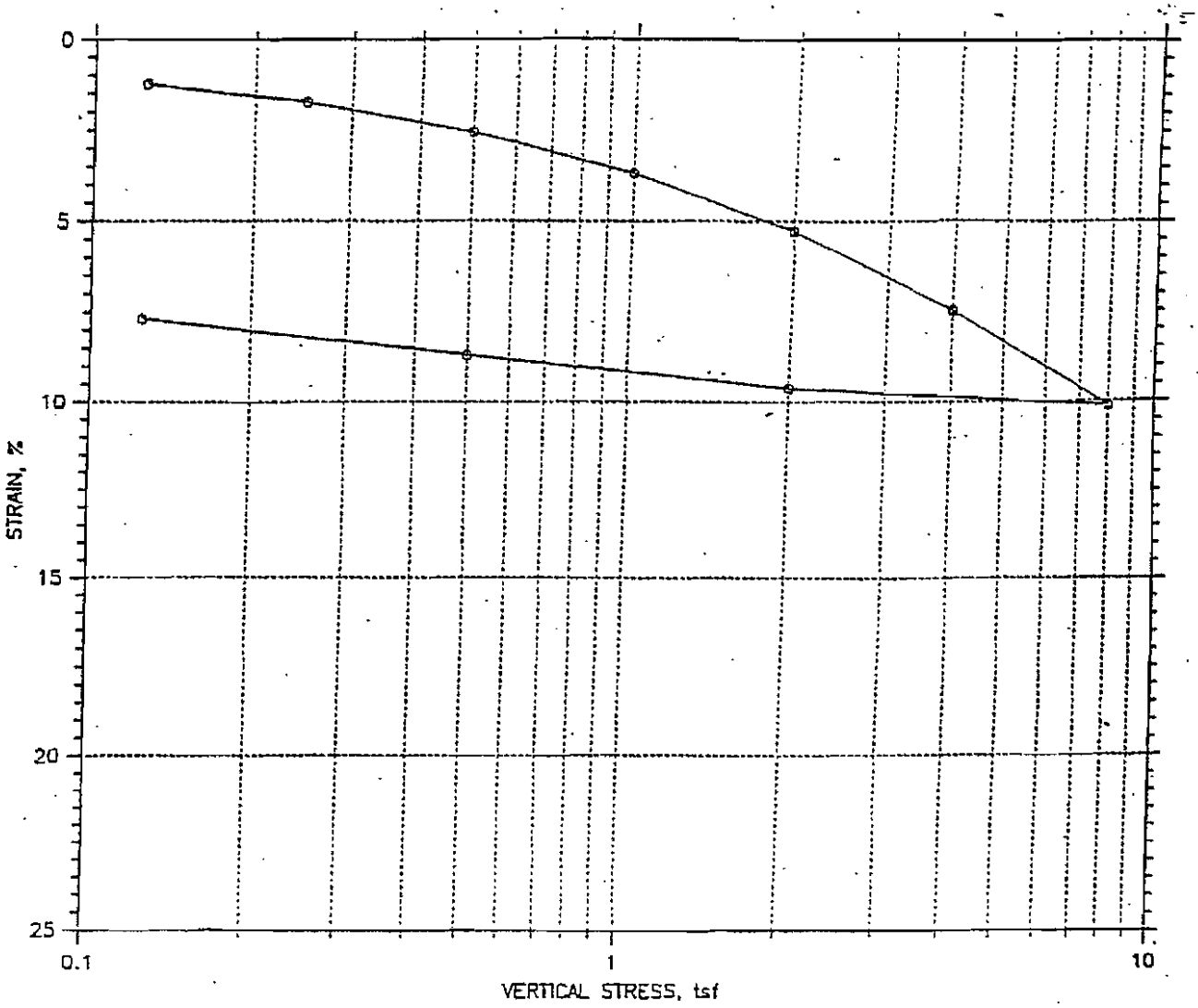
Exploration No.: GMR B-42 Sample No.: 4 Depth (m): 4.6

Description/ Classification: Brown clayey Sand (SC)

	Water Content, %	Total Unit Weight, kN/m³	Dry Unit Weight, kN/m³	Void Ratio	Saturation %	Height cm	Diameter cm	Specific Gravity	Liquid Limit	Plasticity Index
Initial:	6.8	19.7	18.5	0.46	40.7	2.21	4.91	2.75	29	11
Final:	13.1	21.9	19.3	0.39	91.6	2.12		assumed		

Project Name: E22-N5/22 Connector Separation (55-1086G) Project Number: 298666278	CONSOLIDATION TEST Figure: B-8

CONSOLIDATION TEST DATA
SUMMARY REPORT

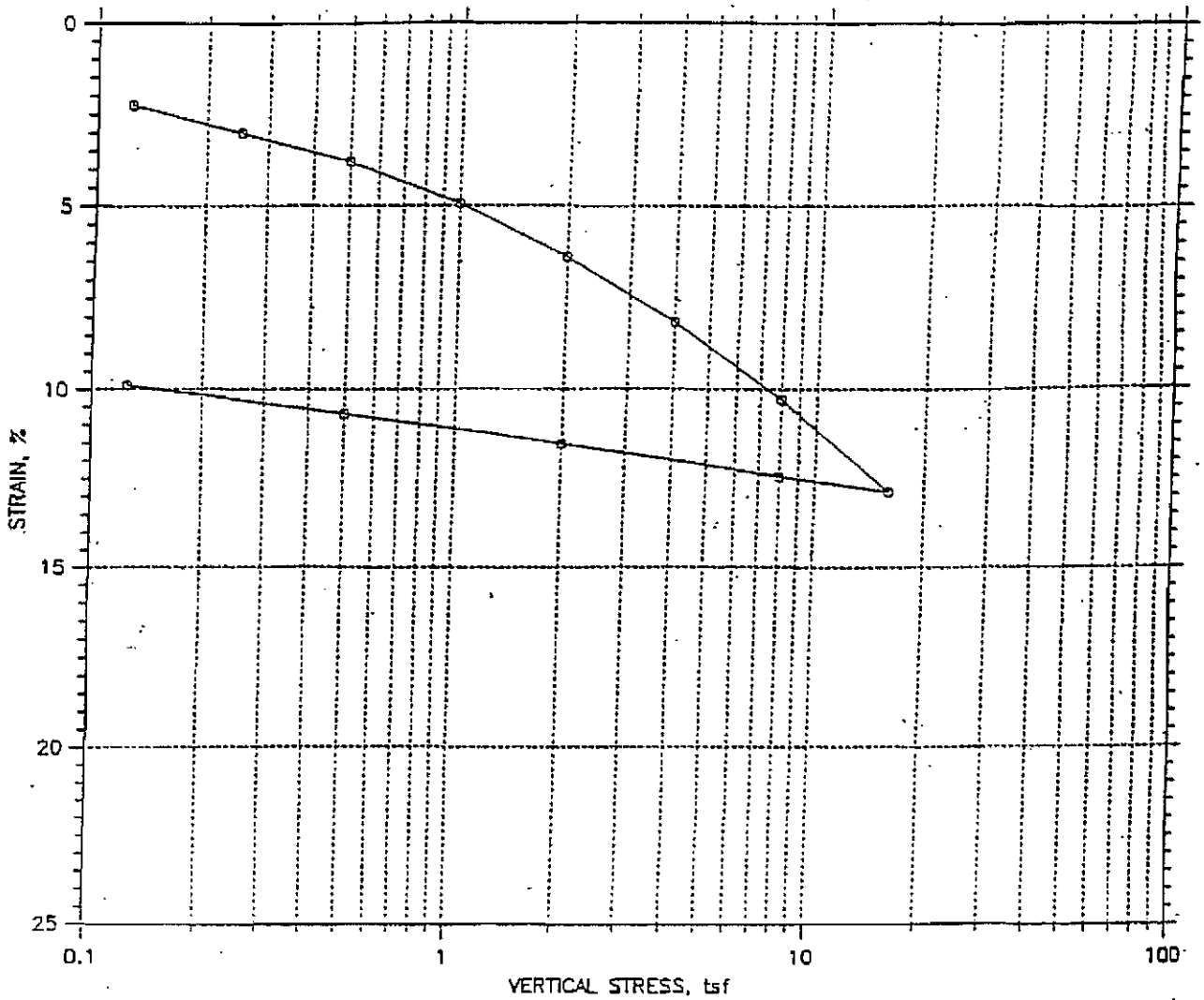


					Before Test	After Test
Overburden Pressure, tsf:				Water Content, %	17.55	16.30
Preconsolidation Pressure, tsf:				Dry Unit Weight, pcf	108.08	117.09
Compression Index:				Saturation, %	83.26	97.99
Diameter: 1.944 in		Height: 0.76 in		Void Ratio	0.57	0.45
LL: 0	PL: 0	PI: 0	GS: 2.73			

Project: SR 22 HOV LANE WIDEN	Location: 12-ORA-22; 1.48/19.04	Project No.: 12-071611
Boring No.: BH-53	Tested By: KS	Checked By:
Sample No.: S-7-B	Test Date: 10/26/01	Depth: 35.9
No.: 01171-G4	Sample Type: 1.944"	Elevation: ---
ption: MOIST, DARK BROWN, SILT WITH SAND & GRAVEL		
Remarks: PATCHED.		

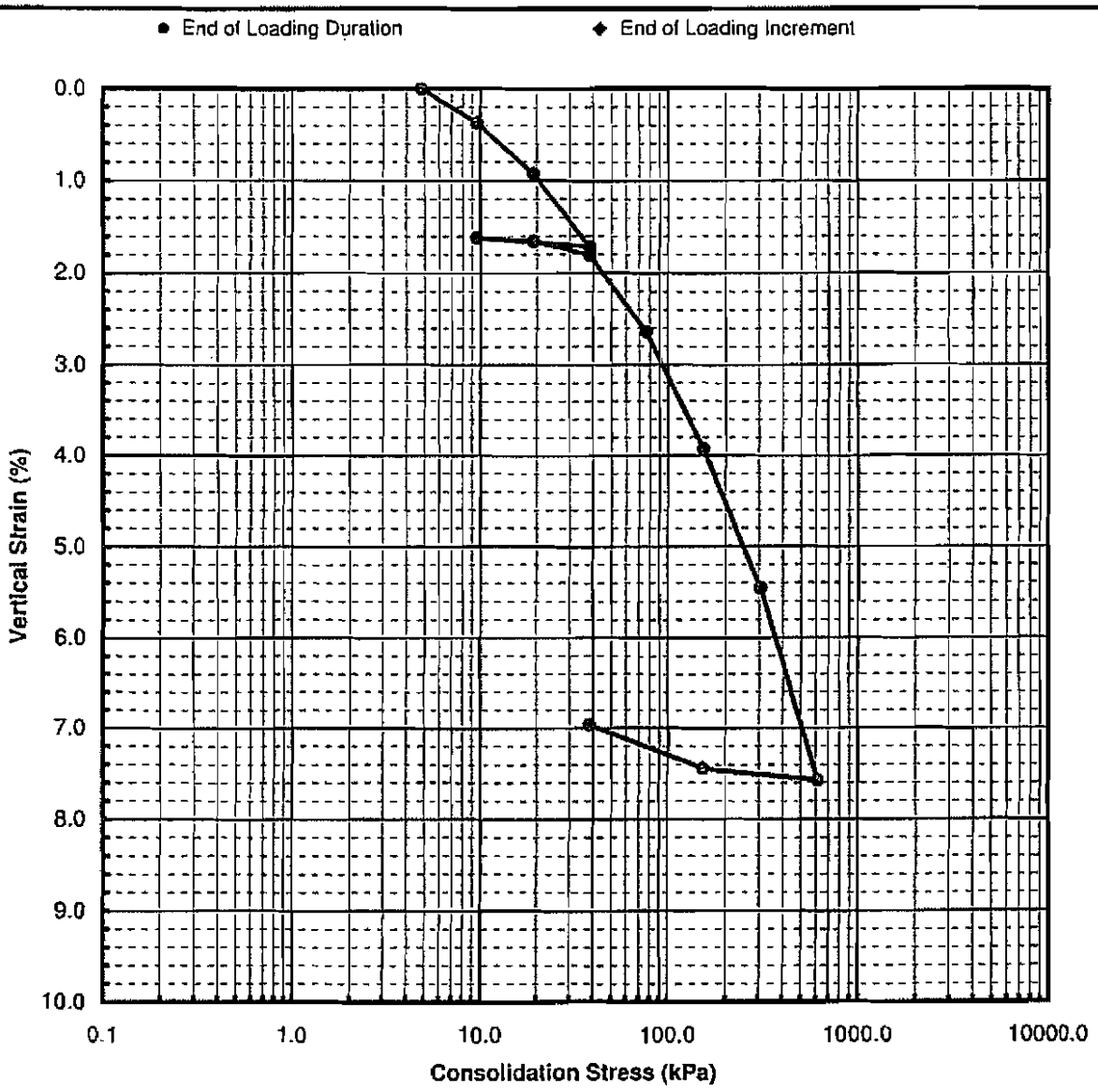
5-NOV-2001 18:17:02

CONSOLIDATION TEST DATA
SUMMARY REPORT



					Before Test	After Test
Overburden Pressure, tsf:				Water Content, %	26.10	20.51
Preconsolidation Pressure, tsf:				Dry Unit Weight, pcf	97.085	107.38
Compression Index:				Saturation, %	95.73	97.18
Diameter: 1.944 in		Height: 0.78 in		Void Ratio	0.74	0.57
LL: 0	PL: 0	PI: 0	GS: 2.70			

Project: SR 22 HOV LANE WIDENING	Location: 12-ORA-22	Project No.: 12-071611
Boring No.: BH-74	Tested By: KS	Checked By:
Sample No.: S-6-C	Test Date: 12/10/01	Depth: 25.9'
o.: 01235-G4	Sample Type: 1.944"	Elevation: ---
Description: MOIST, GRAY, FIRM, SILT WITH CLAY		
Remarks:		



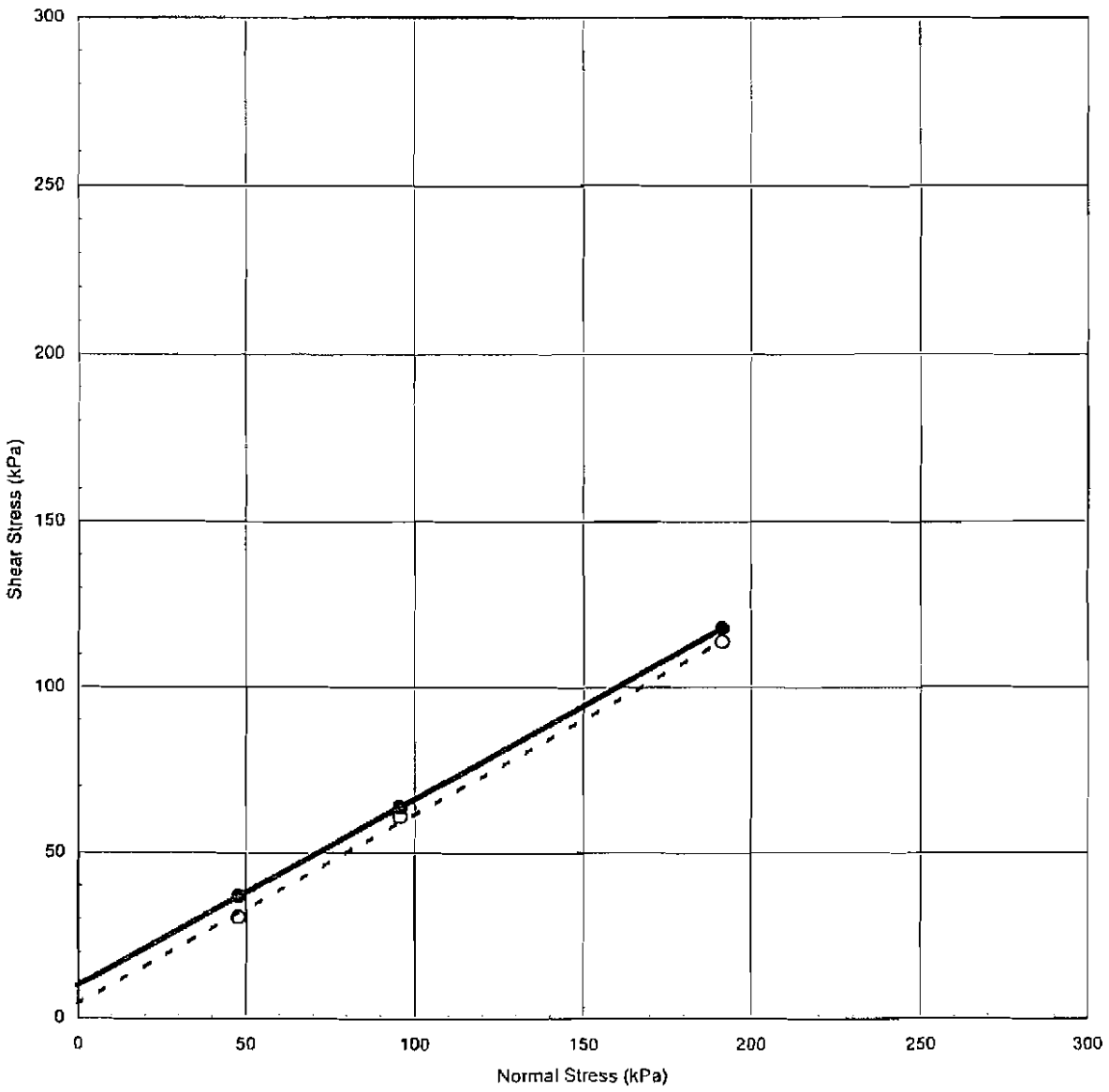
Exploration No.: GMR B-133 Sample No.: 5 Depth (m): 7.6

Description/ Classification: Brown sandy Clay (CL)

	Water Content, %	Total Unit Weight, kN/m³	Dry Unit Weight, kN/m³	Void Ratio	Saturation %	Height cm	Diameter cm	Specific Gravity	Liquid Limit	Plasticity Index
Initial:	19.6	20.8	17.4	0.55	97.6	2.06	6.14	2.75	28	13
Final:	17.4	21.2	18.0	0.49	97.0	1.98		assumed		

Project Name: Retaining Wall No 211
Project Number: 298666278.51100

CONSOLIDATION TEST
Figure:

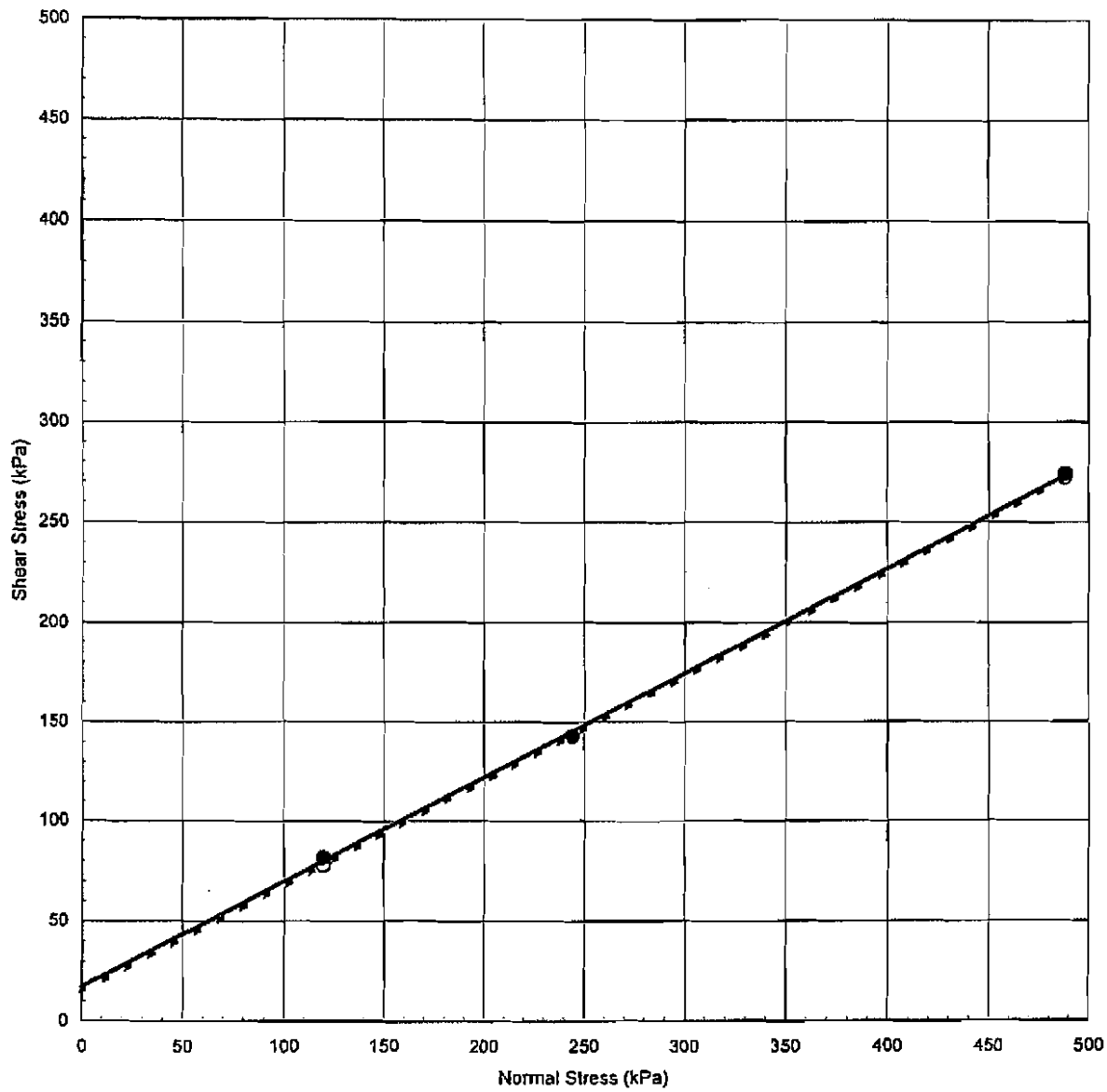


Peak Values are : ● ,solid trend line								Ultimate Values are: ○ ,dashed trend line			
Exploration No.:	B-41		Strength Intercept (C) :		0.20	ksf	Peak	0.08	ksf	Ultimate	
Sample No.:	3				9.8	kPa		4.0	kPa		
Depth (ft | m)	15.0	4.6	Friction Angle (ϕ) :		29	degree		30	degree		
Description:	Brown Clay (CL)						Shear rate :	0.003	(in/min) ,	0.0076	(cm/min)

Sample & Specimen values		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m³)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m³)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
Initial / Set up		18.3	126.6	19.9	107.1	16.8	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	21.2	130.2	20.5	107.4	16.9	1.0	47.9	0.8	36.8	0.6	30.5
	spec. 2	20.6	133.0	20.9	110.3	17.3	2.0	95.8	1.3	63.8	1.3	60.9
	spec. 3	19.2	138.9	21.8	116.6	18.3	4.0	191.5	2.5	117.8	2.4	113.8

URS	SR-22 Improvements	DIRECT SHEAR TEST
	Location: E22-N5/22 Connector Project Number: 29866278 Date: 2/21/2005	Figure No.:

Ds_b41@15.xls

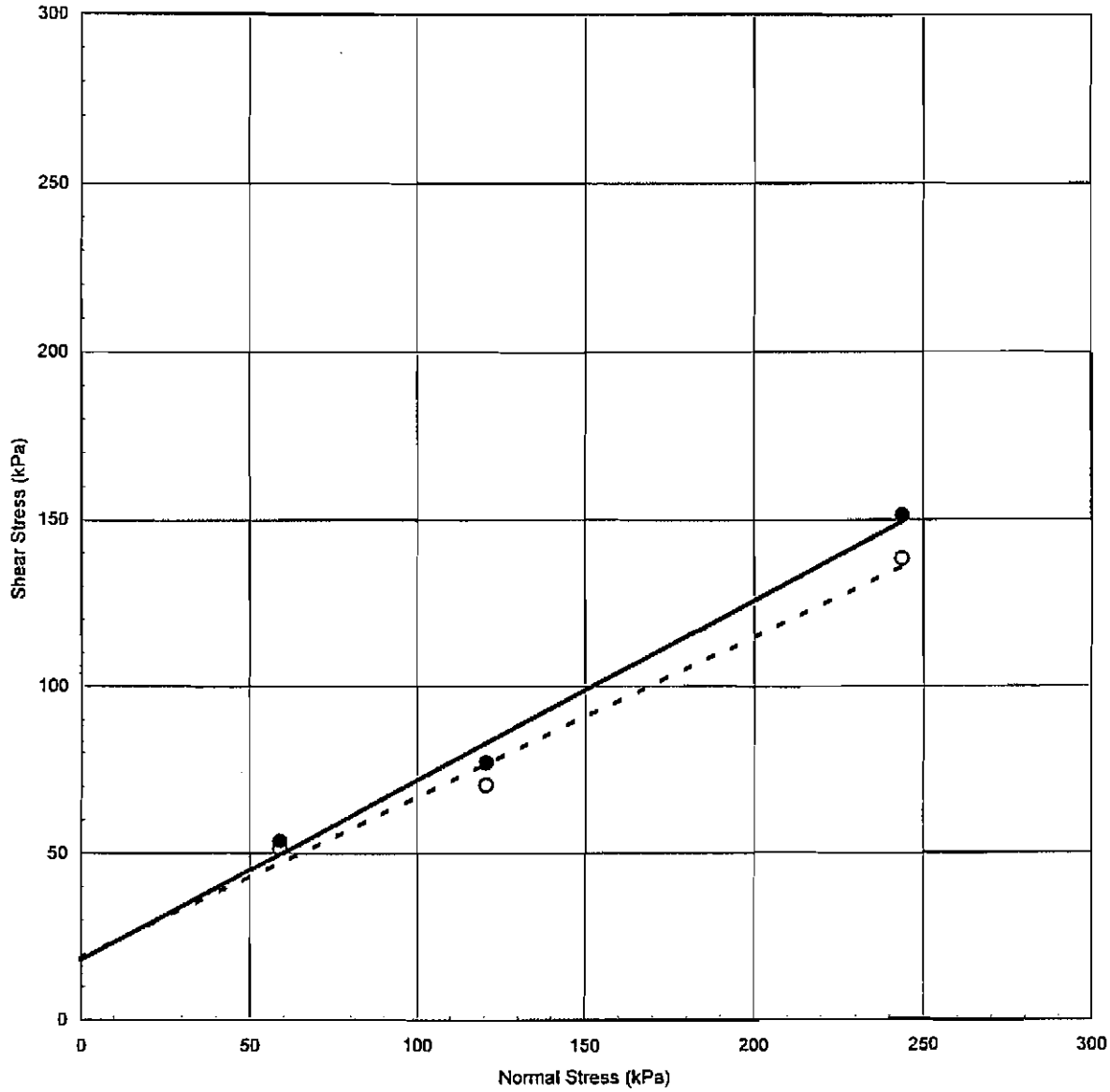


Peak Values are :	●	,solid trend line					Ultimate Values are:		O	,dashed trend line	
Exploration No.:	GMR B-133		Strength Intercept (C) :		0.36	ksf	Peak		0.30	ksf	Ultimate
Sample No.:	5				17.1	kPa			14.2	kPa	
Depth (ft | m)	25.0	7.6	Friction Angle (ϕ) :		28	degree			28	degree	
Description:	Brown Clay (CL)						Shear rate :	0.005	(in/min) ,	0.0127	(cm/min)

SYMBOL		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m³)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m³)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
Initial / Set up		19.5	128.6	20.2	107.6	16.9	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	21.1	135.8	21.3	112.2	17.6	2.5	119.7	1.7	81.4	1.6	77.6
pre-shear	spec. 2	19.7	139.4	21.9	116.4	18.3	5.1	244.2	3.0	142.7	3.0	142.7
pre-shear	spec. 3	18.6	143.5	22.5	121.0	19.0	10.2	488.4	5.7	273.9	5.7	272.0

URS	SR-22 Improvements	DIRECT SHEAR TEST
	Location:	
	Project Number: 29866278 Date: 6/3/2005	Figure No.:

ds_sr22b133@25.xls

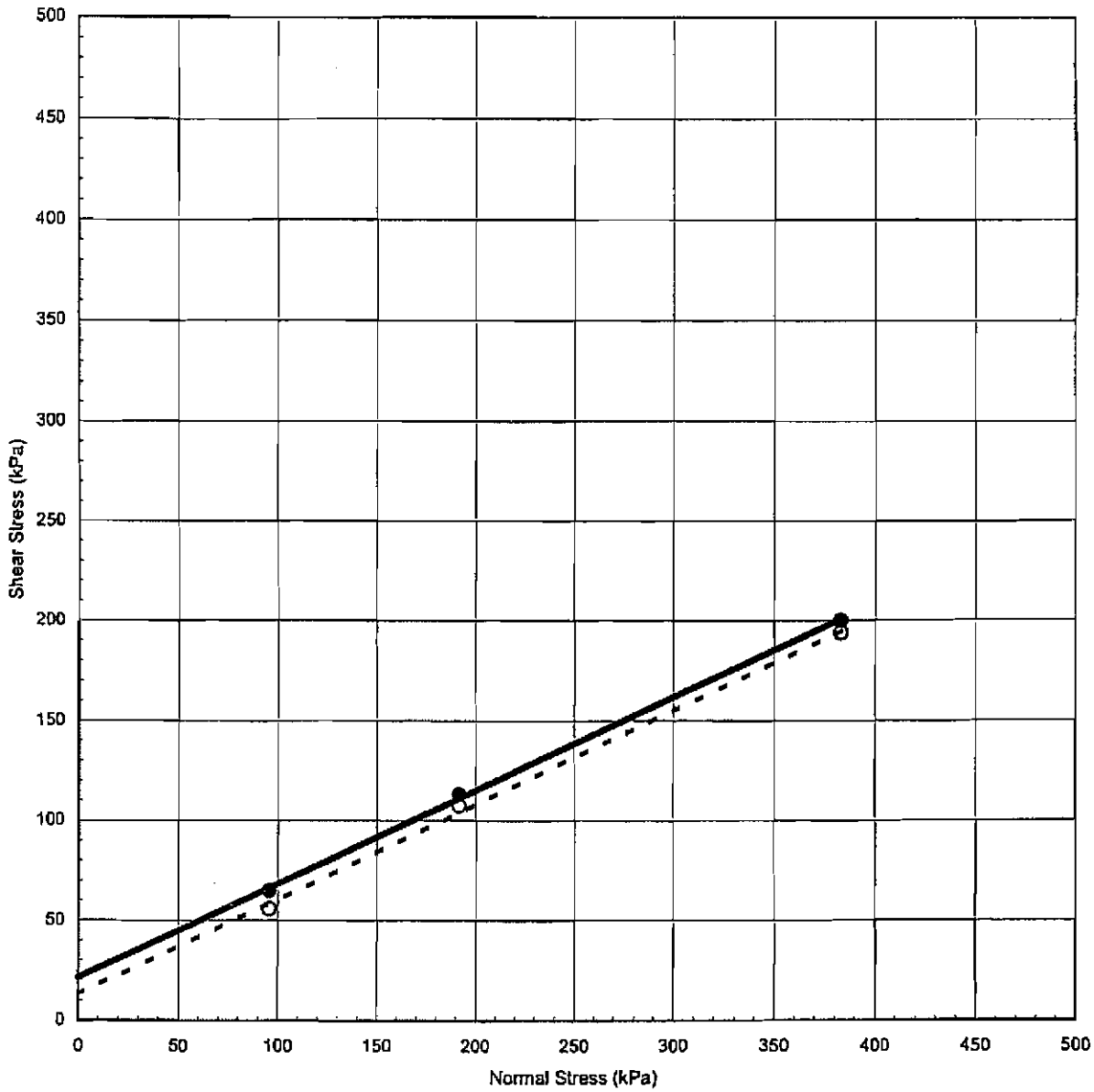


Peak Values are : ● ,solid trend line								Ultimate Values are: ○ ,dashed trend line			
Exploration No.:	GMR B-135		Strength Intercept (C) :		0.37	ksf	Peak	0.39	ksf	Ultimate	
Sample No.:	6				17.9	kPa		18.5	kPa		
Depth (ft | m)	25.0	7.6	Friction Angle (ϕ) :		28	degree		26	degree		
Description:	Brown sandy Clay (CL)						Shear rate :	0.003	(in/min) ,	0.0076	(cm/min)

SYMBOL		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
Initial / Set up		15.4	126.4	19.9	109.5	17.2	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	20.2	128.8	20.2	107.2	16.8	1.2	58.9	1.1	53.6	1.1	51.2
pre-shear	spec. 2	19.9	134.8	21.2	112.5	17.7	2.5	120.7	1.6	77.1	1.5	70.4
pre-shear	spec. 3	19.2	137.1	21.5	115.1	18.1	5.1	243.7	3.2	151.3	2.9	138.4

URS	SR-22 Improvements	DIRECT SHEAR TEST
	Location: Retaining Barrier Project Number: 29866278 Date: 3/24/2005	Figure No.:

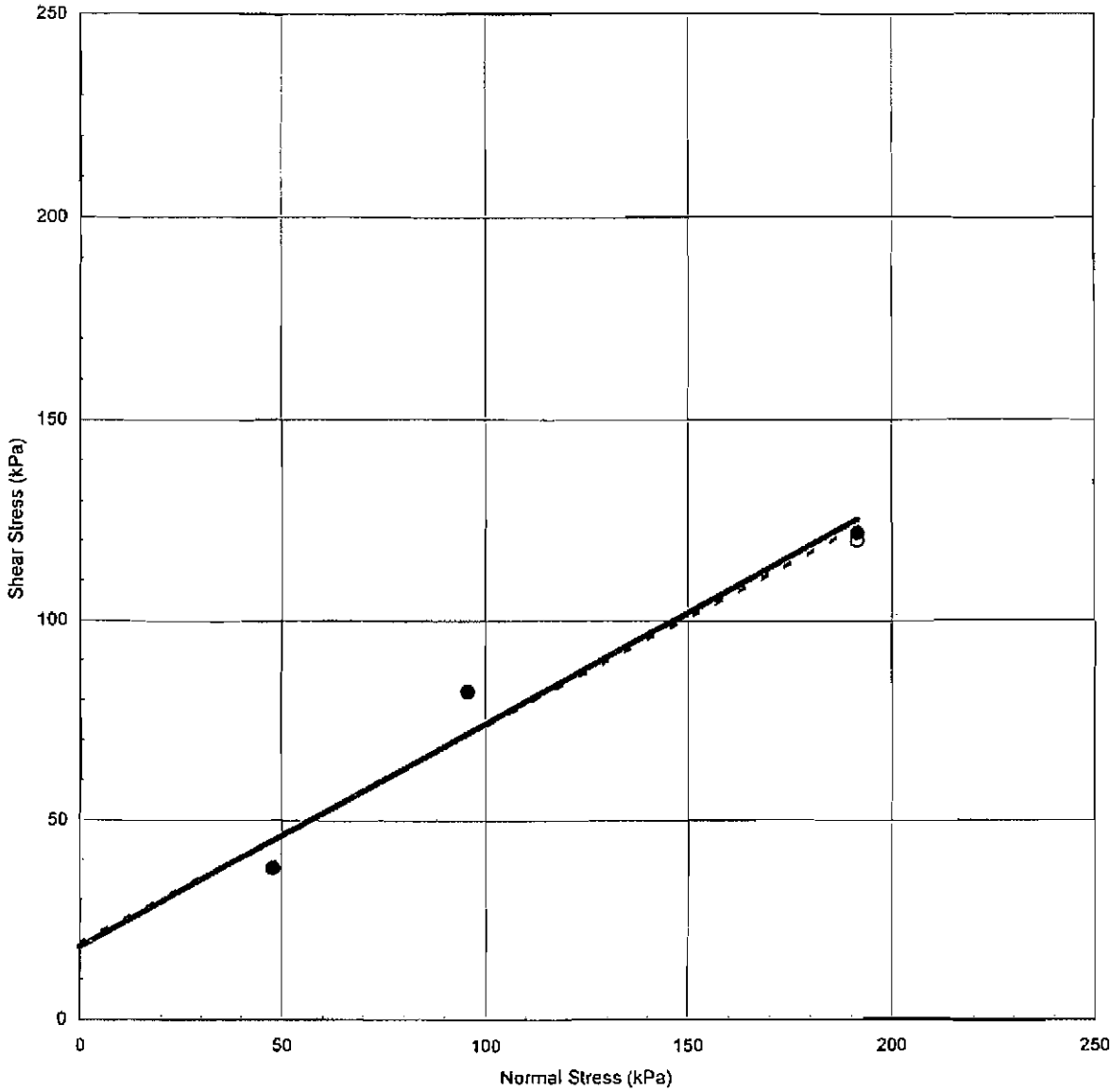
ds_sr22b135@25.xls



Peak Values are : ● ,solid trend line										Ultimate Values are: ○ ,dashed trend line			
Exploration No.:	B-135		Strength Intercept (C) :		0.45	ksf	Peak		0.26	ksf	Ultimate		
Sample No.:	10				21.5	kPa			12.6	kPa			
Depth (ft | m)	45.0	13.7	Friction Angle (ϕ) :		25	degree			25	degree			
Description:	Brown Clay (CL)						Shear rate :	0.003	(in/min) ,	0.0076	(cm/min)		
Sample & Specimen values	% Water Content	Total Unit Weight		Dry Unit Weight		Normal Stress		Peak Stress		Ultimate Stress			
		(pcf)	(kN/m^3)	(pcf)	(kN/m^3)	(ksf)	(kPa)	(ksf)	(kPa)	(ksf)	(kPa)		
Initial / Set up	24.8	123.4	19.4	98.9	15.5	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX		
pre-shear spec. 1	24.6	126.3	19.8	101.4	15.9	2.0	95.8	1.4	64.9	1.2	55.7		
pre-shear spec. 2	24.5	132.5	20.8	106.4	16.7	4.0	191.5	2.4	113.2	2.2	107.4		
pre-shear spec. 3	24.5	140.6	22.1	112.9	17.7	8.0	383.0	4.2	199.9	4.0	193.6		

URS	SR-22 Improvements	DIRECT SHEAR TEST
	Location: Retaining Barrier Project Number: 29866278 Date: 3/29/2005	Figure No.:

Ds_b135@45.xls



Peak Values are : ● ,solid trend line								Ultimate Values are: ○ ,dashed trend line			
Exploration No.:	B-136		Strength Intercept (C) :		0.38	ksf	Peak		0.40	ksf	Ultimate
Sample No.:	4				18.1	kPa			19.0	kPa	
Depth (ft | m)	17.5	5.3	Friction Angle (ϕ) :		29	degree			29	degree	
Description:	**Olive brown silty Sand with gravel (SM)**						Shear rate :	0.010	(in/min) ,	0.0254	(cm/min)

Sample & Specimen values		% Water Content	Total Unit Weight (pcf)	Total Unit Weight (kN/m^3)	Dry Unit Weight (pcf)	Dry Unit Weight (kN/m^3)	Normal Stress (ksf)	Normal Stress (kPa)	Peak Stress (ksf)	Peak Stress (kPa)	Ultimate Stress (ksf)	Ultimate Stress (kPa)
Initial / Set up		1.9	105.6	16.6	103.6	16.3	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
pre-shear	spec. 1	16.5	108.7	17.1	93.3	14.7	1.0	47.9	0.8	37.9	0.8	37.9
	spec. 2	15.5	119.4	18.8	103.4	16.2	2.0	95.8	1.7	82.2	1.7	82.2
	spec. 3	15.6	110.5	17.4	95.6	15.0	4.0	191.5	2.5	121.8	2.5	120.1

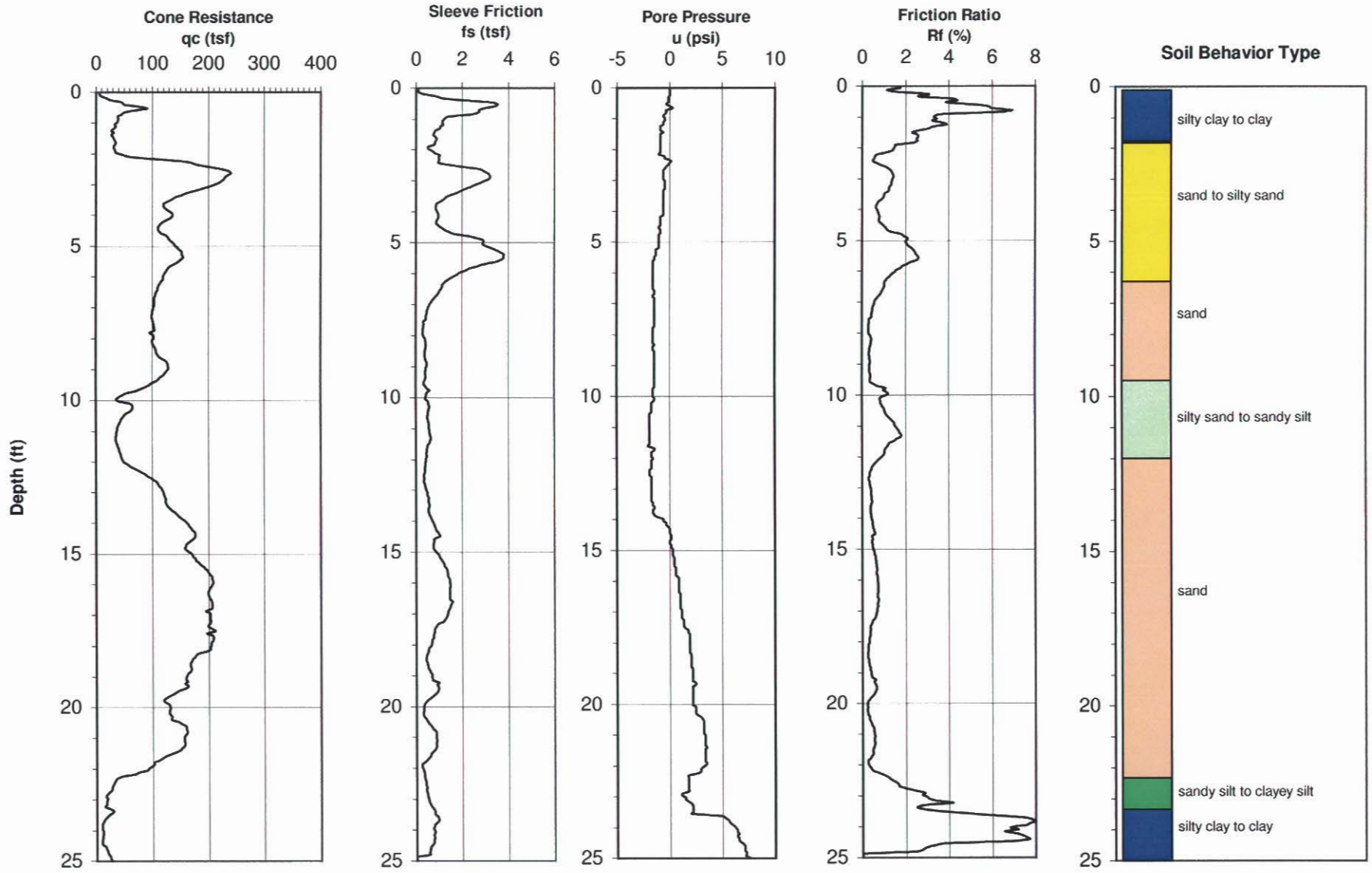
URS	SR-22 Improvements	DIRECT SHEAR TEST
	Location: Sound Wall No. 221	
	Project Number: 29866278 Date: 3/29/2005	Figure No.:

Ds_b136@17.xls

APPENDIX C

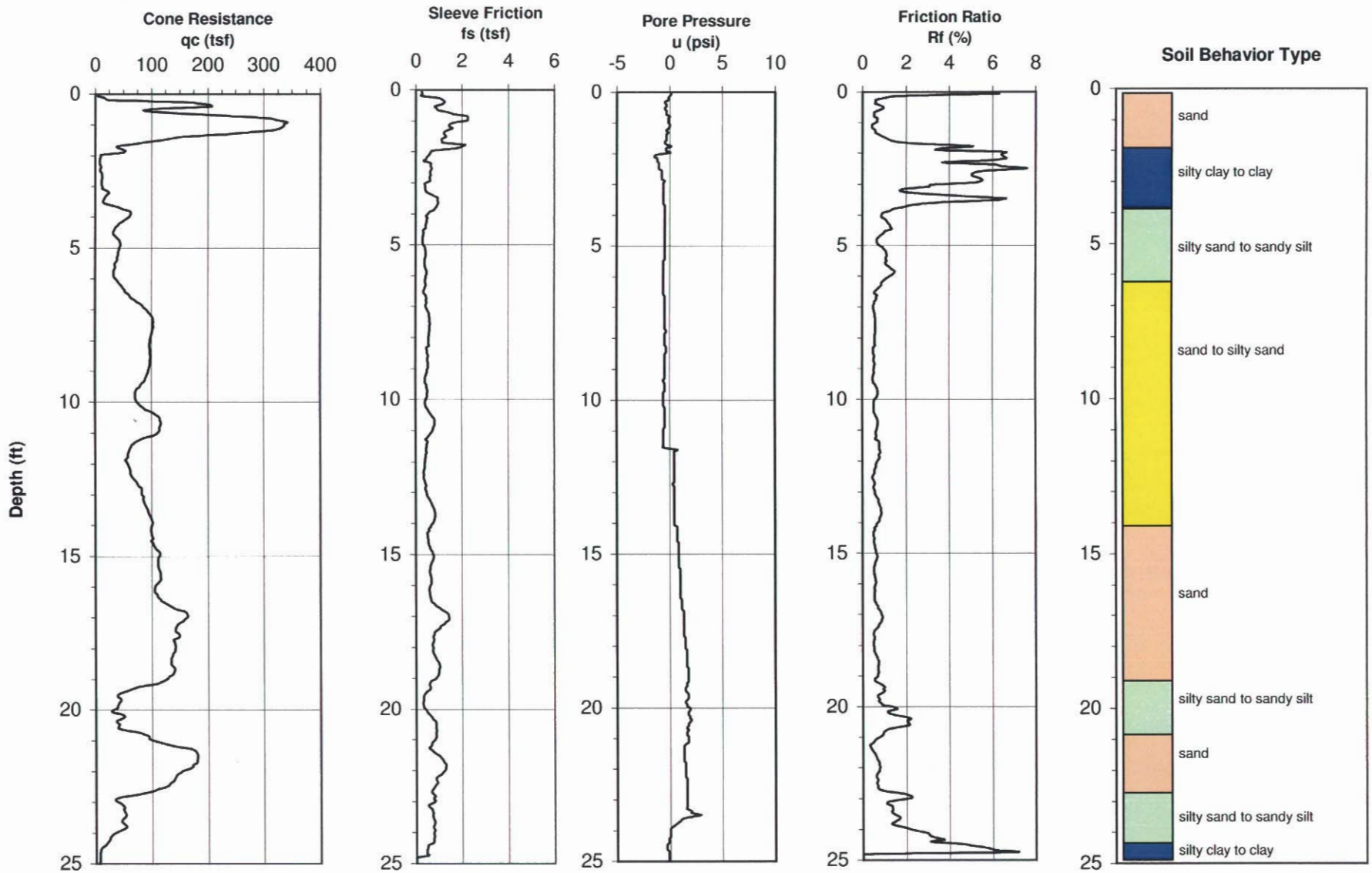
KEHOE TESTING & ENGINEERING

Project :	**SR-22, Orange, CA**	**Client :**	**Leighton Consulting**
Location :	**CPT-1**	**CPT Date :**	**9/8/08**



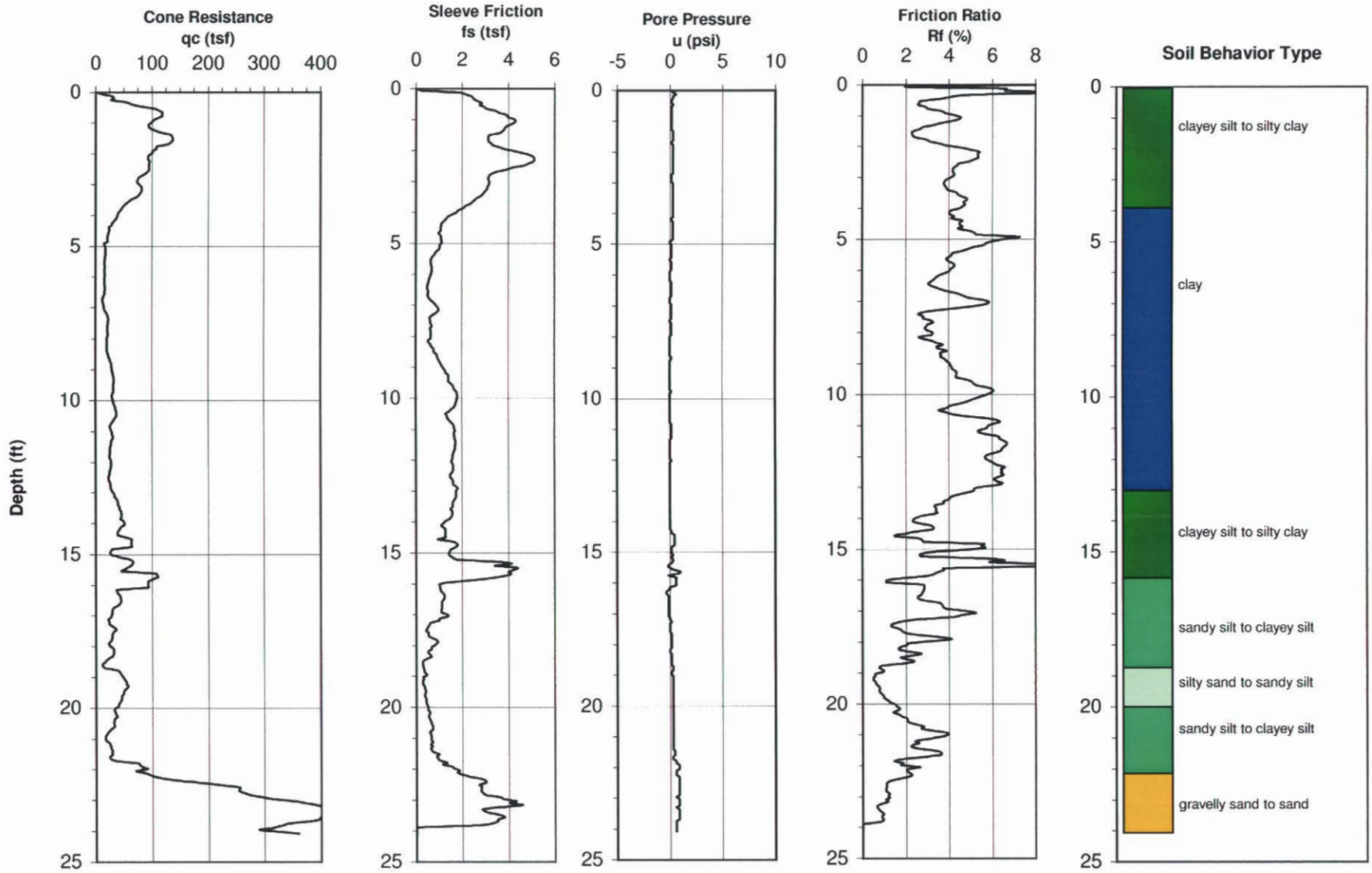
KEHOE TESTING & ENGINEERING

Project :	**SR-22, Orange, CA**	**Client :**	**Leighton Consulting**
Location :	**CPT-2**	**CPT Date :**	**9/8/08**



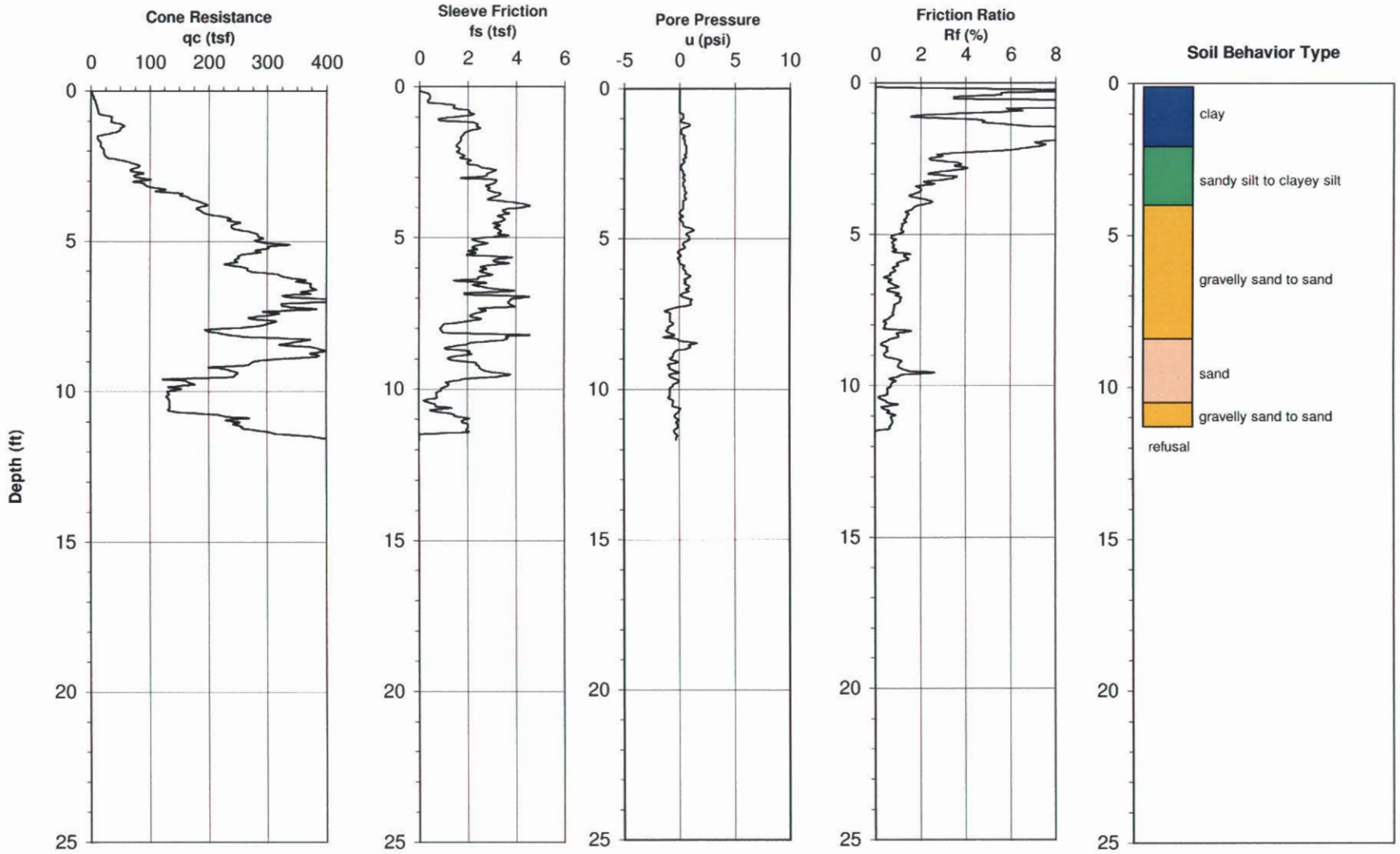
KEHOE TESTING & ENGINEERING

Project :	**SR-22, Orange, CA**	**Client :**	**Leighton Consulting**
Location :	**CPT-3**	**CPT Date :**	**9/8/08**



KEHOE TESTING & ENGINEERING

Project :	**SR-22, Orange, CA**	**Client :**	**Leighton Consulting**
Location :	**CPT-4**	**CPT Date :**	**9/8/08**



APPENDIX D

Djan Chandra

From: Sharid Amiri [sharid_amiri@dot.ca.gov]
Sent: Thursday, December 04, 2008 12:55 PM
To: Djan Chandra
Cc: AMoubayed@pbsj.com; Jamal Salman; Michael Han; Taekuk Kim; Lisa Alviso; Ahmad Hindiyeh; Juan Delira
Subject: Re: Comment on GDR dated 9/11/08 for SR-22 Soundwalls

I concur with your email.

Sharid Khan Amiri

Senior Transportation Engineer
D-12 Geotechnical Oversight
Office of Geotechnical Design South-1
Geotechnical Services
Division of Engineering Services
3337 Michelson Dr., Suite CN 380
Irvine, Ca.92612
Office (949)-724-2599
Fax (949) 724-2849
Cell: (562)-480-8295
****

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****

"Djan Chandra" <dchandra@leightongroup.com>
12/02/2008 04:33 PM

To "Sharid Amiri" <sharid_amiri@dot.ca.gov>
cc <AMoubayed@pbsj.com>, "Jamal Salman" <JSalman@4rmcinc.com>, "Taekuk Kim" <tkim@leightongroup.com>, "Michael Han" <MHan@4rmcinc.com>
Subject Comment on GDR dated 9/11/08 for SR-22 Soundwalls

Hi Sharid -- Per our phone conversation this morning, we understand that the only comment that you have on our revised report dated 9/11/08 is regarding the reported locations and elevations of our CPTs and hand-auger borings. We will include in our final report the survey benchmark of the civil plan that was used to identify the locations and elevations of our CPTs and borings. If you need additional information, please let us know. Thanks.

Regards,
Djan Chandra
Senior Principal
Leighton Consulting, Inc.
(949) 250-1421

-----Original Message-----
From: Sharid Amiri [mailto:sharid_amiri@dot.ca.gov]
Sent: Tuesday, September 02, 2008 3:13 PM
To: Djan Chandra
Cc: AMoubayed@pbsj.com; Jamal Salman; Lisa Alviso; Taekuk Kim; Lisa Alviso; Ahmad Hindiyeh
Subject: RE: Additional Field Exploration for SR-22 Soundwalls

Djan,

I have reviewed and concur with your proposed geotech investigation as shown in your attached file. Please revise the report accordingly and submit it to me, when updated with the new information from the proposed geotech investigation for my final review.

Sharid Khan Amiri

Senior Transportation Engineer
D-12 Geotechnical Oversight
Office of Geotechnical Design South-1
Geotechnical Services
Division of Engineering Services
3337 Michelson Dr., Suite CN 380
Irvine, Ca.92612
Office (949)-724-2599
Fax (949) 724-2849
Cell: (562)-480-8295
****
****

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****
******

	"Djan Chandra" <dchandra@leighton group.com>	
To		"Sharid Amiri" <sharid_amiri@dot.ca.gov>
	09/02/2008 01:01 PM	
cc		<AMoubayed@pbsj.com>, "Jamal Salman" <JSalman@4rmcinc.com>,

"Lisa Alviso"

<lisa_alviso@dot.ca.gov>, "Taekuk

Kim" <tkim@leightongroup.com>

Subject

RE: Additional Field Exploration

for SR-22 Soundwalls

Hi Sharid -- The information that you requested is summarized in the attached table.
Detailed information can be found in our draft report.
Please let us know if you have additional questions. Thanks.

Djan Chandra
Senior Principal
Leighton Consulting, Inc.
(949) 250-1421

-----Original Message-----
From: Sharid Amiri [mailto:sharid_amiri@dot.ca.gov]
Sent: Tuesday, September 02, 2008 8:03 AM
To: Djan Chandra
Cc: AMoubayed@pbsj.com; Jamal Salman; Lisa Alviso
Subject: Re: Additional Field Exploration for SR-22 Soundwalls

Good morning Djan,

Please provide a table that includes soundwall identification (i.e. number), length, total number of existing and proposed borings and CPT for each wall, for my review, include the depth also.

any questions, let me know.

Sharid Khan Amiri

Senior Transportation Engineer
D-12 Geotechnical Oversight
Office of Geotechnical Design South-1
Geotechnical Services
Division of Engineering Services
3337 Michelson Dr., Suite CN 380
Irvine, Ca.92612
Office (949)-724-2599
Fax (949) 724-2849
Cell: (562)-480-8295
****

****

" For individuals with sensory disabilities, this document will be made available, upon request, in Braille, large print, audiocassette, or computer disk. To obtain a copy of one of these alternate formats, please call Della Moore at (916) 227-8185 or TTY (916) 227-8454 or write to Della Moore, Division of Engineering Services, P.O. Box 168041 Sacramento, CA 95816-8041"
****
******

"Djan Chandra"

<dchandra@leighto

ngroup.com>

To

<Sharid_Amiri@dot.ca.gov>

08/29/2008 06:42

cc

PM

"Jamal Salman"

<JSalman@4rmcinc.com>,

<AMoubayed@pbsj.com>

Subject

Additional Field Exploration for

SR-22 Soundwalls

Hi Sharid -- In response to your review comments and per our phone conversations, we will be performing additional field exploration to verify the subsurface conditions at the three soundwall locations on SR-22. We will perform four Cone Penetration Tests (CPTs) to a depth of
25 feet. The approximate location of the CPTs is shown on the attached map. We will revise our LOTBs to include the CPTs and issue a revised report. Please review and let us know if the approach and CPT locations are acceptable to you. Thanks.

Djan Chandra
Senior Principal
Leighton Consulting, Inc.
(949) 250-1421

<<Proposed Boring Location Map.pdf>> (See attached file: Proposed Boring Location Map.pdf)

(See attached file: Summary of Borings and Proposed CPTs.pdf)

Djan Chandra

From: Jamal Salman [JSalman@4rmcinc.com]
Sent: Wednesday, August 20, 2008 10:26 AM
To: Juan Delira
Cc: Ahmad Hindiyeh; gsaba@octa.net; Karen Cohoe; Lisa Alviso; Michael Han; Djan Chandra
Subject: RE: PDT Questions Follow-up

Juan
- There must some confusion on Sharid's part regarding the GDR effort.
Leighton was to use existing recent data from the SR-22 HOV project for the foundation analysis of the walls, which they did.
I think it's important to have Djan Chandra call Sharid and discuss with him the concerns he has on the GDR.(Djan, see Sharid Comment on the GDR below).

- For the VIA, we will make the necessary changes to the report.
- TMP, we will prepare a more expanded TMP.

Thanks,

Jamal Salman
RMC,Inc.
6 Hutton Centre Dr., Suite 1270
Santa Ana, CA 92707
Phone (714)662-3020, EXT 303
Cell (714)642-4380
Fax (714)662-3025
Jsalman@4RMCinc.com

-----Original Message-----
From: Juan Delira [mailto:juan_delira@dot.ca.gov]
Sent: Wednesday, August 20, 2008 8:33 AM
To: Jamal Salman
Cc: Ahmad Hindiyeh; gsaba@octa.net; Karen Cohoe; Lisa Alviso; Michael Han
Subject: RE: PDT Questions Follow-up

Jamal -
Here's review comments for Draft GDR, the Visual Impact Report, & TMP.
Julio already provided comments on the Noise Technical Memo
GDR

Our office has reviewed the subject report, : Titled: " Draft Geotechnical Design Report For Proposed Soundwalls No.224, 603 and 699, State Route 22, PM 3.6 to 12.9", prepared by Leighton and Associates, Inc. , dated July 7,
2008

and have the following comments:

The geotechnical investigation performed by the consultants is based on Hand Augers only. This is not acceptable. Please follow Caltrans Guidelines.
Revise Geotechnical Design Report accordingly.
Prepare GDR based on Caltrans Guidelines.

Sharid Khan Amiri

Senior Transportation Engineer
D-12 Geotechnical Oversight
Office of Geotechnical Design South-1
Geotechnical Services
Division of Engineering Services
3337 Michelson Dr., Suite CN 380
Irvine, Ca.92612

Office (949)-724-2599
Fax (949) 724-2849
Cell: (562)-480-8295

Visual Impact Report
(See attached file: 0J9600 VIA comments 8.19.08.pdf)

In regards to the TMP, our Traffic Operations Department asked that the TMP Guidelines be used in putting together the TMP Report

Juan

"Jamal Salman"
<JSalman@4rmcinc.
com>
08/12/2008 05:43
PM

To "Juan Delira"
<juan_delira@dot.ca.gov>

cc "Karen Cohoe"
<KCohoe@4rmcinc.com>,
"Michael Han" <MHan@4rmcinc.com>,
"Lisa Alviso"
<lisa_alviso@dot.ca.gov>, "Ahmad
Hindiyeh"
<ahmad_hindiyeh@dot.ca.gov>,
<gsaba@octa.net>

Subject RE: PDT Questions Follow-up

Juan - Just following up on the status of the items below:

- Approval of the Noise Technical Memo.
- Review of GDR/Foundation Report.
- Environmental; Approval of the Visual Impact Memo.

- CE
-TMP format.

Please let me know what you find out.

Thanks Juan!

Jamal Salman
RMC, Inc.
6 Hutton Centre Dr., Suite 1270
Santa Ana, CA 92707
Phone (714)662-3020, EXT 303
Cell (714)642-4380
Fax (714)662-3025
Jsalman@4RMCinc.com

-----Original Message-----
From: Juan Delira [mailto:juan_delira@dot.ca.gov]
Sent: Wednesday, August 06, 2008 2:59 PM
To: Jamal Salman
Cc: Karen Cohoe; Michael Han; Lisa Alviso; Ahmad Hindiyeh
Subject: PDT Questions Follow-up

Jamal -
Here's a update on the issues/questions from yesterday PDT meeting.

1. In regards to presentation of the plans regarding the curve no. 3 for wall 224, I spoke with our OE department and they don't see any issue with the way you've presented the information.
2. I submitted the Geotech report to Sharid Amiri for review. He will provide a quick turn-around.
3. NPDES informed me that they will have their comments on the SWDR by the end of the week.
4. I believe Scott R. provided guidance in regards to the CE and it's ultimate approval.
5. I've asked our Traffic Ops department to provide us the TMP documentation we should use for this project as soon as I get it I'll pass it on.
6. Everything can be shown on District layout sheets including wall details.

If I missed anything or need additional clarification please let me know.

Juan
(949) 724-2608

AERIALLY DEPOSITED LEAD INVESTIGATION REPORT, SR 22 SOUNDWALLS BETWEEN BEACH BOULEVARD AND TUSTIN AVENUE, CITIES OF GARDEN GROVE AND ORANGE, CALIFORNIA

Prepared for:

PBS&J
625 The City Drive South, Suite 200
Orange, California 92868

June 11, 2008

Project No. 602198-001

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

June 11, 2008

Project No. 602198-001

To: PBS&J
625 The City Drive South, Suite 200
Orange, California 92868

Attention: Mr. Alaedin Moubayed

Subject: Aerially Deposited Lead Investigation Report, SR 22 Soundwalls between Beach Boulevard and Tustin Avenue, Cities of Garden Grove and Orange, California

INTRODUCTION

Leighton Consulting, Inc. (Leighton) is pleased to present this report summarizing an aerially deposited lead (ADL) investigation conducted within the California Department of Transportation (Caltrans) right-of-way associated with the proposed Soundwalls at three locations along SR-22 in the cities of Garden Grove and Orange, California.

ADL is the result of tetra ethyl lead, which was added to gasoline to prevent knocking for many years. The lead was present in the vehicle exhaust emissions and is often found in the near-surface soils adjacent to major thoroughfares.

This investigation was conducted to determine if the soil must be considered a hazardous waste or if it can be reused at the Site in accordance with the Department of Toxic Substances Control (DTSC) Variance (Variance) issued for management of soils containing ADL in Caltrans rights of way. This Variance was issued on September 22, 2000, and was modified in a letter dated July 28, 2006.

17781 Cowan ■ Irvine, CA 92614-6009
949.253.9836 ■ Fax 949.250.1114 ■ www.leightonconsulting.com

BACKGROUND

The proposed soundwalls will be located along SR-22 east of Cambridge Street, east of the connector to SR-22 and I-5, and at the eastbound onramp from the northbound side of Beach Boulevard. The first two soundwalls are located in the city of Orange and the last soundwall is located in the city of Garden Grove. The approximate location of the soundwalls is shown on Figure 1. The existing ADL investigation by Parsons for the last soundwall at the SR-22 eastbound onramp from the northbound side of Beach Boulevard was used for ADL evaluation at that location. This work was conducted to assess to what extent lead-impacted soil may be present at the site in order to determine the appropriate disposition of soils that will be disturbed during construction of the soundwall.

PRE-FIELD ACTIVITIES

Health and Safety Plan

Leighton prepared a Health and Safety Plan (HSP) for the ADL soil sampling to be performed at the site. The HSP is in compliance with Cal-OSHA Title 8 Sections 5192 and 5196 and signed by a Certified Industrial Hygienist.

Work Plan

Leighton prepared a Work Plan for the ADL investigation. The work plan described the field activities and included a sampling and analysis plan.

Underground Utility Clearance/Encroachment Permit

This investigation was coordinated with the geotechnical exploration. Utility clearances, permits, and traffic control were provided as part of the geotechnical work discussed in a separate report.

INVESTIGATION

On May 9, 2008, Leighton personnel observed and directed the placement of 5 hand-auger borings (Figures 2 and 3) within the existing Caltrans right-of-way to a maximum depth of 4 feet below ground surface (bgs) according to the following tables:

Table 1a - ADL Assessment Sampling Depths,
SR-22 & I-5 Connector Soundwall, City of Orange, California

Boring No.	Location	Sampling Depths (ft bgs)	Planned Depth of Excavation(ft)
HA-1	Eastbound SR-22 & I-5 Connector Soundwall	0.5, 1.5, 3, and 4	4

Table 1b - ADL Assessment Sampling Depths,
SR-22 & Cambridge Soundwall, City of Orange, California

Boring No.	Location	Sampling Depths (ft bgs)	Planned Depth of Excavation(ft)
HA-2	Westbound SR-22 Cambridge Soundwall	0.5 and 1.5	4
HA-3	Westbound SR-22 Cambridge Soundwall	0.5, 1.5, 3, and 4	4
HA-4	Westbound SR-22 Cambridge Soundwall	0.5, 1.5, 3, and 4	4
HA-5	Westbound SR-22 Cambridge Soundwall	0.5, 1.5, 3, and 4	4

Notes:

1. Due to rocky conditions and refusal, HA-2 was not advanced to the planned depth. An attempt was made to advance another boring approximately three feet from the proposed location but refusal was again encountered. Samples were collected at the indicated depths before refusal was encountered.

The soil samples were placed in laboratory supplied glass jars, placed in an ice-cooled chest for temporary storage, and transported to TestAmerica in Irvine, a State of California certified laboratory for analysis as described below. Sampling equipment was decontaminated between boreholes by washing in a solution of trisodium phosphate and water, rinsing with potable water, and final rinsing with de-ionized water, then allowed to air-dry. Chain-of-custody protocol was followed throughout all phases of the sample handling process.

A Trimble GeoXH was used to determine the coordinates of each boring. The coordinates, based on the NAD 83 Zone 6 datum, are given in Table 2.

Table 2 - Boring Coordinates

Boring No.	X-Value	Y-Value
HA-1	6068891.2478	2230990.0523
HA-2	6077235.1315	2229920.8888
HA-3	6077666.7010	2230001.6510
HA-4	6078014.5029	2230007.7220
HA-5	6078213.2049	2230017.3032

Laboratory Analysis

Eighteen soil samples were analyzed by the laboratory for total lead concentration by EPA Method 6010b.

Four soil samples were also analyzed for soil pH by EPA Method 9045c.

TEST RESULTS

SR-22 & Cambridge

Lead was reported above the detection limit in the 14 soil samples collected at this site at concentrations ranging from 3.0 mg/kg to 25 mg/kg. These concentrations are below the California Code of Regulation (CCR), Title 22 waste disposal criterion for lead. The concentrations are also less than ten times both the STLC and the TCLP. Therefore, it was not necessary to perform either the STLC-WET or the TCLP analyses on any of these samples.

Results of the pH analyses ranged from 8.58 (HA-2-0.5 ft) to 8.98 (HA-3-1.5) in the three analyzed soil samples which indicate slightly alkaline conditions.

Results of the laboratory analysis for soil samples are summarized in Table 3 (rear of text). Copies of the laboratory reports and chain of custody are included in Appendix B.

SR-22 & I-5 Connector

Lead was reported above the detection limit in the four soil samples collected at this site, at concentrations ranging from 7.1 milligrams per kilogram (mg/kg) to 14 mg/kg. These concentrations are below the California Code of Regulation (CCR), Title 22 waste disposal criterion for lead. The concentrations are also less than ten times both the Soluble Threshold Limit Concentration (STLC) and the Toxicity Characteristic Leaching Procedure (TCLP) for lead, 5 milligrams per liter (mg/l). Therefore, it was not necessary to perform either the STLC Waste Extraction Test (STLC-WET) or the TCLP analyses on any of these samples.

Results of the pH analysis was 8.25 (HA-1-1.5 ft) in the analyzed soil sample indicating slightly alkaline conditions.

Results of the laboratory analysis for soil samples are summarized in Table 4 (rear of text). Copies of the laboratory reports and chain of custody are included in Appendix B.

SR-22 & Beach Boulevard Connector

For this soundwall, Leighton evaluated the data collected by Parsons (2003) in their report titled, "Final Report for the ADL Investigation along the SR-22 Alignment between Valley View and SR-55". Leighton reviewed two hand-auger borings (RB35 and RB36) for a total of seven soil samples.

Lead was reported above the detection limit in the seven soil samples collected at this site, at concentrations ranging from 7.5 mg/kg to 43.4 mg/kg. These concentrations are below the California Code of Regulation (CCR), Title 22 waste disposal criterion for lead. The concentrations are also less than ten times both the STLC and the TCLP. Therefore, it was not necessary to perform either the STLC-WET or the TCLP analyses on any of these samples.

Results of the pH analysis was 8.22 (RB35-0.5 ft) in the analyzed soil sample which indicate slightly alkaline conditions.

Results of the laboratory analysis for soil samples are summarized in Table 5 (rear of text). The Parson report is referenced in Appendix A.

STATISTICAL ANALYSIS

Leighton evaluated the results of the soil sample analyses to determine the mean and upper confidence intervals for lead in soil in accordance with SW-846, Chapter 9. This evaluation was conducted to determine if the soil would be considered a hazardous waste or if it could be reused at the Site in accordance with the Variance for management of ADL issued for soil in Caltrans rights of way. The Variance uses the mean concentrations and 90% and 95% upper confidence limits (UCLs) of the data to determine the appropriate disposition of the soil.

SR-22 & Cambridge Analysis

The mean of the sample analysis data of 14 samples for total lead is 8.73 mg/kg and the variance is 35.68 mg/kg. Since the mean is significantly less than the variance of the sample set, the data was normalized by dividing each value by the highest concentration, 25 mg/kg, and then transformed using the arcsine transformation. The 90% and 95% total lead UCLs were calculated using transformed data and determined to be 12.76 mg/kg and 13.65 mg/kg, respectively. Since none of the samples were required to be analyzed by the STLC-WET procedure, there are no results on which to perform a statistical analysis. A summary of the laboratory results for lead and the statistical analysis is presented on Table 3.

SR-22 & I-5 Connector Analysis

The mean of the sample analysis data of four samples for total lead is 10.35 mg/kg and the variance is 13.40 mg/kg. Since the mean is relatively equal to the variance of the sample set, the data was evaluated assuming a normal distribution. The 90% and 95% total lead UCLs were calculated using the t-distribution and determined to be 13.74 mg/kg and 14.00 mg/kg, respectively. Since none of the samples were required to be analyzed by the STLC-WET procedure, there are no results on which to perform a statistical analysis. A summary of the laboratory results for lead and the statistical analysis is presented in Table 4.

SR-22 & Beach Boulevard Connector Analysis

The mean of the sample analysis data of seven samples for total lead is 21 mg/kg and the variance is 190.7 mg/kg. Since the mean is significantly less than the variance of the sample set, the data was normalized by dividing each value by the highest concentration, 43.4 mg/kg, and then transformed using the arcsine transformation. The 90% and 95% total lead UCLs were calculated using transformed data and determined to be 33.05 mg/kg and 35.60 mg/kg, respectively. Since none of the samples were required to be analyzed by the STLC-WET

procedure, there are no results on which to perform a statistical analysis. A summary of the laboratory results for lead and the statistical analysis is presented on Table 5.

CONCLUSIONS

Based on the information gathered during our investigation, Leighton concludes that aerially deposited lead in the near surface soil at the three proposed soundwall locations along SR-22 have lead concentrations less than 1,000 mg/kg, and the concentrations are also less than 10 times the values of the STLC and TCLP (50 mg/L). Therefore, these soils can be classified as non-hazardous by California and Resource Conservation and Recovery Act (RCRA) standards and can be re-used without special handling.

Leighton appreciates this opportunity to be of service. Should you have any questions regarding this report, please contact the undersigned at (949) 681-4254.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

Charles R. Mazowiecki, PE 30068
Senior Project Engineer

Attachments: Figure 1 – Site Location Map
Figure 2 – Boring Location Map
Figure 3 – Boring Location Map
Table 3 – Statistical Analysis for ADL, SR-22 & Cambridge Soundwall
Table 4 – Statistical Analysis for ADL, SR-22 & I-5 Connector Soundwall
Table 5 – Statistical Analysis for ADL, SR-22 & Beach Boulevard Connector Soundwall
Appendix A – References
Appendix B – Laboratory Results and Chain of Custody's

Distribution: (2) Addressee
(3) RMC, Inc.
Attention: Mr. Jamal Salman

SR-22 Soundwall Locations

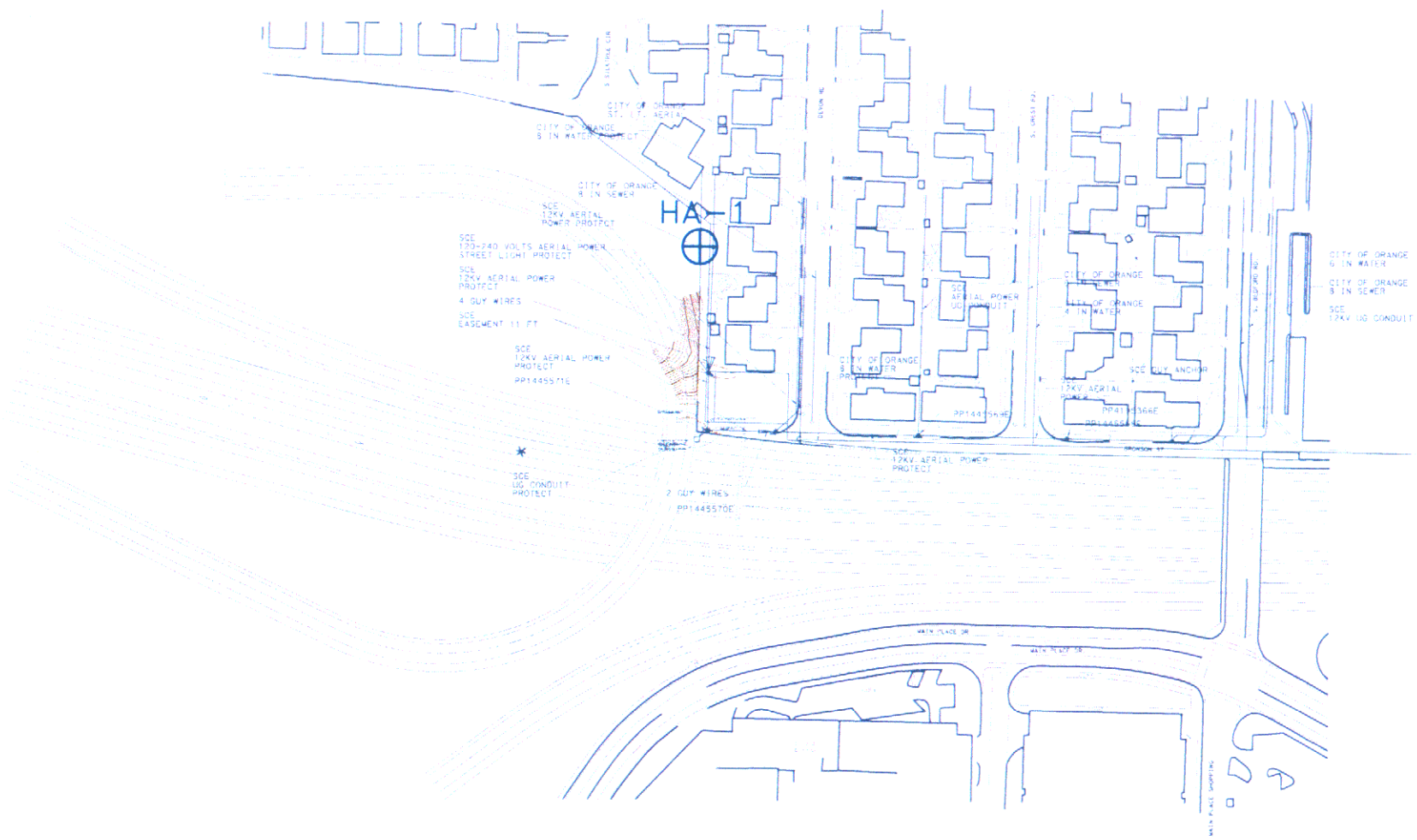
SITE LOCATION MAP

Project No.
602198-001

Date
June 2008

Figure 1

\\GIS\Drafting\602198\002\Fig1_SiteLocationMap.mxd



LEGEND

HA-1 ADL SAMPLING BORING

N

0 200 400
SCALE FEET

Figure 2

BORING LOCATION MAP

SR-22 AND I-5 CONNECTOR SOUNDWALL
ORANGE, CALIFORNIA

Proj: 602198-001	Scale: 1"=200'	Date: 6/08
Eng./Geol. CRM	Drafted By: VMN	CP By: BQT

P:\DRAFTING\602198\001\OF_2008-06-03\FIGURE2-BORING.DWG (06-12-08 3:04:11PM) Plotted by: vnguyen

Leighton

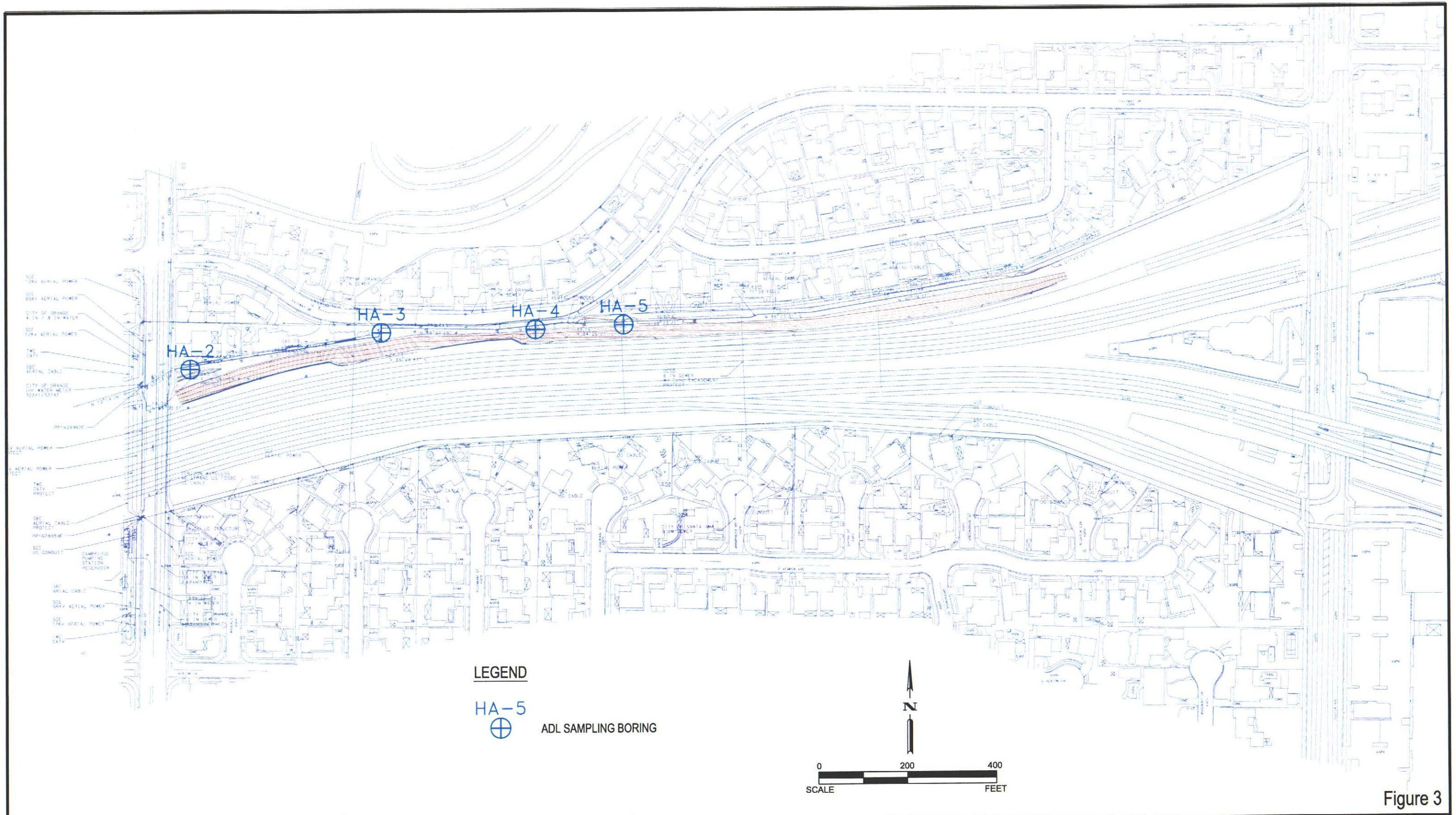


Figure 3

BORING LOCATION MAP

SR-22 AND CAMBRIDGE SOUNDWALL
ORANGE, CALIFORNIA

Proj: 602198-001	Scale: 1"=200'	Date: 6/08
Eng./Geol. CRM	Drafted By: BQT	CP By: BQT

P:\DRAFTING\602198\001\OF_2008-06-03\FIGURE3-BORING.DWG (06-12-08 3:05:30PM) Plotted by: vnguyen

Leighton

Table 3:
Laboratory Results and Statistical Analysis for Aerially Deposited Lead
SR-22 and Cambridge Soundwall, City of Orange, California

Boring Number	Depth (feet bgs)	Sample Date	Total Lead (mg/kg)	Normalized Data	Transformed Data (Arcsin)	WET STLC Citric Acid (mg/L)	WET STLC Deionized Water (mg/L)	TCLP (mg/L)	pH
HA-2	0.5	04/05/08	**18**	0.72	0.803802319	NR	NR	NR	**8.58**
	1.5	04/05/08	**7.1**	0.284	0.287963323	NR	NR	NR	
HA-3	0.5	04/05/08	**6.5**	0.26	0.263022203	NR	NR	NR	
	1.5	04/05/08	**3.5**	0.14	0.140461415	NR	NR	NR	**8.98**
	3	04/05/08	**9.3**	0.372	0.381162725	NR	NR	NR	
	4	04/05/08	**3.0**	0.12	0.120289882	NR	NR	NR	
HA-4	0.5	04/05/08	**10**	0.4	0.411516846	NR	NR	NR	**8.67**
	1.5	04/05/08	**8.7**	0.348	0.355436911	NR	NR	NR	
	3	04/05/08	**3.9**	0.156	0.156639767	NR	NR	NR	
	4	04/05/08	**7.5**	0.3	0.304692654	NR	NR	NR	
HA-5	0.5	04/05/08	**25**	1	1.570796327	NR	NR	NR	
	1.5	04/05/08	**8.3**	0.332	0.338423049	NR	NR	NR	
	3	04/05/08	**5.5**	0.22	0.22181447	NR	NR	NR	
	4	04/05/08	**5.9**	0.236	0.238247508	NR	NR	NR	

Data Analysis	Total Lead Data
Number of Samples, n	14
Mean (Average), x	8.73
Std Deviation of sample set, s	5.97
Variance of sample set, s^2	35.68
need to normalize (by highest conc.) and transform data. Assume a Negative Binomial Distribution	
mean of normalized data	0.349
mean of transformed data	0.400
Std Dev of transformed data	0.377
Std Dev of mean of transformed data	0.101
Variance of transformed data	0.142
90% CL on transformed data	0.136
90% UCL on transformed data	0.535
reverse transformation for 90%	12.76
Variance ok	
95% CL on transformed data	0.178
95% UCL on transformed data	0.578
reverse transformation for 95% UCL	13.65
Assume a Normal Distribution	
t value (90% UCL)	1.35
Std Dev of mean data	1.60
90% UCL on data	10.88
t value (95% UCL)	1.77
95% UCL on data	11.56

mg/kg = Milligrams per Kilogram
mg/L = Milligrams per Liter
TCLP = Toxicity Characteristic Leaching Procedure
STLC = Soluble Threshold Limit Concentrations
NR = Analysis not required
NA= No data available
CI = Confidence Interval
UCL = Upper Confidence Level

Std Dev of mean = $s / n^{1/2}$
reverse transformation for %UCL = sin(%UCL)*25

Normal Distribution:

% UCL of mean data = $x + t_{a,n-1} * s / n^{1/2}$
t= t distribution (Gilbert 1987)
a= (1 - %UCL)

Table 4:
Laboratory Results and Statistical Analysis for Aerially Deposited Lead
SR-22 and I-5 Connector Soundwall, City of Orange, California

Boring Number	Depth (feet bgs)	Sample Date	Total Lead (mg/kg)	Normalized Data	Transformed Data (Arcsin)	WET STLC Citric Acid (mg/L)	WET STLC Deionized Water (mg/L)	TCLP (mg/L)	pH
HA-1	0.5	04/05/08	**14**	1	1.570796327	NR	NR	NR	
	1.5	04/05/08	**13**	0.9285714	1.19054512	NR	NR	NR	**8.25**
	3	04/05/08	**7.3**	0.5214286	0.548524278	NR	NR	NR	
	4	04/05/08	**7.1**	0.5071429	0.531866463	NR	NR	NR	

Data Analysis	Total Lead Data
Number of Samples, n	4
Mean (Average), x	10.35
Std Deviation of sample set, s	3.66
Variance of sample set, s^2	13.40
need to normalize (by highest conc.) and transform data. Assume a Negative Binomial Distribution	
mean of normalized data	0.739
mean of transformed data	0.960
Std Dev of transformed data	0.510
Std Dev of mean of transformed data	0.255
Variance of transformed data	0.260
90% CL on transformed data	0.417
90% UCL on transformed data	1.378
reverse transformation for 90%	13.74
Variance ok	
95% CL on transformed data	0.600
95% UCL on transformed data	1.560
reverse transformation for 95% UCL	14.00
Assume a Normal Distribution	
t value (90% UCL)	1.64
Std Dev of mean data	1.83
90% UCL on data	**13.35**
t value (95% UCL)	2.35
95% UCL on data	**14.66**

mg/kg = Milligrams per Kilogram
mg/L = Milligrams per Liter
TCLP = Toxicity Characteristic Leaching Procedure
STLC = Soluble Threshold Limit Concentrations
NR = Analysis not required
NA= No data available
CI = Confidence Interval
UCL = Upper Confidence Level

Std Dev of mean = $s / n^{1/2}$
reverse transformation for %UCL = sin(%UCL)*25

Normal Distribution:

% UCL of mean data = $x + t_{a,n-1} * s / n^{1/2}$
t= t distribution (Gilbert 1987)
a= (1 - %UCL)

Table 5:
Laboratory Results and Statistical Analysis for Aerially Deposited Lead
SR-22 and Beach Boulevard Connector Soundwall, City of Garden Grove , California

Boring Number	Depth (feet bgs)	Sample Date	Total Lead (mg/kg)	Normalized Data	Transformed Data (Arcsin)	WET STLC Citric Acid (mg/L)	WET STLC Deionized Water (mg/L)	TCLP (mg/L)	pH
RB35	0.5	09/26/02	**7.5**	0.1728111	0.173682957	NR	NR	NR	**8.22**
	1.5	09/26/02	**8.8**	0.202765	0.204180731	NR	NR	NR	
	2.5	09/26/02	**43.4**	1	1.570796327	NR	NR	NR	
	4	09/26/02	**34.1**	0.7857143	0.903849982	NR	NR	NR	
RB36	0.5	09/26/02	**26.2**	0.6036866	0.648117411	NR	NR	NR	
	1.5	09/26/02	**13.2**	0.3041475	0.309043369	NR	NR	NR	
	2.5	09/26/02	**13.8**	0.3179724	0.323590073	NR	NR	NR	

Data Analysis	Total Lead Data
Number of Samples, n	7
Mean (Average), x	21.00
Std Deviation of sample set, s	13.81
Variance of sample set, s^2	190.70
need to normalize (by highest conc.) and transform data. Assume a Negative Binomial Distribution	
mean of normalized data	0.484
mean of transformed data	0.590
Std Dev of transformed data	0.506
Std Dev of mean of transformed data	0.191
Variance of transformed data	0.256
90% CL on transformed data	0.275
90% UCL on transformed data	0.866
reverse transformation for 90%	33.05
Variance ok	
95% CL on transformed data	0.372
95% UCL on transformed data	0.962
reverse transformation for 95% UCL	35.60
Assume a Normal Distribution	
t value (90% UCL)	1.44
Std Dev of mean data	5.22
90% UCL on data	28.51
t value (95% UCL)	1.94
95% UCL on data	31.14

mg/kg = Milligrams per Kilogram
mg/L = Milligrams per Liter
TCLP = Toxicity Characteristic Leaching Procedure
STLC = Soluble Threshold Limit Concentrations
NR = Analysis not required
NA= No data available
CI = Confidence Interval
UCL = Upper Confidence Level

Std Dev of mean = $s / n^{1/2}$
reverse transformation for %UCL = sin(%UCL)*25

Normal Distribution:

% UCL of mean data = $x + t_{a,n-1} * s / n^{1/2}$
t= t distribution (Gilbert 1987)
a= (1 - %UCL)

*The data analyzed is from an ADL investigation conducted by Parsons

APPENDIX A

APPENDIX A

REFERENCES

California Department of Transportation (Caltrans), 2004, Standard Environmental Reference, Volume 1: Guidance for Compliance, Chapter 10: Hazardous Waste, updated June 18.

Leighton Consulting, Inc., 2008, Work Plan for Aerially Deposited Lead Investigation for Three Soundwalls along SR-22 between Beach Boulevard and Tustin Avenue, Cities of Garden Grove and Orange, California, dated May 2, 2008.

Leighton Consulting, Inc., 2008, Site Specific Health and Safety Plan for Soundwalls on State Route 22 at Beach Boulevard, Interstate 5, and Cambridge Street-Aerial Deposited Lead Survey, dated May 2, 2008.

Parsons, 2003, Final Report for the ADL Investigation along the SR-22 Alignment between Valley View and SR-55, 100 West Walnut Street Pasadena, California, March, 2003.

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

APPENDIX B

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
17461 Derian Avenue, Suite 100, Irvine, CA 92614 (949) 261-1022 Fax:(949) 260-3297

LABORATORY REPORT

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

Project: CalTrans
602198001

Sampled: 05/09/08
Received: 05/10/08
Issued: 05/21/08 11:18

NELAP #01108CA California ELAP#1197 CSDLAC #10256

The results listed within this Laboratory Report pertain only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a wet weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica. The Chain(s) of Custody, 2 pages, are included and are an integral part of this report.
This entire report was reviewed and approved for release.

CASE NARRATIVE

SAMPLE RECEIPT: Samples were received intact, at 2°C, on ice and with chain of custody documentation.

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

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

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

COMMENTS: No significant observations were made.

SUBCONTRACTED: No analyses were subcontracted to an outside laboratory.

LABORATORY ID	CLIENT ID	MATRIX
IRE0927-01	HA-1-0.5	Soil
IRE0927-02	HA-1-1.5	Soil
IRE0927-03	HA-1-3	Soil
IRE0927-04	HA-1-4	Soil
IRE0927-05	HA-2-0.5	Soil
IRE0927-06	HA-2-1.5	Soil
IRE0927-07	HA-3-0.5	Soil
IRE0927-08	HA-3-1.5	Soil
IRE0927-09	HA-3-3	Soil
IRE0927-10	HA-3-4	Soil
IRE0927-11	HA-4-0.5	Soil

TestAmerica Irvine

Patty Mata
Project Manager

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Charles Mazowiecki

Project ID: CalTrans 602198001
Report Number: IRE0927

Sampled: 05/09/08
Received: 05/10/08

LABORATORY ID	CLIENT ID	MATRIX
IRE0927-12	HA-4-1.5	Soil
IRE0927-13	HA-4-3	Soil
IRE0927-14	HA-4-4	Soil
IRE0927-15	HA-5-0.5	Soil
IRE0927-16	HA-5-1.5	Soil
IRE0927-17	HA-5-3	Soil
IRE0927-18	HA-5-4	Soil

Reviewed By:

TestAmerica Irvine

Patty Mata
Project Manager

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Attention: Charles Mazowiecki

Project ID: CalTrans 602198001
Report Number: IRE0927

Sampled: 05/09/08
Received: 05/10/08

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: IRE0927-01 (HA-1-0.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**14**	1	5/19/2008	5/20/2008	
Sample ID: IRE0927-02 (HA-1-1.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**13**	0.995	5/19/2008	5/20/2008	
Sample ID: IRE0927-03 (HA-1-3 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**7.3**	0.995	5/19/2008	5/20/2008	
Sample ID: IRE0927-04 (HA-1-4 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**7.1**	1	5/19/2008	5/20/2008	
Sample ID: IRE0927-05 (HA-2-0.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**18**	1.01	5/19/2008	5/20/2008	
Sample ID: IRE0927-06 (HA-2-1.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**7.1**	1	5/19/2008	5/20/2008	
Sample ID: IRE0927-07 (HA-3-0.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**6.5**	1	5/19/2008	5/20/2008	
Sample ID: IRE0927-08 (HA-3-1.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**3.5**	1.01	5/19/2008	5/20/2008	
Sample ID: IRE0927-09 (HA-3-3 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**9.3**	0.995	5/19/2008	5/20/2008	
Sample ID: IRE0927-10 (HA-3-4 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**3.0**	0.995	5/19/2008	5/20/2008	

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Patty Mata
Project Manager

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Leighton Consulting, Inc.
17781 Cowan, Suite 140
Irvine, CA 92614
Attention: Charles Mazowiecki

Project ID: CalTrans 602198001
Report Number: IRE0927

Sampled: 05/09/08
Received: 05/10/08

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: IRE0927-11 (HA-4-0.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**10**	0.995	5/19/2008	5/20/2008	
Sample ID: IRE0927-12 (HA-4-1.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**8.7**	1	5/19/2008	5/20/2008	
Sample ID: IRE0927-13 (HA-4-3 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**3.9**	1	5/19/2008	5/20/2008	
Sample ID: IRE0927-14 (HA-4-4 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**7.5**	1	5/19/2008	5/20/2008	
Sample ID: IRE0927-15 (HA-5-0.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**25**	1	5/19/2008	5/20/2008	
Sample ID: IRE0927-16 (HA-5-1.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**8.3**	1.01	5/19/2008	5/20/2008	
Sample ID: IRE0927-17 (HA-5-3 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**5.5**	1	5/19/2008	5/20/2008	
Sample ID: IRE0927-18 (HA-5-4 - Soil)				**Sampled: 05/09/08**				
Reporting Units: mg/kg								
Lead	EPA 6010B	8E19074	2.0	**5.9**	0.995	5/19/2008	5/20/2008	

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Attention: Charles Mazowiecki

Project ID: CalTrans
602198001
Report Number: IRE0927

Sampled: 05/09/08
Received: 05/10/08

INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
Sample ID: IRE0927-02 (HA-1-1.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: pH Units								
pH	EPA 9045C	8E10050	0.100	**8.25**	1	5/10/2008	5/10/2008	
Sample ID: IRE0927-05 (HA-2-0.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: pH Units								
pH	EPA 9045C	8E10050	0.100	**8.58**	1	5/10/2008	5/10/2008	
Sample ID: IRE0927-08 (HA-3-1.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: pH Units								
pH	EPA 9045C	8E10050	0.100	**8.98**	1	5/10/2008	5/10/2008	
Sample ID: IRE0927-11 (HA-4-0.5 - Soil)				**Sampled: 05/09/08**				
Reporting Units: pH Units								
pH	EPA 9045C	8E10050	0.100	**8.67**	1	5/10/2008	5/10/2008	

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Report Number: IRE0927

Sampled: 05/09/08
Received: 05/10/08

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 8E19074 Extracted: 05/19/08										
Blank Analyzed: 05/20/2008 (8E19074-BLK1)										
Lead	ND	2.0	mg/kg							
LCS Analyzed: 05/20/2008 (8E19074-BS1)										
Lead	46.8	2.0	mg/kg	50.0		94	80-120			
Matrix Spike Analyzed: 05/20/2008 (8E19074-MS1)					**Source: IRE0927-01**					
Lead	56.7	2.0	mg/kg	50.0	14.1	85	75-125			
Matrix Spike Dup Analyzed: 05/20/2008 (8E19074-MSD1)					**Source: IRE0927-01**					
Lead	61.5	2.0	mg/kg	50.0	14.1	95	75-125	8	20	

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Sampled: 05/09/08
Received: 05/10/08

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: 8E10050 Extracted: 05/10/08										
Duplicate Analyzed: 05/10/2008 (8E10050-DUP1)					**Source: IRE0927-02**					
pH	8.23	0.100	pH Units		8.25			0	5	

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Leighton Consulting, Inc.	Project ID: CalTrans 602198001	
17781 Cowan, Suite 140		Sampled: 05/09/08
Irvine, CA 92614	Report Number: IRE0927	Received: 05/10/08
Attention: Charles Mazowiecki		

DATA QUALIFIERS AND DEFINITIONS

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

RPD Relative Percent Difference

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Leighton Consulting, Inc.	Project ID: CalTrans 602198001	Sampled: 05/09/08
17781 Cowan, Suite 140		Received: 05/10/08
Irvine, CA 92614	Report Number: IRE0927	
Attention: Charles Mazowiecki		

Certification Summary

TestAmerica Irvine

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

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

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IKEUM21

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THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY FORM

1014 E. Cooley Dr. Suite A, Colton, CA 92324 (909) 370-4667 FAX (909) 370-1046
1835 South 51st St. Suite B 120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851
2520 E. Sunset Rd. #3, Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

Page 1 of 2

Client Name/Address: LCF 17781 COWAN IRV CA

Project PO Number: 602198

Project Manager: Charles Marcuccio

Phone Number: 949-253-9836

Sampler: BRJ

Fax Number: 949-250-1114

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	1=PA 6010	TCLP 1311	PH							Special Instructions
HA-1-0.5	S	JAR	1	5-9-08	0830	None	X									If a sample
HA-1-1.5					0839				X							< 1000 mg/kg
HA-1-3					0843											run TCLP
HA-1-4					0846											1311
HA-2-0.5					1409				X							
~~HA~~ HA-2-1.5					1413											
HA-3-0.5					1216											
HA-3-1.5					1219				X							
HA-3-3					1221											
HA-3-4					1223											
HA-4-0.5					1256				X							HE 5-10-08
HA-4-1.5					1300											9:30
HA-4-3					1310											
HA-4-4					1315											

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature]	5-10-08 0900			same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ✓
				48 hours ____ normal ____
Relinquished By:	Date/Time:	Received in Lab By: [signature]	Date/Time: 5/10/08 0900	Sample Integrity: (Check) intact ✓ on ice 2.3/

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

2.4

#005

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CHAIN OF CUSTODY FORM

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10 South 43rd St. Suite B 120 Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851
2520 E. Sunset Rd. #3 Las Vegas, NV 89120 (702) 798-3620 FAX (702) 798-3621

Page 2 of 2

Client Name/Address: LCS 17781 Cowan Irv

Project/PO Number: 6C2198001

Project Manager: Charles Mazowiecki

Phone Number: 949-250 #5836

Sampler: BRJ

Fax Number: 250 1114

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	EPA 6010B	TCLP 1311							Special Instructions
HA-5-0.5	S	Jar	1	5-9-08	1430	None	+								* see page 1
HA-5-1.5	↓	↓	↓	↓	1435	↓	↓								
HA-5-3					1440										
HA-5-4					1445										

Relinquished By:	Date/Time:	Received By:	Date/Time:	Turnaround Time: (Check)
[signature] 5-10-08	0900			same day ____ 72 hours ____
Relinquished By:	Date/Time:	Received By:	Date/Time:	24 hours ____ 5 days ✓
				48 hours ____ normal ____
Relinquished By:	Date/Time:	Received in Lab By: [signature]	Date/Time: 5/10/08 0900	Sample Integrity: (Check) intact ✗ on ice ✗ 2-3/

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